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# Bulletin of the World Health Organization

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**Special theme: prevention and control of noncommunicable diseases**



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**Front cover photo:** village women carry dried cow dung cakes in the Teliarganj area on the outskirts of the city of Allahabad, in the state of Uttar Pradesh, India. Cow dung cakes are a major source of domestic fuel for rural households and a source of indoor air pollution. (AFP/Getty Images Diptendu Dutta)

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# JUST PUBLISHED!



**World Health Organization**



The new WHO global action plan to promote physical activity responds to the requests by countries for updated guidance, and a framework of effective and feasible policy actions to increase physical activity at all levels. It also responds to requests for global leadership and stronger regional and national coordination, and the need for a whole-of-society response to achieve a paradigm shift in both supporting and valuing all people being regularly active, according to ability and across the life course.

The action plan was developed through a worldwide consultation process involving governments and key stakeholders across multiple sectors including health, sports, transport, urban design, civil society, academia and the private sector.

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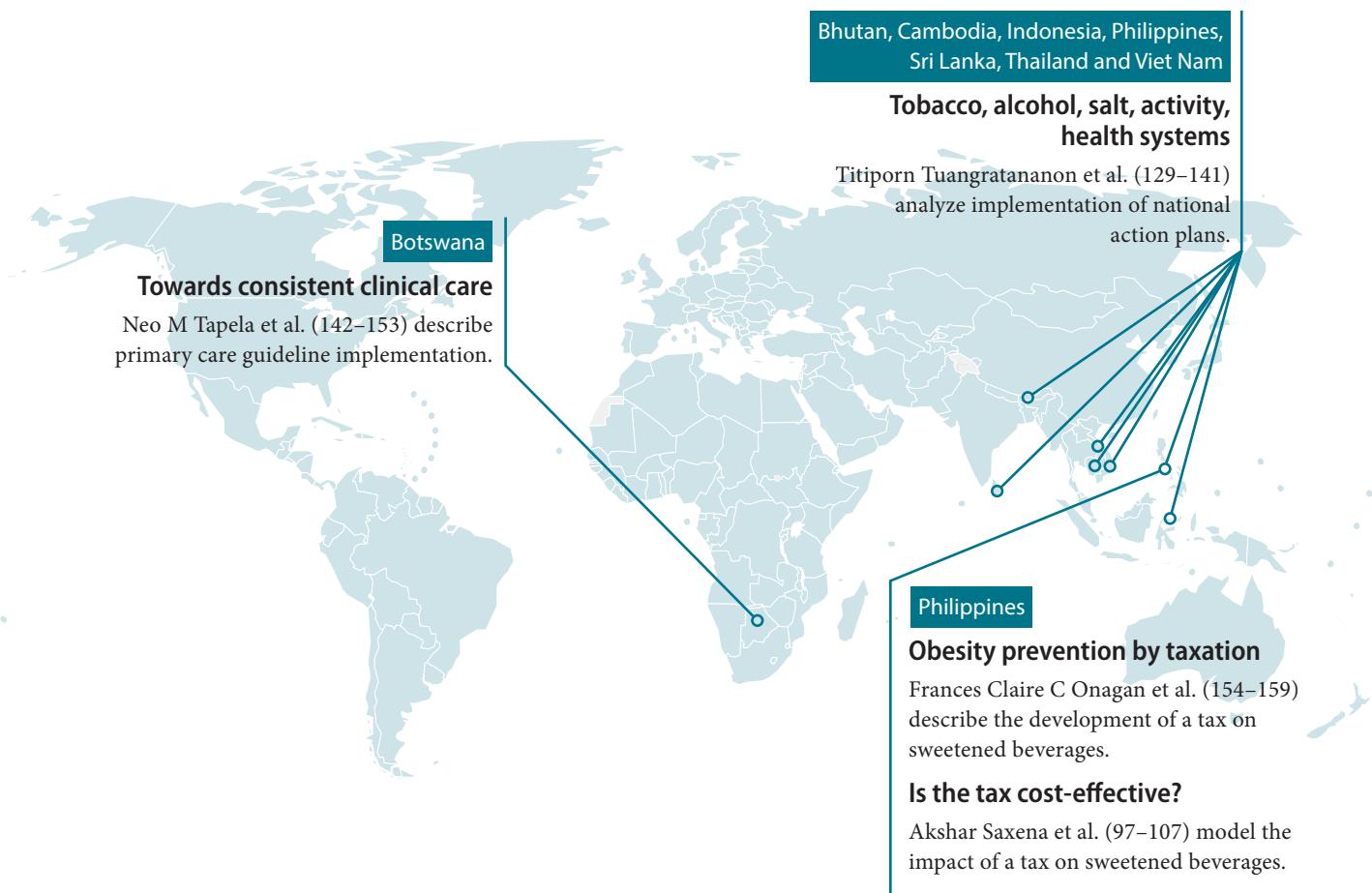
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This month's issue is dedicated to the prevention and control of noncommunicable diseases, to accompany the Prince Mahidol Award Conference on the same theme, as introduced by Viroj Tangcharoensathien (74) in the editorial section.

Nicholas Banatvala et al. (75) list actions needed to prevent noncommunicable diseases and improve mental health. Manjulaa Narasimhan & Mukesh Kapila (76) discuss the implications of self-care for health service provision.

Sophie Cousins (79–80) reports on the introduction of a ban on coal-burning in Ulaanbaatar, Mongolia. Kalpana Balakrishnan explains to Gary Humphreys (81–82) how her training in neurotoxicology has informed her public health work at the Center for Advanced Research on Air Quality, Climate and Health in India.



## Overcoming internal challenges and external threats to noncommunicable disease control

Viroj Tangcharoensathien<sup>a</sup> Orana Chandrasiri<sup>a</sup> Orratai Waleewong<sup>a</sup> & Nattadhanai Rajatanavin<sup>a</sup>

Despite global commitments, progress on noncommunicable disease prevention and control has been slow and uneven, particularly in low- and middle-income countries.<sup>1</sup> This theme issue on noncommunicable diseases presents a selection of papers that analyse how the burden of noncommunicable diseases could be addressed more efficiently.

The World Health Organization (WHO) has recommended 16 best-buy interventions<sup>2</sup> that are highly cost-effective, affordable, and could save a total of 9.6 million global premature deaths from noncommunicable diseases by 2025.<sup>1</sup> Furthermore, every United States dollar (US \$) invested in these interventions would yield a return of at least US \$ 7 by 2030 from increased employment, improved productivity and longer life.<sup>2</sup> However, the implementation status of these interventions in seven Asian countries shows that progress is uneven and capacity gaps exist.<sup>3</sup> In these countries, the absence or inadequate capacity of national non-communicable disease coordinating agencies – that is, agencies responsible for multisectoral actions to prevent and control such diseases – is a major barrier to the successful implementation of the noncommunicable disease agenda.

Papers in this issue also show that addressing risk factors is an important and cost-effective strategy, but political actions are needed to reduce exposure to these risk factors. For example, action to reduce air pollution and to mitigate climate change can address leading risk factors for noncommunicable diseases.<sup>4</sup> Evidence on the effect of legislation designed to reduce unhealthy diets is also needed. A modelling paper by Saxena et al. shows that the introduction of the sweetened beverage tax in the Philippines in 2017 would not only raise government revenue, but also reduce health-care costs of noncommunicable diseases, prevent catastrophic health expenditure by patients and reduce deaths from such diseases.<sup>5</sup> Onagan et al.

describe the strategies employed when arguing for the introduction of this tax.<sup>6</sup>

To enhance the promotion of physical activity, which has multiple positive impacts on health, Rutter et al. propose a system mapping of factors contributing to activity.<sup>7</sup>

Health promotion campaigns are another prevention strategy. To finance such campaigns, 20 countries have used innovative financing or created health promotion foundations.<sup>8</sup>

External threats, combined with weak national capacities, allow industries to have a significant influence on noncommunicable disease control, for instance through threatening governments with law suits and sponsoring front groups<sup>9</sup> to challenge scientific evidence on the health consequences of harmful products. Food industries employ similar tactics to those of the tobacco and alcohol industries to undermine public health policies on noncommunicable disease control, as highlighted in a paper on palm oil by Kadandale et al.<sup>10</sup> Tobacco company lawyers helped to conceal evidence on the dangers of smoking and used threatening litigation that prevented successful lawsuits against their client companies.<sup>11</sup> For instance, the tobacco industry has filed lawsuits against Thailand for increasing the size of health warnings and against Australia for introducing plain packaging of tobacco products. More than a decade into the implementation of the Framework Convention on Tobacco Control, State Parties have yet to fully fulfil their obligations. Magnusson et al. argues that legislative and regulatory actions are central to successful non-communicable disease prevention and control.<sup>12</sup> Legally binding instruments at international and national levels have contributed to progress on tobacco control, but have yet to be applied to the protracted challenges of the harmful use of alcohol. Furthermore, trade and investment agreements might influence the availability of commodities affect-

ing noncommunicable disease burden. However, further studies are required to investigate the effect of such agreements at national level.<sup>13</sup>

Other strategies to tackle the non-communicable disease burden are also needed, such as innovative financing mechanisms and the use of new technology and data.<sup>14</sup> Countries will need to adapt their health systems to the increasing burden of noncommunicable diseases, and sharing of experience between countries will be important for implementation of new guidelines. The strategies and lessons learnt from adapting and implementing Botswana's first primary health-care guidelines for adults are presented in this theme issue.<sup>15</sup>

Many countries are unlikely to achieve the global noncommunicable disease targets by 2025 unless bolder political actions are taken to translate political pledges into financial commitments. Effective implementation to address the countries' internal challenges by strengthening national systems to better monitor progress and hold all stakeholders accountable are needed. Good governance, transparency, civil society engagement, and policy coherence across sectors would also contribute to improve countries' capacities to address external threats and protect people's health. ■

### References

Available at: <http://www.who.int/bulletin/volumes/97/2/18-228809>

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# Actions needed to prevent noncommunicable diseases and improve mental health

Nicholas Banatvala<sup>a</sup> Svetlana Akselrod<sup>b</sup> Douglas Webb<sup>c</sup> Tim Sladden<sup>d</sup> David Hipgrave<sup>e</sup> & Miriam Schneidman<sup>f</sup>

The 2018 Political Declaration of the Third High-level Meeting on Noncommunicable Diseases notes that progress and investment on noncommunicable diseases have been insufficient to meet the health-related targets of the sustainable development goals.<sup>1</sup> Countries face many challenges in responding to the rapid rise in noncommunicable diseases and improving mental health as part of the 2030 agenda for sustainable development.<sup>2</sup> These challenges include insufficient political action on noncommunicable diseases; limited government capacity for policy development, coherence and implementation; insufficient domestic and international finance as well as issues around the impact of economic, market and commercial factors on noncommunicable diseases; and weak health systems, including limited progress on achieving universal health coverage.<sup>3</sup>

The United Nations (UN) Inter-Agency Task Force on the Prevention and Control of Non-communicable Diseases has undertaken joint missions to over 25 countries to support government responses to these challenges.<sup>4</sup> The missions, in which 17 UN entities have participated, have galvanized political support and influenced policy and practice by engaging with governments, who have primary responsibility for tackling noncommunicable diseases, as well as nongovernmental organizations, the private sector and academia.

These missions have identified priorities for an effective national response on noncommunicable diseases. The first priority is developing national frameworks comprising an investment case; a prioritized and costed national plan with sustainable financing; maximized domestic resources; and coordination

and accountability structures. The second priority is achieving greater policy coherence across government to effectively deliver national multisectoral action plans on noncommunicable diseases, including stronger legislation and regulation to reduce levels of risk factors, and to build enabling environments for health-promoting behaviours.<sup>5</sup> The third priority is increasing effective, pro-health partnerships with civil society and the private sector, giving due regard to managing conflicts of interest. The fourth priority is stronger systems for service delivery, including community-based responses with risk communication strategies and social contracting mechanisms.

While the responsibility for addressing these priorities lies with countries, the UN system has a key role in catalysing these responses. The United Nations Development Programme and the World Health Organization (WHO) are already providing support for developing noncommunicable disease investment cases in 15 countries.<sup>6</sup> Many others are also requesting support. To respond to this demand, a solid mechanism is needed. The task force has proposed a catalytic fund for governments to use in collaboration with development partners, aligning with recent United Nations Economic and Social Council (ECOSOC) resolutions and the 2018 Political Declaration.

The 2017 ECOSOC resolution urged governments, the private sector and donors to explore financing for noncommunicable disease prevention and control, and to mobilize adequate, predictable and sustained resources for the programmatic work of the task force.<sup>7</sup> In 2018 ECOSOC further called upon the task force and its members

to cooperate with philanthropic foundations, civil society and the private sector to identify additional resources to support Member States.<sup>8</sup> In the 2018 Political Declaration, heads of State and Government called upon WHO to promote action on noncommunicable diseases. This call included the need to coordinate with other UN agencies, development banks and regional and international organizations; explore new financing, implementation, monitoring and evaluation and accountability mechanisms; and develop national noncommunicable disease investment cases. The WHO Independent High-level Commission also recommended that the international community consider a multidonor fund to catalyse financing for the development of national noncommunicable disease and mental health responses and stronger policy coherence at country level.<sup>9</sup>

The 2015 Addis Ababa Action Agenda was clear that noncommunicable disease responses should be financed from domestic resources.<sup>10</sup> Seven years after the first noncommunicable diseases Political Declaration,<sup>11</sup> now is the time to catalyse this response and build sustainable health-promoting policies and programmes to reverse the increasing levels of noncommunicable diseases across the world. ■

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Available at: <http://www.who.int/bulletin/volumes/97/2/18-228700>

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## Implications of self-care for health service provision

Manjulaa Narasimhan<sup>a</sup> & Mukesh Kapila<sup>b</sup>

Self-care interventions for health are among the most promising and exciting new approaches contributing to universal health coverage (UHC). The World Health Organization's (WHO) working definition of self-care is "the ability of individuals, families and communities to promote health, prevent disease, maintain health, and to cope with illness and disability with or without the support of a health-care provider."<sup>1</sup> The scope of self-care in this definition includes health promotion; disease prevention and control; self-medication; providing care to dependent persons; seeking hospital/specialist care if necessary; and rehabilitation, including palliative care. This definition recognizes that individuals act to preserve health or respond to symptoms by determining their health-seeking behaviour and when to interface with professional care.<sup>1</sup> Self-care is therefore comprised of actions within an individual's control to manage health, including noncommunicable diseases or sexual and reproductive health.

With the increase of noncommunicable diseases such as diabetes, cancers, cardiovascular and chronic lung diseases, self-care can play a vital role in preventing and reducing underlying risk factors, optimizing treatment and managing complications.<sup>2</sup> In this regard, the declaration of the Global Conference on Primary Health Care highlights the importance of empowering individuals as self-carers and caregivers.<sup>3</sup> Self-care for noncommunicable diseases is not new and WHO has developed interventions for primary health care in low-resource settings.<sup>4</sup> For instance, WHO recommends self-measurement to monitor blood pressure for the management of hypertension in patients where the affordability of the technology has been established.<sup>5</sup> With increased access to drugs, diagnostics and devices converging with rapid advances in digital technologies, new configurations of self-care are made possible. Furthermore, as the power dynamics between doctor and patient shift to be more inclusive of

the patients' points of view, attention to human rights and health-sector accountability are essential to improve individuals' autonomy for self-care.<sup>6</sup> Health workers, including medical doctors, may be challenged by new forms of self-diagnostics and self-treatments for noncommunicable diseases and sexual and reproductive health. As health professionals integrate new technologies of self-care in the areas of testing, diagnostics, treatments and health maintenance into their practices, health care will change. Issues of shifting health costs, for health systems and individuals, and patterns of reimbursement will need to be addressed. On the other hand, self-care may be a preferred option in situations where patients are treated disrespectfully in health clinics, for instance women living with human immunodeficiency virus (HIV).<sup>7</sup> Self-care interventions fulfil a particularly important role in these situations, as the alternative might be that people would not access health services at all. As individuals become increasingly able to take more active roles in their health management, people-centred approaches will become more acceptable and patients will be seen as active participants of their health and well-being.<sup>8</sup>

Improving access, equity and safety of health care lies at the heart of self-care. For instance, the potential of digital health in self-care is limited for vulnerable populations who may not be able to access the new technologies. Similarly, while pharmacies and pharmacists play an increasingly important role in providing information and services, factors such as out-of-pocket costs may not allow all those who need services and interventions to receive them.

More research is needed to strengthen the evidence base. However, use of existing technologies could support various noncommunicable disease and sexual and reproductive health programmes, which could be delivered for instance through digital technology and

mobile applications and be articulated in the context of self-care health.

The potential of self-care is that it can reach those who may not normally come to a health-care setting. Self-care can also support health goals in low-resource settings with fragile health-care systems. With increased cooperation between communities, health technology developers, practitioners and health ministries, multisectoral self-care interventions that meet people's needs through comprehensive and integrated health services can be envisioned. As roles and responsibilities shift among different health practitioner groups, inter-professional communication will be vital.

WHO is developing a consolidated normative guideline around self-care, including for sexual and reproductive health and rights. Through a broad, consultative process, this guideline will build upon existing recommendations,<sup>4,9,10</sup> including those for noncommunicable diseases, HIV self-testing and self-management of abortion. Self-care holds promise for reducing health inequities, potentially enhancing user autonomy and advancing UHC. ■

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Available at: <http://www.who.int/bulletin/volumes/97/2/18-228890>

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## Public health round-up

### Indonesia tsunami response

UNICEF/Arimacs Wilandar



National and provincial authorities continue to assist people affected by the tsunami which hit Indonesia on 22 December 2018, breaking along the Sunda Strait and devastating Banten and Lampung provinces. According to Indonesia's National Agency for Disaster Countermeasures, 437 people were killed, and 14 059 injured. This photo shows residents searching through the rubble to salvage possessions from their home that was damaged during the tsunami in Tanjung Jaya Village, Panimbang District, Pandeglang, Banten, in the western part of Java.

### WHO forms gene editing advisory group

The World Health Organization (WHO) is setting up an expert advisory group to develop global standards for governance and oversight of human gene editing.

The move follows the recent application of the new CRISPR-Cas9 technology to edit the human genome.

The technique uses an enzyme to edit gene sequences. The sequences are known as clustered regularly interspaced short palindromic repeats (CRISPR) and the enzyme is called CRISPR-Associated (Cas).

In December 2018, Chinese scientist He Jiankui announced that he had used CRISPR-Cas9 technology to edit the genes of embryonic twin girls, an intervention he maintains will help protect the twins from human immunodeficiency virus infection.

The announcement sparked an international debate about the ethics and safety of such research.

WHO is establishing the expert advisory group to examine the scientific,

ethical, social and legal challenges associated with human gene editing. The group will assess the state of human gene editing research and its applications, the technology's potential uses, and societal attitudes to the technology.

Based on this work, the group will advise the WHO Director-General on potential oversight mechanisms for research into, and application of, human gene editing technology, and will make recommendations in that regard.

<https://www.who.int/ethics/topics/gene-editing/call-for-members/en/>

### Tobacco packaging breakthrough

Thailand has become the first country in Asia to adopt plain packaging for tobacco products.

Legislation requiring plain packaging for tobacco products will enter into force on 10 September 2019.

Under the new rules, cigarettes will be sold in drab brown coloured packs, free of any logos or images except for graphic health warnings, which are

already obligatory in Thailand, as are textual warnings. Thailand also bans tobacco advertisement and promotion, restricts sponsorship and forbids the sale of tobacco products to people less than 20 years of age as well as the sale of single cigarettes.

Despite these control efforts the prevalence of tobacco use remains high in Thailand where, according to its 2017 national *Smoking and drinking behaviour survey*, roughly one in every five adults in the country smokes. The same survey reported that 37.7% of males aged 15 and above smoked, compared with 1.7% of females in the same age group.

Plain packaging of tobacco products is recommended under the Guidelines for the Implementation of Articles 11 and 13 of the WHO Framework Convention on Tobacco Control (WHO FCTC), a legal treaty that aims to protect present and future generations against the devastating health and socio-economic impacts of tobacco use. The introduction of plain packaging is expected to further boost the country's tobacco control efforts.

"Thailand's bold steps against tobacco – the single most important cause of preventable deaths worldwide – is commendable and reflects the country's earnest efforts in promoting health and well-being of its people," said Dr Poonam Khetrapal Singh, Regional Director of the WHO South-East Asia, congratulating Thailand on its new tobacco legislation.

<http://www.searo.who.int/media-centre/releases/2018/1704/en/>

### WHO Director-General pushes for end of polio

WHO Director-General Tedros Adhanom Ghebreyesus underlined WHO's commitment to the final push to eradicate polio on a 4-day visit to Afghanistan and Pakistan, the only two countries where wild poliovirus cases were reported last year.

Together with WHO Regional-Director for the Eastern Mediterranean Dr Ahmed Al-Mandhari, Dr Tedros met with heads of state and senior government officials in both countries and

witnessed first-hand WHO-supported health programmes.

Dr Tedros also visited the Emergency Operations Centre for Polio Eradication in Islamabad, Pakistan, where he commended the work of government and partners as “one team under one roof” and highlighted the critical importance of Pakistan working closely with Afghanistan to prevent cross-border transmission.

“We must all give our best on this last mile to eradicate polio once and for all. My wish for 2019 is for zero polio transmission. You have WHO’s full support to help reach every child and stop this virus for good,” Dr Tedros said.

As recently as 30 years ago, wild poliovirus paralysed more than 350 000 children in more than 125 countries every year. In 2018 there were 29 reported cases in just two countries – Afghanistan and Pakistan.

Polio eradication requires high immunization coverage everywhere to block transmission. Unfortunately, some children are still missing out on polio vaccination for several reasons, including lack of infrastructure, remote locations, population movement, conflict and insecurity and resistance to vaccination.

Failure to eradicate polio from these last remaining strongholds could result in a resurgence of the disease, with as many as 200 000 new cases predicted worldwide every year within 10 years.

## India to tackle air pollution

India has launched an action plan to cut air pollution in the country’s 102 worst affected cities. Announced on 10 January, the *National clean air plan* targets cuts in industrial and vehicular emissions as well as a reduction in the burning of biomass. The overall aim of the plan is to achieve a 20–30% reduction in particulate matter concentrations by 2024, relative to levels reported in 2017.

According to the WHO global ambient air quality database, 14 of the 15 cities with the worst air pollution in the world are in India. A study published in *Lancet Planetary Health* in December 2018, reported that toxic air claimed 1.24 million lives in India in 2017.

## Cover photo

Village women carry dried cow dung cakes in the Teliarganj area on the outskirts of the city of Allahabad, in the state of Uttar Pradesh, India. Cow dung cakes are a major source of domestic fuel for rural households and a source of indoor air pollution.



AFP/Getty Images Diptendu Dutta.

## Road traffic injuries leading killer of young

Road traffic injuries are now the leading killer of children and young people aged 5–29 years, according to *Global status report on road safety 2018*.

The WHO report, which was released in December last year, found that road traffic crash-related deaths continue to rise, with 1.35 million fatalities in 2016, the latest year for which data are available. Pedestrians, cyclists and motorcyclists are the main victims and those living in developing countries are worst affected.

“These deaths are an unacceptable price to pay for mobility,” said Dr Tedros at the launch of the report.

He noted that there are proven measures to reduce road traffic injury, including strategies to reduce speeding and address drinking and driving, among other dangerous behaviours. Also, safer infrastructure such as dedicated lanes for cyclists and motorcyclists can also help, as can improved vehicle standards such as those that mandate electronic stability control. Finally, prompt, effective post-crash care is vital to improving survival.

## The Prince Mahidol Award Conference

This annual conference, held in Bangkok, Thailand, focuses this year on non-communicable diseases (NCDs), under

the banner: “The Political Economy of NCDs: A Whole-of-Society Approach”. The overall aim of the conference is to propose solutions at national and global levels to accelerate implementation of NCD prevention and control measures.

Policy-makers and other senior government officials attend this annual conference, as well as representatives from civil society organizations, international organizations and development partners, universities and industries.

<http://pmac2019.com/site/conferenceprogram> ■

## Looking ahead

4 February - World Cancer Day 2014

6–8 February – WHO Symposium on the Future Digital Health Systems in the European Region, Copenhagen, Denmark

13 – 14 February – First Food and Agriculture Organization, World Health Organization and African Union International Conference on Food Safety, Addis Ababa, Ethiopia.

3 – March - International Ear and Hearing Care Day

## Air pollution in Mongolia

Starting in May, the government of Mongolia will introduce a coal burning ban in the capital, Ulaanbaatar, as part of efforts to clean up the city's air. Implementing the ban is going to be a challenge, but reducing air pollution is of fundamental importance to improving population health. Sophie Cousins reports.

In June of last year, Dr Rokho Kim, an environmental specialist for the World Health Organization's (WHO) Western Pacific Region, visited a school on the outskirts of Mongolia's capital, Ulaanbaatar.

"I was concerned about the proximity of schools to sources of pollution," he says. When he got to the school, he found that it stood right next to one of the low-pressure boilers used to heat the city's hydraulic grid. "The boilers are heated using raw coal," he explains. "The chimney for this particular boiler was just few metres from the school's fence. In the winter time the smoke must have been unbearable."

A central Asian country bordered by China and Russia, Mongolia is known for its vast tracts of largely empty grassland, freezing winters and nomadic culture. In recent years it has become known for something else: some of the world's worst air in the winter months.

The most polluted air in Mongolia is found in Ulaanbaatar, where 46% of the country's population resides.

The defining characteristic of air pollution in Mongolia – as in many countries – is the high concentration of particulate matter. Measured in micrograms (millionth of a gram) per cubic metre, particulate matter consists of a

complex mixture of solid and liquid particles suspended in air, and comprises a wide range of substances, from sulphates to black carbon.

Particles with a diameter of 10 microns or less can penetrate the lungs, but the most harmful are those with a diameter of 2.5 microns or less. Such fine particles can cross the lung barrier and enter the blood system. Fine particulate pollution has health impacts even at very low concentrations.

Ulaanbaatar's air pollution problem has grown with the city, which has almost tripled in size since 1990, and today accommodates just under 1.5 million people. The way it has grown is as important as the extent of its growth, with intensive rural-to-urban migration resulting in a sharp increase of informal settlements. These settlements are comprised of structures called 'gers' – portable, circular dwellings made of wood and canvas that are insulated with felt. Ger districts, located in the north of the city, are now home to more than 60% of Ulaanbaatar's population.

"Gers are heated with traditional stoves which stand in the centre of the structure and are connected to a chimney that passes up through the roof," explains Dr Delgermaa Vanya, health and environment officer at the WHO

Mongolia office. "These stoves can burn coal, wood, and dung, but during the winter, when temperatures can drop to -40 °C, coal is used because it burns longer than other fuels."

"The coal used in the stoves is a primary cause of Ulaanbaatar's air pollution, much worse than other sources of pollution such as cars and trucks or waste burning," Vanya says, citing a World Health Organization Regional Office for the Western Pacific policy brief published in 2018. The brief states that 80% of Ulaanbaatar's air pollution in the winter months is caused by households and low pressure boilers burning raw coal in ger districts.

Referred to as raw coal, the fuel burned is not washed or processed in any way and produces copious amounts of particulate matter as well as sulfur dioxide, carbon monoxide and nitrogen oxide. Dug out of the ground in the city's Nalaikh area, it is also very cheap.

"There is really no affordable alternative in terms of clean fuel," says Vanya. "As a result, in the winter months over 600 000 tonnes of raw coal are burned for heating in the city's approximately 200 000 gers, accounting for about 80% of Ulaanbaatar's winter pollution."

The Mongolian National Agency for Meteorology and Environment Monitoring reports that in 2017, in the winter months that extend from November to March, the mean concentration of particulate matter for the country as a whole was between 80-140 micrograms per cubic meter. In ger districts of Ulaanbaatar, the concentration of fine particulate matter can reach well above 1 000 micrograms per cubic meter.

Mongolia has a population of 3 million people and in 2016 an estimated 1 800 people died from diseases attributable to household air pollution and a further 1 500 people died from diseases attributable to outdoor air pollution. These included: ischaemic heart disease; stroke; lung cancer; acute low respiratory infections and chronic obstructive pulmonary disease.

Rokho is keen to stress that the impact of pollution goes beyond the respiratory tract and lungs. "The main



UNICEF/Tamir Bayarsaikhan

Ger district of Bayangol and Songinokhairkhan districts, Ulaanbaatar city, Mongolia.

consequences of air pollution are not just a bad cough; they are heart attacks, and strokes. There is also emerging evidence regarding neurodevelopmental diseases, and adverse birth outcomes, and the relation between early exposure and later non-communicable diseases, such as diabetes," he says.

Bataa Chuluunbaatar, health specialist at UNICEF Mongolia concurs, saying, "Air pollution affects all the organs that are supplied by blood vessels. It affects brain development, lung function, and the cardiovascular system." Chuluunbaatar believes that children are particularly vulnerable to particulate matter as their bodies develop, and points to possible evidence that the finest particulate matter can pass through the placenta to an unborn child.

The 2017 *Mongolia national program on reduction of air and environmental pollution* aims by 2025 to decrease air pollutants by 80% and calls for prohibiting the use of unprocessed coal everywhere except in thermal power plants in Ulaanbaatar.

In the past, efforts to curb pollution have focused on rehousing ger district residents in apartments connected to the communal heating grid. More recently, the government started discussing the feasibility of connecting existing homes to city utilities. Subsidies have also been offered to families encouraging them to

purchase stoves that produce less pollution. Since January 2017, electricity in many of the city's highest-polluting districts has been provided free of charge at night. Needless to say, this has little impact on households not connected to electricity.

To support the government's anti-pollution efforts, in February 2018 WHO released a set of suggested actions.

Suggested short-term actions included a ban on the burning of waste as fuel and improving indoor air quality by banning smoking indoors. WHO also suggested improving ventilation in gers and other homes and the use of better insulation to reduce the need for heating. The creation of a sustainable support scheme to help low-income groups adopt affordable cleaner technology was also proposed.

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**// The coal used in the stoves is a primary cause of Ulaanbaatar's air pollution. //**

*Delgermaa Vanya*

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A key medium-term suggestion was for Mongolia to introduce more stringent national standards for outdoor air quality, while suggestions for the long term included the drawing up of plans

for the sustainable development of clean energy options.

Just under a year later, there has been some progress. For example, the government passed a law on hygiene in 2016 prohibiting the burning of all types of waste. There has also been an initiative to encourage people to move out of the gers into better insulated and less polluting apartments.

According Shagdar Urantsetseg, the officer-in-charge of environmental health in the Department of Public Health at Mongolia's Ministry of Health, a fund had been set up to give those who live in gers or small houses in designated 'air quality improvement zones' the first 30% of their mortgage towards purchasing a new apartment. To date, some 86 households have moved to newly built apartments. More transfers of this kind will be required to have an impact on the 200 000 or so gers in the city.

The outright ban on the burning of unprocessed coal will come into effect in May in six central districts of the capital and will cover the use of raw coal in households, companies and enterprises, except enterprises with special licenses for energy and electricity generation.

The government has also committed to providing households in ger districts with cleaner processed solid fuels and plans on having 600 000 tonnes of such fuel stored by September 2019.

Dr Sergey Diorditsa, WHO Representative to Mongolia, welcomes the government's commitment to ban the use of raw coal. "The challenge is going to be making sure the ban is implemented effectively," he says.

Diorditsa argues that, in the long term, the country will need to develop alternative energy sources. "It is important for Mongolia to continue to think how to introduce clean energy sources and technologies, and this may mean transitioning from fossil energy to renewable energy, using solar or wind power," he says.

Diorditsa also stresses the importance of communities and government working together on improving housing in ger areas. When the next winter rolls around, better insulated housing will make a huge difference to the heating needs of the residents of Ulaanbaatar and to the air they are obliged to breathe. ■



Mongolian family inside a traditional Mongolian dwelling.

# Kalpana Balakrishnan: the power of data to drive positive change

Gary Humphreys talks to Kalpana Balakrishnan about her background in biophysics and how science has informed her public health work.

**Q:** You grew up in India, but moved to the USA in 1984 where you obtained a doctoral degree in biophysics at Johns Hopkins University. How has that beginning in science influenced your work in public health?

A: Well, I think this gave me the foundation to approach things on the basis of first principles. I spent my doctoral years training in neurotoxicology, looking at how neurons respond to different kinds of signals, how they process the signals, and what affects signal transduction. So it was a really hardcore mechanistic way of trying to figure out how things work at the cellular level, a paradigm I continue to apply in the larger realm of public health.

**Q:** How did you get from there to public health?

A: The thing that really triggered the transition was exposure to new areas of study during my post-doctoral years. One of my advisors at Johns Hopkins encouraged me to take a couple of courses on population dynamics and health economics just to make me appreciate how I might consider applying my mechanistic knowledge. It was not easy, partly because it was so far away from my laboratory-based skills, but it turned out that I found a perfect niche.

**Q:** Which was?

A: Essentially applying my knowledge of physiology and toxicology and looking at the mechanisms of normal and abnormal response at the cellular level based on the dose of external stimuli. Morton Corn, Patrick Breyses and Peter Lees – my advisors at Johns Hopkins – trained me on the fundamentals of how you can measure things in the environment and assess health risks. I was looking at occupational exposures to asbestos, cadmium, beryllium and nickel. The context of the work was industrial, but the methods were extendable to the general environment.

**Q:** You returned to India in 1996. Were you able to apply those skills when you got home?

A: Fortunately, yes. I went to several government departments to talk about



Courtesy of Kalpana Balakrishnan

Kalpana Balakrishnan

Kalpana Balakrishnan acquired her undergraduate education at the All India Institute of Medical Sciences, New Delhi, India (1983), and her doctoral degree in biophysics from Johns Hopkins University, Baltimore, Maryland, USA (1991), where she also undertook post-doctoral training in environmental physiology, population dynamics, and environmental health engineering/risk assessment (1991–1995). She has established one of the largest inter-disciplinary

occupational and environmental health research

groups in Chennai, India, at Sri Ramachandra University, an institution with which she has worked since 1995 and where she has occupied a number of positions, including Professor of Biophysics and Head of Environmental Health Engineering (2000–2012) and, since 2010, Director of the Indian Council of Medical Research, Center for Advanced Research on Air Quality, Climate and Health. Her research group serves as a World Health Organization (WHO) Collaborating Center for Occupational and Environmental Health and as a Center for Advanced Research on Air Quality, Climate and Health for the Indian Council of Medical Research, Government of India.

my work, and I ended up at here at the Sri Ramachandra Medical College & Research Institute (now Sri Ramachandra Institute of Higher Education and Research) in Chennai. I am a researcher at heart and I really wanted to kick-start research into occupational exposures within the medical university.

**Q:** What was your first project?

A: I started by looking at health risks from exposure to chromium. I was fortunate enough to get access to some industrial units handling chromium. That was a defining moment for me. I went to this factory and I saw these workers who were just drenched in chromium. I came back home and just sat and cried. I was thinking how futile it was to produce another study on chromium toxicity. I said to myself I'm sure I can understand a bit more by spending another 30 years on exactly how chromium affects human tissue, but who cares? That guy in that factory is dying!

**Q:** So that was your induction into a public health way of thinking.

A: It certainly was. I knew I didn't just want to showcase these problems. I wanted to do something about them.

Which I did, by bringing evidence to the attention of large and small industries. Not just on chromium, but on a wide range of harmful environmental factors in a variety of sectors, ranging from leather and textiles to power, chemical manufacturing and cars.

“... spending another 30 years on exactly how chromium affects human tissue, but who cares? That guy in that factory is dying!”

**Q:** How did industry view this?

A: With misgivings initially. The manufacturing industry at that point was so skeptical of these kinds of assessments because they thought they would appear in the papers the next day. But they let us in to do the assessments and make the recommendations. It was all about finding solutions, suggestions that they could consider internally. Finger-

pointing without proposing feasible solutions is not constructive.

**Q:** Do you feel you were able to make a difference even though the industries you were looking at were self-regulating?

A: I don't think we can possibly make a dent in the magnitude of the problem they have, but we have created a movement, and many industry sectors have benefited from our assessments and guidance on solutions.

**Q:** So at what point did you start working on the health impact of indoor air pollution? Did it come out of the work you were doing in industry?

A: Yes it did. Initially we were focused on the occupational environment, but then we started thinking about population level exposures. It was at this time that I met Professor Kirk Smith of UC Berkley, who is one of the pioneers of air pollution research, and, incidentally, also a physicist by training. In 1988 we started going to communities, some rural, some peri-urban, looking at ambient pollution monitors, but we felt that they were only getting part of the picture because no measurement was going on in people's homes. So I proposed using the instruments that we used to measure workers' exposures to assess women's exposures and child exposures to household air pollution. The big breakthrough came when in 2000 when we were given a four months contract to measure levels of particulate matter in 400 biomass-using households.

**Q:** How did you make the measurements?

A: We used air sampling pumps that mimic the deposition of particulate matter into the lungs. We presented the results of the 400 household measurements in the first WHO consultation in 2002. That same year WHO invited me to present the epidemiological evidence on the risks from household, solid fuel use at the World Health Assembly. WHO had put together an assessment comparing the disease burden attributable to different health risk factors such as salt intake, tobacco use etc. Lo and behold in South Asia and India, household air pollution ended up ranking amongst the top 10 risk factors. This came as a complete surprise. That comparative risk

assessment made a huge difference to awareness of the issue and started people thinking about what to do in response.

**Q:** You also carried out a study looking at the impact of a pregnant mother's exposure to air pollution on her baby's birthweight.

A: That's right. We examined whether exposure to fine particulate matter ( $PM_{2.5}$ ) during pregnancy were associated with lower birthweight. The study provided some of the first quantitative effects estimates for linking rural-urban  $PM_{2.5}$  exposures and birthweight in India.

**“There is nothing more powerful than data if you want to bring about change.”**

**Q:** So the evidence of harm was steadily accumulating. What came out of it in terms of a response?

A: Initially we didn't quite know how to address the issue because there was no access to clean energy in India. The only thing that was sort of working were these improved cooking stoves. In the field, however, we'd see these stoves just lying in the corner; nobody was using them because they couldn't really hold the pans that a traditional stove would take, and would break down most of the time. So after studying the evidence for a number of years we said, "Let's reframe our thinking. Let's stop trying to improve the way we burn biomass and focus on clean fuels." By 2014 when the household air pollution guidelines for WHO were being formulated, there was enough evidence to say that liquid propane gas (LPG) is likely the only technology that, when scaled, can consistently meet the minimum emission and exposure targets set by the WHO guidelines. We knew there was a lot of demand for LPG in India, and we knew also that 40% of the world's population were already using clean

fuels. So it seemed logical and ethical to look for ways of making this available to the other 60%.

**Q:** Is LPG available everywhere in India?

A: Not everywhere, and as you might expect, distribution problems and access problems arise more in rural areas. LPG distribution is highly regulated in India and is also subsidized by the government. The oil marketing companies bottle the LPG and supply registered, authorized distributors who sell to consumers. There have been a number of consultations about expanding access by enlarging LPG distributor networks. They want to scale distribution to a point where anybody who wants to use LPG can. Currently coverage is around 70-80% in rural areas; the government wants to get to 95% by 2020.

**Q:** Do you think they will reach that target?

A: Well, thus far, the programme has exceeded its targets. So it seems very likely.

**Q:** What about alternatives to LPG, such as electricity, perhaps generated through solar power?

A: I think we have the ability to develop renewable electricity in India on a huge scale. If the investment in infrastructure is made why not? But right now, LPG is perfect.

**Q:** What about the future for yourself?

A: Well first I would say that, in my opinion, nobody has the bandwidth to do high level policy and hard-core field research at the same time. And for me the choice is simple. I just want to be a scientist! If it were not for the encouragement provided by WHO and some other reputed bodies, I would never stand up and speak my mind about what should or should not be done. I would much rather be in the lab, or the field and let my data do the talking. I believe that it is by engaging in ground-based research that I can contribute the most for this issue. Because there is nothing more powerful than data if you want to bring about change. Unfortunately, not many of us in developing countries are generating solid data. ■

# World Trade Organization membership and changes in noncommunicable disease risk factors: a comparative interrupted time-series analysis, 1980–2013

Krycia Cowling,<sup>a</sup> Elizabeth A Stuart,<sup>b</sup> Roni A Neff,<sup>c</sup> Daniel Magraw,<sup>d</sup> Jon Vernick<sup>b</sup> & Keshia Pollack Porter<sup>b</sup>

**Objective** To investigate the relationship between joining the World Trade Organization (WTO) and the availability of several commodities with both harmful and protective effects for the development of noncommunicable diseases.

**Methods** We used a natural experiment design to compare trends in the domestic supply of tobacco, alcohol and seven food groups, between 1980 and 2013, in 21 countries or territories joining WTO after 1995 and 26 non-member countries, using propensity score weights. We applied a comparative interrupted time-series framework, by using multivariate random-effects linear models, adjusted for gross domestic product per capita, the percentages of urban population and female labour force participation. In the tobacco model, we controlled for Member States that had ratified the Framework Convention on Tobacco Control and in the alcohol model, the percentage of the population identifying themselves as Muslim.

**Findings** Following accession to WTO, member states experienced immediate increases in the domestic supply of fruits and vegetables of 55 g per person per day on average, compared to non-member countries. The analysis showed gradual increases in the geometric mean of the supply of tobacco and alcohol of 6.2% and 3.6% per year, respectively. We did not detect any significant changes in the availability of red meats and animal fats; seafood; nuts, seeds and legumes; starches; or edible oils; and results for sugars were inconsistent across model variations.

**Conclusion** The results suggest that WTO membership may lead to increases in both harmful and protective factors for noncommunicable disease, but further exploration of country-specific variation is warranted.

Abstracts in **عربي**, **中文**, **Français**, **Русский** and **Español** at the end of each article.

## Introduction

Noncommunicable diseases are increasing in prevalence worldwide, especially in low- and middle-income countries, and now account for most of the global morbidity and mortality.<sup>1</sup> Unhealthy food and alcohol consumption and tobacco use contribute to a significant proportion of the noncommunicable disease burden. These three risk factors collectively explain approximately one-quarter of the total disease burden worldwide.<sup>2</sup> Evidence suggests that globalization and, in particular, trade and investment liberalization may play a key role in increasing the supply of these risk factors.<sup>3,4</sup> Studies have shown that as countries liberalize, the consumption of unhealthy commodities increases.<sup>5–7</sup> For example, consumption of meats high in fat has increased in the Federated States of Micronesia due to decades of foreign dependence and food imports,<sup>8</sup> consumption of high-sugar and high-fat items has increased in Fiji after becoming increasingly reliant on food imports<sup>9</sup> and meat and snacks consumption increased in Central America after lowering trade barriers.<sup>10</sup>

Few studies have used longitudinal data from many countries or causal inference methods to examine relationships between trade and investment liberalization and changes in noncommunicable disease risk factors, limiting conclusions about generalizability and causality from existing studies. A systematic review found that liberalizing trade and investment

was associated with increased imports and consumption of edible oils, meats, processed foods and sugar-sweetened beverages, while the results for tobacco were inconclusive.<sup>11</sup> A study examining 42 countries showed that between 1970 and 1995, higher trade volume was significantly associated with increased cigarette consumption in low- and middle-income countries only.<sup>12</sup> However, another study did not detect any relationship between foreign direct investment and tobacco consumption in 50 low- and middle-income countries between 1997 and 2010. The study, though, found a significant positive association between increased foreign direct investment and consumption of alcohol and processed foods high in salt, fat and sugar.<sup>5</sup> Case-control studies have identified an increase in sugar-sweetened beverage sales in Viet Nam following its accession to the World Trade Organization (WTO),<sup>13</sup> while no significant changes were detected of such sales in Peru following its ratification of a free trade agreement with the United States of America.<sup>14</sup>

WTO agreements and institutions are an important set of trade policies. As of 2017, 164 countries were members of WTO, 126 of whom were original members of the predecessor General Agreement on Tariffs and Trade.<sup>15</sup> Accession to the WTO is a discrete liberalizing event that is broadly comparable across countries, despite variations in accession commitments between countries, facilitating the comparison of countries joining the WTO with non-member countries. To provide

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Table 1. Countries and territories included in analysis, by WTO membership and domestic supply quantity for each commodity in 1993 and 2011

Country or territory	Commodity, by year									
	Tobacco (g/capita older than 14 years)		Alcohol (kg/capita older than 14 years)		Fruits and vegetables (kg/capita)		Nuts, seeds and legumes (kg/capita)		Seafood (kg/capita)	
	1993	2011	1993	2011	1993	2011	1993	2011	1993	2011
<b>WTO members (by WTO membership date)<sup>a</sup></b>										
Ecuador (21 Jan 1996)	321.4	517.5	28.4	55.7	181.9	141.5	5.0	3.7	7.2	8.5
Bulgaria (1 Dec 1996)	4263.5	23322	93.7	106.5	167.3	118.2	7.6	6.0	1.6	5.7
Mongolia (29 Jan 1997)	44.2	1468.9	6.6	48.1	11.7	76.9	0.6	1.8	0.1	0.7
Panama (6 Sept 1997)	640.3	1199.7	75.4	115.7	72.9	93.9	5.4	8.1	13.5	13.7
Kyrgyzstan (20 Dec 1998) <sup>b</sup>	366.6	2885.8	14.1	20.3	59.5	173.7	1.8	3.4	0.1	2.3
Latvia (10 Feb 1999) <sup>b</sup>	307.3	994.2	32.9	117.9	134.6	162.2	0.3	3.7	30.3	25.9
Estonia (13 Nov 1999) <sup>b</sup>	1388.2	1539.2	56.0	168.8	96.3	189.7	1.0	7.1	27.5	14.2
Jordan (11 Apr 2000)	2030.8	1679.4	3.1	1.2	153.3	188.2	10.5	12.2	3.9	5.7
Georgia (14 June 2000) <sup>b</sup>	268.7	2531.4	47.1	46.5	131.5	102.4	4.2	2.1	3.8	11.0
Albania (8 Sept 2000)	5851.6	1771.9	14.7	54.2	196.8	439.9	5.7	10.1	0.9	6.4
Oman (9 Nov 2000)	1093.0	2679.3	5.9	6.2	260.4	350.0	4.9	5.5	22.8	25.4
Lithuania (31 May 2001) <sup>b</sup>	927.2	371.6	51.9	165.7	131.2	149.7	2.1	4.3	24.3	43.1
Republic of Moldova (26 July 2001) <sup>b</sup>	9801.6	2766.3	56.3	57.1	188.4	133.4	4.7	2.3	0.5	11.1
China (11 Dec 2001)	3931.3	27666	24.5	54.6	155.3	437.8	8.2	10.9	14.5	34.0
Armenia (5 Feb 2003) <sup>b</sup>	2240.5	3054.4	15.6	10.0	136.4	390.7	0.0	2.2	1.2	3.2
Nepal (23 Apr 2004)	796.2	517.1	1.2	2.9	99.7	165.9	6.5	12.6	0.8	2.2

(continues...)

(...continued)

Country or territory	Commodity, by year											
	Tobacco (g/capita older than 14 years)		Alcohol (kg/capita older than 14 years)		Fruits and vegetables (kg/capita)		Nuts, seeds and legumes (kg/capita)		Seafood (kg/capita)		Red meats and animal fats (kg/capita)	
	1993	2011	1993	2011	1993	2011	1993	2011	1993	2011	1993	2011
Cambodia (13 Oct 2004)	985.9	4148.3	2.1	34.2	68.9	65.1	2.2	12.1	7.4	40.6	15.5	15.4
Saudi Arabia (11 Dec 2005)	2624.2	2484.2	0.6	0.0	218.5	175.3	4.1	8.3	4.9	10.7	15.9	19.5
Viet Nam (11 Jan 2007)	533.9	1212.1	6.7	21.2	92.9	149.5	4.8	15.6	11.9	33.9	17.2	48.8
Ukraine (16 May 2008) <sup>b</sup>	1336.5	1402.3	37.2	93.7	131.1	223.4	6.0	3.7	7.6	14.3	53.7	35.2
Cabo Verde (23 July 2008)	336.1	287.3	40.7	62.8	85.9	202.9	5.6	13.7	14.4	12.1	31.3	21.4
<b>WTO non-member as of 2011</b>												
Afghanistan	207.0	799.0	0.0	0.2	63.0	56.5	4.3	5.9	0.1	21.5	14.6	183.3
Algeria	1900.8	1250.2	4.5	6.0	119.1	254.9	5.5	9.9	3.7	4.1	14.4	15.2
Azerbaijan <sup>b</sup>	8924.3	2095.6	11.0	68.9	134.5	245.6	3.2	4.2	3.0	2.2	16.5	26.8
Bahamas	2008.1	1564.6	65.7	35.6	228.9	363.7	5.5	2.7	24.6	29.5	73.0	56.8
Belarus <sup>b</sup>	1420.8	2830.4	58.0	97.2	125.0	207.1	1.0	4.1	1.2	14.4	74.5	77.6
Democratic People's Republic of Korea	3606.3	4199.2	15.9	11.3	206.7	179.3	20.4	16.0	18.3	9.4	10.7	13.2
Ethiopia	174.6	116.5	7.3	16.4	17.6	26.5	10.4	20.5	0.1	0.3	8.4	9.4
French Polynesia	1838.6	1181.3	96.8	87.5	170.1	174.1	6.8	7.0	40.1	48.1	65.7	68.2
Iran (Islamic Republic of)	792.8	789.4	0.0	0.0	264.8	384.6	12.1	21.2	5.3	9.1	17.2	14.0
Iraq	1083.6	1676.5	6.6	2.9	213.6	155.1	4.8	3.5	1.3	2.9	7.8	5.2
Kazakhstan <sup>b</sup>	1689.4	1386.8	24.6	49.1	60.9	262.1	0.8	4.6	3.7	5.3	66.2	61.2
Kiribati	1105.0	2304.8	0.0	0.0	253.2	241.8	2.2	3.0	73.6	71.1	14.6	16.5
Lao People's Democratic Republic <sup>c</sup>	14492.2	10957.5	16.1	22.7	58.2	267.0	4.1	7.5	6.7	21.1	11.8	19.1
Lebanon	6887.7	53266	22.3	22.9	537.2	291.7	26.0	21.3	3.5	11.1	28.4	25.8
Liberia	382.0	249.1	15.3	16.1	92.0	61.9	6.5	3.6	4.8	4.4	8.9	8.0
New Caledonia	3558.9	2495.2	113.2	96.2	126.5	175.8	1.4	6.3	20.1	28.4	39.4	52.6
Russian Federation <sup>b,d</sup>	630.4	1834.8	47.1	107.4	108.2	179.6	2.8	3.7	14.3	22.4	68.2	55.7

(continues...)

Country or territory	Commodity, by year															
	Tobacco (g/capita older than 14 years)	Alcohol (kg/capita older than 14 years)	Fruits and vegetables (kg/capita)	Nuts, seeds and legumes (kg/capita)	Seafood (kg/capita)	Red meats and animal fats (kg/capita)	Starches (kg/capita)	Sugars (kg/capita)	Edible oils (kg/capita)	2011						
1993	2011	1993	2011	1993	2011	1993	2011	1993	2011	1993	2011	1993	2011	1993	2011	
Samo <sup>a</sup> <sup>d</sup>	3390.0	3072.2	60.7	52.7	268.8	369.2	0.9	4.6	41.6	47.4	53.3	41.8	105.2	203.5	24.8	30.2
Sao Tome and Principe	78.2	163.4	46.9	61.3	292.0	371.0	4.2	8.1	25.4	28.1	28.1	10.9	196.8	153.2	16.0	23.9
Sudan <sup>e</sup>	150.6	121.8	58.6	41.8	83.7	143.6	9.9	16.9	1.8	2.1	25.5	34.8	187.4	162.2	27.1	37.2
Tajikistan <sup>b,c</sup>	1605.8	148.7	8.8	1.4	146.6	185.7	1.4	4.0	0.5	0.5	13.0	12.4	189.1	175.6	10.9	19.0
Timor-Leste	283.0	922.3	6.2	7.9	46.6	49.8	10.8	12.6	0.0	0.0	40.2	32.8	305.5	218.3	3.3	11.5
Turkmenistan <sup>b</sup>	1361.6	1029.2	4.7	12.0	127.9	208.6	0.4	0.3	4.6	3.6	35.1	56.9	215.7	234.8	16.7	9.4
Uzbekistan <sup>b</sup>	53.4	287.8	11.4	18.6	160.0	311.6	0.7	1.2	0.9	0.7	27.0	37.9	232.4	235.1	13.4	10.2
Vanuatu <sup>d</sup>	578.9	336.2	11.1	6.7	341.7	277.3	6.2	7.4	31.3	33.7	35.5	31.4	243.7	311.1	9.2	20.3
Yemen	2104.4	2454.6	3.4	0.6	66.1	70.4	7.0	6.1	6.0	2.5	8.2	10.6	177.9	171.1	20.2	28.6

WTO: World Trade Organization.

<sup>a</sup> We obtained membership dates from the WTO web site.<sup>15</sup><sup>b</sup> We analysed former Soviet Union member states data from 1992.<sup>c</sup> We did not analyse data after 2012 since the country joined WTO in 2013.<sup>d</sup> We did not analyse data after 2011 since the country joined WTO in 2012.<sup>e</sup> Data ended in 2011 when country divided into Sudan and South Sudan.

Note: Quantities for each commodity for the periods before and after joining the WTO are presented for the first and last years with complete data for all countries, except for pre-exposure tobacco data for Oman, which are from 1992.

quantitative evidence on the role of trade and investment liberalization in the global noncommunicable disease burden, we studied changes in the domestic supply of tobacco, alcohol and several food groups at the national level after WTO accession and compared to these trends in non-member countries.

## Methods

### Study design

We used a natural experiment approach to compare domestic supply patterns of nine commodities in 47 countries or territories, from 1980 to 2013: 21 countries or territories joining WTO between 1996 and 2008 (exposed group) and 26 countries not in WTO as of 2011 (unexposed group; Table 1). We defined exposure as accession to WTO and the post-exposure period was therefore the beginning of each country's individual WTO joining date. The years 1980 to 1995 comprise the pre-exposure period for all countries, as the first countries joined the WTO in 1995.

The commodities were tobacco (all types); alcohol (all types, including beer, wine and spirits); and seven food groups relevant to the development of noncommunicable diseases, either protective or harmful. These food groups were: fruits and vegetables; nuts, seeds and legumes; seafood; red meats and animal fats; sugars; starches; and edible oils. We based the selection of these food categories on a review of common elements of indices of dietary quality<sup>16–19</sup> and dietary diversity<sup>20,21</sup> and available evidence on the protective and harmful effects of major food groups for the development of noncommunicable diseases.<sup>22–24</sup> A list of food items included in the different commodity groups and the data completeness for each item is available from the figshare data repository.<sup>25</sup> We hypothesized that following WTO accession, the supply of tobacco, alcohol, edible oils, red meats and animal fats and sugars would increase; the supply of starches and nuts, seeds and legumes would decline. The expected trends in fruits and vegetables and seafood were unknown.

From our sample, we excluded original member states of WTO and all members of the former General Agreement on Tariffs and Trade. Nine countries in the unexposed group joined WTO in the final two years (2012–2013)

Table 2. Baseline characteristics of countries included in study on WTO membership and changes in noncommunicable disease risk factors

Covariates	WTO members <sup>a</sup> (n = 21)	WTO non-members (n = 26)	Standardized difference in means (P) <sup>b,c</sup>
<b>No. of countries per area</b>			NA (0.55)
East Asia and Pacific	4	8	
Europe and central Asia	10	7	
Latin America and Caribbean	2	1	
Middle East and north Africa	3	5	
North America	0	0	
South Asia	1	1	
Sub-Saharan Africa	1	4	
<b>No. of former Soviet Union member states</b>	8	7	NA (0.41)
<b>Mean GDP per capita in 2005 Int\$ (SD)</b>			
Year 1980	5565 (8314)	6907 (9697)	0.15 (0.69)
Year 1995	4805 (4845)	6357 (11005)	0.18 (0.55)
<b>Mean % of female labour force participation (SD)</b>			
Year 1980	44.1 (25.1)	42.1 (26.0)	-0.08 (0.82)
Year 1995	51.9 (18.3)	46.5 (22.4)	-0.26 (0.37)
<b>Mean % of urban population (SD)</b>			
Year 1980	38.2 (20.6)	37.2 (21.9)	-0.05 (0.90)
Year 1995	53.1 (20.1)	45.8 (20.9)	-0.35 (0.23)
<b>Mean % of Muslim population (SD)<sup>d</sup></b>			
Year 1980	30.0 (40.4)	36.0 (43.4)	0.14 (0.70)
Year 1995	22.4 (36.2)	41.8 (42.8)	0.48 (0.11)
<b>Mean weight of commodity per capita<sup>e</sup></b>			
Tobacco, gram (SD) <sup>f</sup>			
Year 1980	1890 (1532)	2182 (1997)	0.16 (0.67)
Year 1995	1358 (1045)	1913 (2716)	0.26 (0.38)
Alcohol, kilogram (SD) <sup>f</sup>			
Year 1980	25.2 (36.9)	29.8 (33.0)	0.14 (0.72)
Year 1995	29.2 (26.2)	26.3 (27.5)	-0.11 (0.71)
Fruits and vegetables, kilogram (SD)			
Year 1980	108.9 (74.7)	165.8 (93.0)	0.64 (0.09)
Year 1995	137.1 (61.1)	159.0 (113.2)	0.23 (0.43)
Nuts, seeds and legumes, kilogram (SD)			
Year 1980	6.0 (3.5)	7.9 (6.2)	0.36 (0.34)
Year 1995	4.4 (2.6)	6.4 (6.7)	0.38 (0.19)
Seafood, kilogram (SD)			
Year 1980	7.7 (6.8)	17.0 (17.8)	0.62 (0.09)
Year 1995	9.5 (8.9)	13.9 (18.6)	0.30 (0.32)
Red meats and animal fats, kilogram (SD)			
Year 1980	28.0 (32.2)	27.2 (18.2)	-0.03 (0.93)
Year 1995	37.3 (23.8)	28.7 (20.9)	-0.38 (0.20)
Starches, kilogram (SD)			
Year 1980	193.1 (37.2)	223.0 (52.1)	0.62 (0.10)
Year 1995	215.5 (55.4)	207.8 (53.3)	-0.14 (0.63)
Sugars, kilogram (SD)			
Year 1980	24.4 (14.8)	23.9 (14.1)	-0.04 (0.93)
Year 1995	23.2 (8.9)	21.5 (13.1)	-0.15 (0.61)
Edible oils, kilogram (SD)			
Year 1980	6.1 (4.5)	6.8 (4.4)	0.15 (0.70)
Year 1995	7.3 (4.8)	8.3 (5.5)	0.19 (0.52)

GDP: gross domestic product; Int\$: international dollars; NA: not applicable; SD: standard deviation; WTO: World Trade Organization.

<sup>a</sup> Countries joining WTO between 1996 and 2008.

<sup>b</sup> We calculated standardized difference in means as follows: (mean for non-member states – mean for member states)/(combined standard deviation).

<sup>c</sup> For continuous variables, we used two-sided t-tests to calculate P-values. For categorical variables, we used  $\chi^2$  tests.

<sup>d</sup> Covariate used in alcohol models only.

<sup>e</sup> Commodity available for domestic consumption.

<sup>f</sup> Data for population older than 14 years.

Note: The years presented are the first (1980) and last (1995) years we used for analyses of the period before countries and territories included in the study started to join WTO.

or after the analysis period; data for these countries were censored to exclude values in or after the year they joined. For countries that comprised the former Soviet Union (eight exposed, seven unexposed), the analysis period begins in 1992, when independent countries were established.

## Data sources

The data sources for all commodities were the Food and Agriculture Organization national commodity balance sheets (tobacco) and food balance sheets (all other commodities), which measure the annual supply of each commodity, by country, and are widely used as a proxy for consumption.<sup>26,27</sup> We obtained covariate data on urban population and female labour force participation from the World Bank's World Development Indicators;<sup>28</sup> population data from the United Nations Population Division;<sup>29</sup> gross domestic product (GDP) per capita from the Institute for Health Metrics and Evaluation;<sup>30</sup> percentage Muslim population from the Pew Research Center;<sup>31</sup> and the ratification dates for the Framework Convention on Tobacco Control (FCTC) from the United Nations Treaty Collection.<sup>32</sup>

## Variables

We measured all commodity variables in units of grams (tobacco) or kilograms (all other commodities) per capita. For tobacco and alcohol, we restricted these measures to the population older than 14 years, as is standard.<sup>33,34</sup> We controlled for the following key confounders established by the existing literature in all models: GDP per capita, urban population and female labour force participation.<sup>4,5</sup> Models for alcohol included each country's proportion of population identifying themselves as Muslim as a covariate, because being Muslim is linked to lower rates of alcohol use.<sup>35</sup> Models for tobacco included a variable indicating whether the country had ratified the FCTC, because this ratification represents a commitment to reduce tobacco use.<sup>36</sup>

## Propensity score weights

With observational data, the non-random assignment of the exposure (in this case, WTO membership) can create imbalance in covariates and baseline levels of the outcome variables between the groups compared.<sup>37</sup> Characteristics of the groups in the pre-exposure period

Table 3. Model output from best-performing model to study WTO membership and changes in noncommunicable disease risk factors, 1980–2013

Variable	Tobacco <sup>a</sup>	Alcohol <sup>a</sup>	Fruits and vegetables	Nuts, seeds and legumes <sup>a</sup>	Seafood <sup>a</sup>	Red meats and animal fats <sup>a</sup>	Starches	Sugars	Edible oils <sup>a</sup>
<b>Fixed effect, coefficient (<i>P</i>)</b>									
WTO membership	0.098 (0.477)	-0.118 (0.133)	19.794 (0.003)	0.107 (0.171)	-0.137 (0.436)	0.008 (0.865)	-6.277 (0.133)	-2.401 (0.115)	-0.070 (0.296)
WTO membership*year	0.061 (0.054)	0.037 (0.050)	-12.76 (0.367)	-0.017 (0.151)	0.032 (0.367)	0.001 (0.875)	-0.120 (0.904)	0.250 (0.176)	0.005 (0.730)
GDP per capita <sup>b,c</sup>	0.449 (0.004)	0.496 (<0.001)	7.571 (0.218)	0.313 (0.060)	0.826 (<0.001)	0.184 (0.020)	5.308 (0.464)	6.133 (0.003)	0.150 (0.243)
% urban population	-0.017 (0.024)	0.014 (0.160)	1.993 (0.004)	-0.005 (0.491)	0.006 (0.637)	0.004 (0.533)	0.616 (0.189)	0.019 (0.879)	0.011 (0.052)
% female labour force participation	-0.010 (0.099)	-0.009 (0.202)	-1.029 (0.069)	-0.001 (0.804)	-0.036 (0.016)	0.003 (0.553)	0.298 (0.371)	-0.133 (0.088)	-0.012 (0.102)
FCTC ratification <sup>d</sup>	-0.204 (0.032)	NA	NA	NA	NA	NA	NA	NA	NA
% Muslim population <sup>d</sup>	NA	-0.025 (<0.001)	NA	NA	NA	NA	NA	NA	NA
Year <sup>e</sup>	-9.72×10 <sup>-6</sup> (0.251)	NA	NA	NA	-1.46×10 <sup>-6</sup> (0.875)	NA	NA	NA	NA
Constant	4.759 (<0.001)	-1.088 (0.337)	7.268 (0.883)	-1.413 (0.265)	-3.845 (0.022)	1.437 (0.049)	142.441 (0.020)	-18.940 (0.163)	0.066 (0.950)
<b>Random effects, variance (SE)</b>									
Intercept	0.944 (0.199)	1.660 (0.530)	6917.032 (1656.286)	3.070 (1.585)	2.950 (0.747)	0.396 (0.073)	5228010 (1123.200)	87.917 (19.290)	8.46×10 <sup>-4</sup> (1.93×10 <sup>-4</sup> )
Slope	7.83×10 <sup>-10</sup> (2.8×10 <sup>-10</sup> )	0.003 (0.0012)	20.161 (5.345)	0.002 (0.0013)	4.38×10 <sup>-10</sup> (9.97×10 <sup>-11</sup> )	2.55×10 <sup>-4</sup> (5.61×10 <sup>-5</sup> )	3.667 (0.828)	0.185 (0.0367)	0.953 (0.186)
Intercept and slope <sup>f</sup>	-1.3×10 <sup>-5</sup> (4.95×10 <sup>-6</sup> )	-0.030 (0.013)	-255.959 (87.756)	-0.0713 (0.0449)	-1.13×10 <sup>-5</sup> (6.86×10 <sup>-6</sup> )	-0.0058 (0.0015)	-93.382 (21.924)	-2.055 (0.632)	-0.0251 (0.0061)
Residual	0.215 (0.046)	0.071 (0.014)	437.215 (95.743)	0.076 (0.0158)	0.162 (0.0454)	0.018 (0.0027)	184.153 (28.207)	12.292 (2.310)	0.052 (0.0107)

FCTC: Framework Convention on Tobacco Control; GDP: gross domestic product; NA: not applicable; SD: standard deviation; SE: standard error; WTO: World Trade Organization.

<sup>a</sup> Natural logarithm of commodity values used in model.

<sup>b</sup> In 2005 International dollars.

<sup>c</sup> Only included in tobacco model.

<sup>d</sup> Only included in alcohol model.

<sup>e</sup> Coefficient values for individual year fixed effects not shown (when applicable); complete model output available from the figshare repository<sup>25</sup>.

<sup>f</sup> Data presented are covariances and SEs.

are presented in **Table 2**. Although no differences were statistically significant, to improve comparability, we estimated and applied propensity score weights that optimized comparability on pre-exposure values of each commodity.

In the first step, we estimated propensity scores to predict the probability of WTO membership as a function of annual values of each commodity in the pre-exposure period using a generalized boosted regression modelling approach.<sup>38,39</sup> In the second step, we used propensity scores to construct weights for each country, with all exposed countries or territories receiving a weight of 1, and unexposed countries receiving a weight of  $p/(1-p)$ , where  $p$  is the estimated propensity score. This weighting estimates the average treatment effect on the exposed group, i.e. the average effect of joining WTO for those countries or territories that did join.

**Fig. 1** (available at: <http://www.who.int/bulletin/volumes/97/1/18-218057>) displays the balance, between the groups, for annual values of the commodities and covariates during the pre-exposure period, before and after applying weights. The balance metric is the absolute value of the difference in group means divided by the standard deviation across both groups; 0.25 is a generally accepted balance threshold.<sup>37</sup> Improvements are reflected by the weighted values generally being closer to zero than unweighted values, though, in several cases, improving balance on commodities sacrificed balance on covariates. However, we further controlled for the influence of covariates in the regression models.

## Commodity models

We modelled changes in domestic supplies of the commodities using separate linear regression models for each of the nine commodities in a comparative interrupted time-series framework. We used WTO membership as the treatment ( $t$ ) term and used a treatment\*year interaction ( $ty$ ) term to compare the pre- and post-exposure level and trend in the commodities ( $c$ ), respectively, in the exposed versus unexposed groups.<sup>40</sup> For unexposed countries, the WTO membership variable was always 0. For exposed countries, this variable ranged from 0 (before accession) to 1 (after accession); for the year of each country's accession to WTO, we used a fraction

reflecting the number of days of membership. Each commodity model had the following equation:

$$c_{ij} = \beta_0 + \beta_1 (\text{year})_j + \beta_2 (t)_{ij} + \beta_3 (ty)_{ij} + \beta_4 (x)_{ij} + \varepsilon_{ij} \quad (1)$$

where  $i$  indexes country;  $j$  indexes year (1980 to 2013);  $x$  is a set of countries- and year-specific covariates;  $\beta$ 's represent coefficients estimated by the linear model; and  $\varepsilon$  is the residual error term. Covariates for urban population, female labour force participation and percentage Muslim population (alcohol model only) were continuous, ranging from 0 to 100%. The FCTC covariate (tobacco model only) ranged from 0 (not ratified) to 1 (ratified), with a fraction reflecting the number of days after ratification in the year during which each country was ratified. All models were run with commodity-specific propensity score weights applied as inverse-probability-of-treatment weights.

We tested multiple model variations for each commodity. For six commodities (tobacco; alcohol; red meats and animal fats; seafood; nuts, seeds and legumes; and edible oils), we log-transformed the commodity values to constrain predicted values to be greater than 0. The key output of the best-performing model for each commodity is presented in **Table 3**; additional output and model fit graphs are available in the figshare repository.<sup>25</sup>

## Sensitivity analyses

We did several sensitivity analyses to assess whether various aspects of the study design affected the estimated effects of WTO membership. First, to eliminate the influence of missing data, we restricted the analysis period to 1993 to 2011, years with complete data for all 47 countries. Second, because the effects of WTO accession may take time, we explored lagged values of the WTO membership and WTO membership\*year terms. Third, to examine whether the effects of WTO membership were predominantly mediated through economic growth, we excluded GDP per capita from all models. Fourth, we excluded several countries in the unexposed group that may be poor comparisons due to war, famine or isolation from the global economy: Afghanistan,

Democratic People's Republic of Korea, Ethiopia, Iraq and Sudan. Lastly, we stratified models by income group. All analyses were conducted in Stata version 14.2 (StataCorp. LCC, College Station, United States), except for the *twang* package for propensity scores, run in R version 3.3.2 (R Foundation, Vienna, Austria).

## Results

**Fig. 2**, **Fig. 3**, **Fig. 4**, **Fig. 5** and **Fig. 6** show average trends for each commodity for the exposed, unweighted unexposed and weighted unexposed groups. Trends during the pre-exposure period illustrate the improved comparability between the groups after weighting. Outputs from the best-performing models to estimate changes in supply of the commodities are shown in **Table 3**. The coefficients for the WTO membership and WTO membership\*year terms indicate whether there is any difference in the level and trend, respectively, of each commodity for countries and territories joining the WTO, compared with non-WTO members. The domestic availability of fruits and vegetables increased the most: the average annual supply of fruits and vegetables was 19.79 kg per capita (95% confidence interval, CI: 6.60–32.99) higher in countries or territories that have joined WTO than in non-member countries. For tobacco and alcohol, the WTO membership\*year coefficients suggest significant increasing trends in the availability of these products following WTO accession. The geometric means of the supply of tobacco increased by 6.2% (95% CI: 0.0–13.0) annually and of the supply of alcohol by 3.8% (95% CI: 0.0–7.7) annually. In the tobacco model, the FCTC ratification coefficient indicates an 18.5% (95% CI: 1.8–32.4) lower geometric mean supply of tobacco after ratification. In the random effect model, the intercept and slope are significantly different from zero for all commodities, indicating substantial remaining heterogeneity across countries in both the level and trend in domestic supply quantities (**Table 3**).

The sensitivity analyses generally supported the main findings. The treatment effect on fruits and vegetables was robust in all sensitivity analyses. The trend coefficient for the alcohol supply stayed of a consistent magnitude and

remained significant in most analyses. The trend coefficient for the tobacco supply also remained of a consistent magnitude, but not always statistically significant. In only the lagged effect models, treatment effects for sugars were significant and similar in magnitude to those in the main model, providing some evidence of an initial decrease in the availability of sugars following WTO accession, followed by a minimal steady increase. When we stratified the analyses by country income group, the results did not support any of the main conclusions. However, propensity score weights were generated to balance the sample and likely generated false results from these models, which were run with 23 countries or less (out of the total 47) per income group. Further details on each sensitivity analysis are available in the figshare repository.<sup>25</sup>

## Discussion

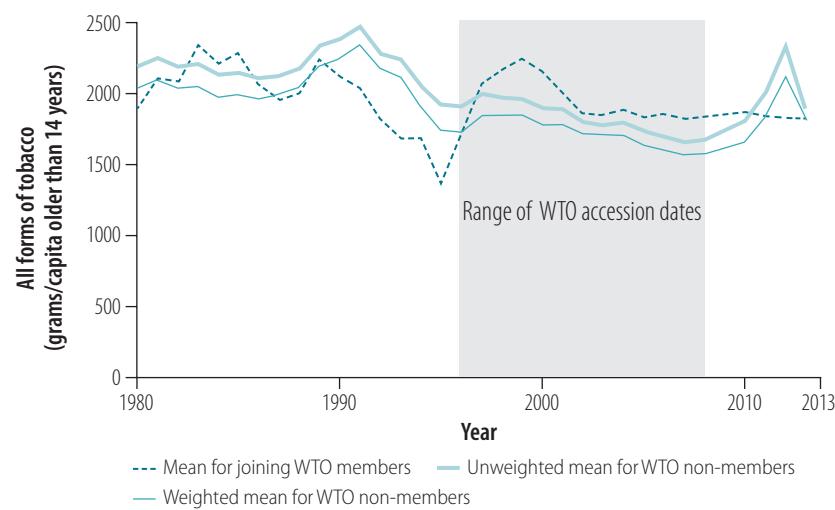
Here we show that following a country's accession to WTO, there was a significant increasing trend in the domestic supply of alcohol; a borderline significant increasing trend in the supply of tobacco; and a significant immediate increase in the availability of fruits and vegetables, compared with non-member countries. Assuming that increases in supply likely translate to increases in consumption, these changes have both positive and negative implications for global health. For example, recent research has indicated that any amount of alcohol consumption increases the risk of a range of negative health outcomes, hence an increase in alcohol supply could be harmful.<sup>41</sup> Likewise, an increase in tobacco use is negative, as tobacco contributes to several noncommunicable diseases.<sup>42</sup> In contrast, increases in fruit and vegetable consumption can protect against the development of numerous noncommunicable diseases.<sup>24</sup> The WHO recommends a 400 g intake of fruit and vegetables daily,<sup>43</sup> although even an intake of 200 g per day has been found to reduce the risk of many non-communicable diseases and premature mortality.<sup>44</sup> We estimate that average increase in the supply is about 55 g of fruits and vegetables per person per day higher in the countries after joining WTO.

Our results provide more evidence about the links between trade liberalization and global health, suggesting that

trade agreements should be considered as social determinants of health at the global scale. As the burden of noncommunicable diseases continues to grow, stakeholders should prioritize identifying the most effective strategies to curb the increase in risk factors, including tobacco and alcohol use and poor diet. For example, addressing aspects of trade and investment policies that alter the supply

of these products can help to tackle the noncommunicable disease burden at the root cause level. This approach can be achieved through actions grounded in the Health in All Policies framework<sup>45</sup> and the application of health impact assessment to proposed trade and investment policies.<sup>46</sup> At the global level, further development and consideration of international agreements to prevent

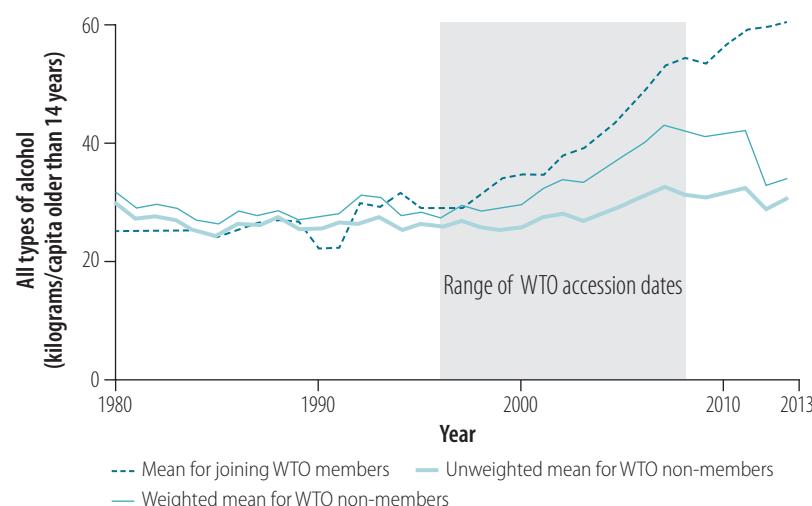
**Fig. 2. Changes in the supply of all forms of tobacco, by joining WTO members and non-member states, 1980–2013**



WTO: World Trade Organization.

Notes: The grey box represents the range of accession dates for countries and territories joining WTO. Aberrations in trends starting in 1992 likely reflect the changing composition of countries in each exposure group due to data availability for former Soviet Union countries. We obtained weighted means by applying tobacco-specific propensity score weights.

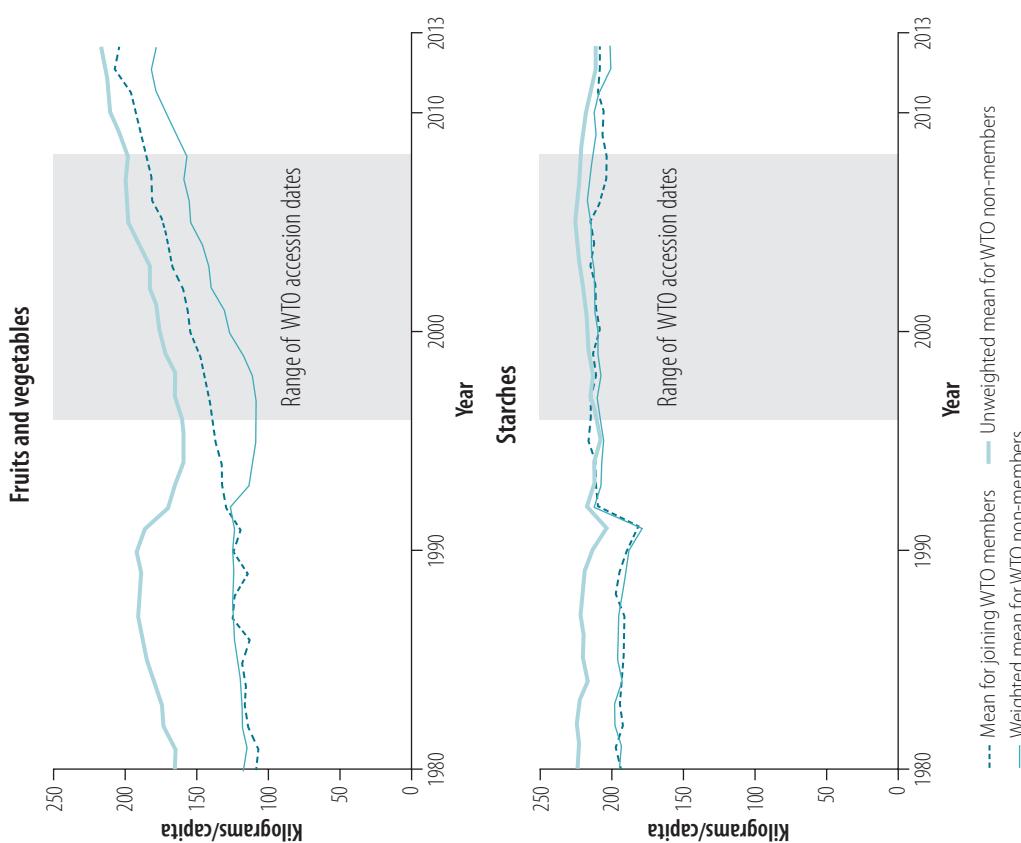
**Fig. 3. Changes in the supply of all types of alcohol, by joining WTO members and non-member states, 1980–2013**



WTO: World Trade Organization.

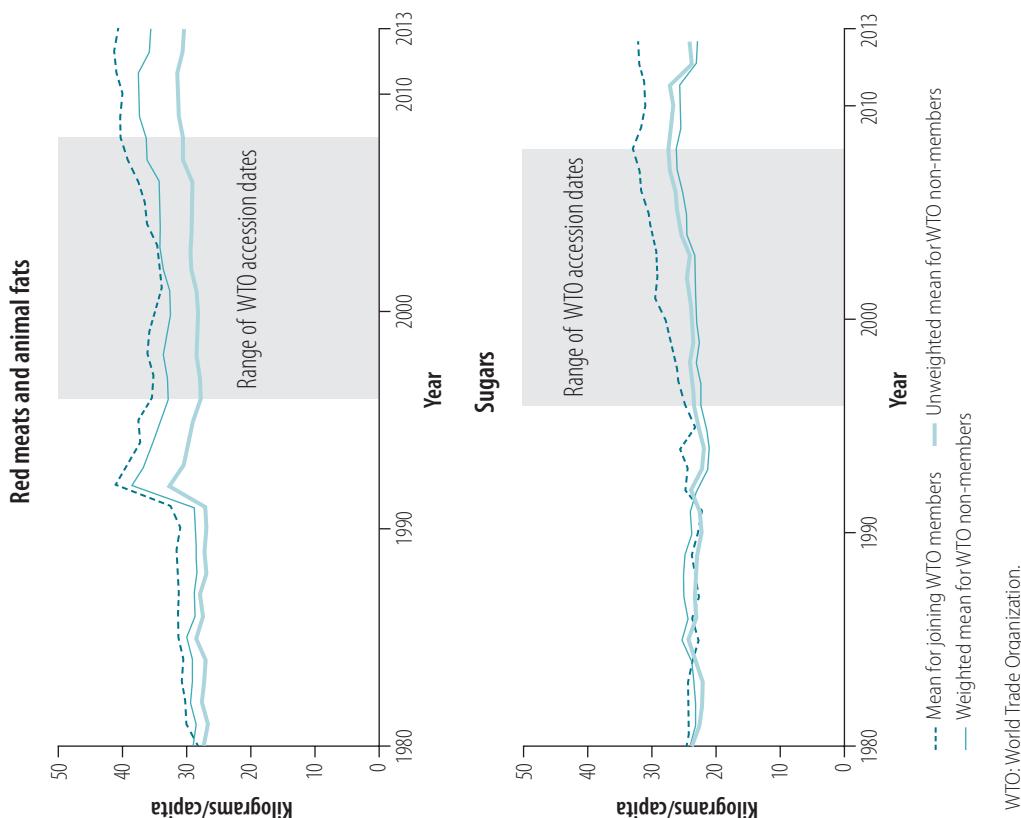
Notes: The grey box represents the range of accession dates for countries and territories joining WTO. Aberrations in trends starting in 1992 likely reflect the changing composition of countries in each exposure group due to data availability for former Soviet Union countries. We obtained weighted means by applying alcohol-specific propensity score weights.

**Fig. 4. Changes in the supply of fruits and vegetables and starches, for joining WTO members and non-member states, 1980–2013**



WTO: World Trade Organization.  
Notes: The grey box represents the range of accession dates for countries and territories joining WTO. Aberrations in trends starting in 1992 likely reflect the changing composition of countries in each exposure group due to data availability for former Soviet Union countries. We obtained weighted means by applying commodity-specific propensity score weights.

**Fig. 5. Changes in the supply of red meats and animal fats, and sugars, by joining WTO members and non-member states, 1980–2013**



WTO: World Trade Organization.  
Notes: The grey box represents the range of accession dates for countries and territories joining WTO. Aberrations in trends starting in 1992 likely reflect the changing composition of countries in each exposure group due to data availability for former Soviet Union countries. We obtained weighted means by applying commodity-specific propensity score weights.

and control noncommunicable diseases, like the FCTC, but focused on other noncommunicable disease risk factors, is warranted. Such agreements can legally bind countries to health commitments, providing a counterweight for commitments to international trade and investment rules.

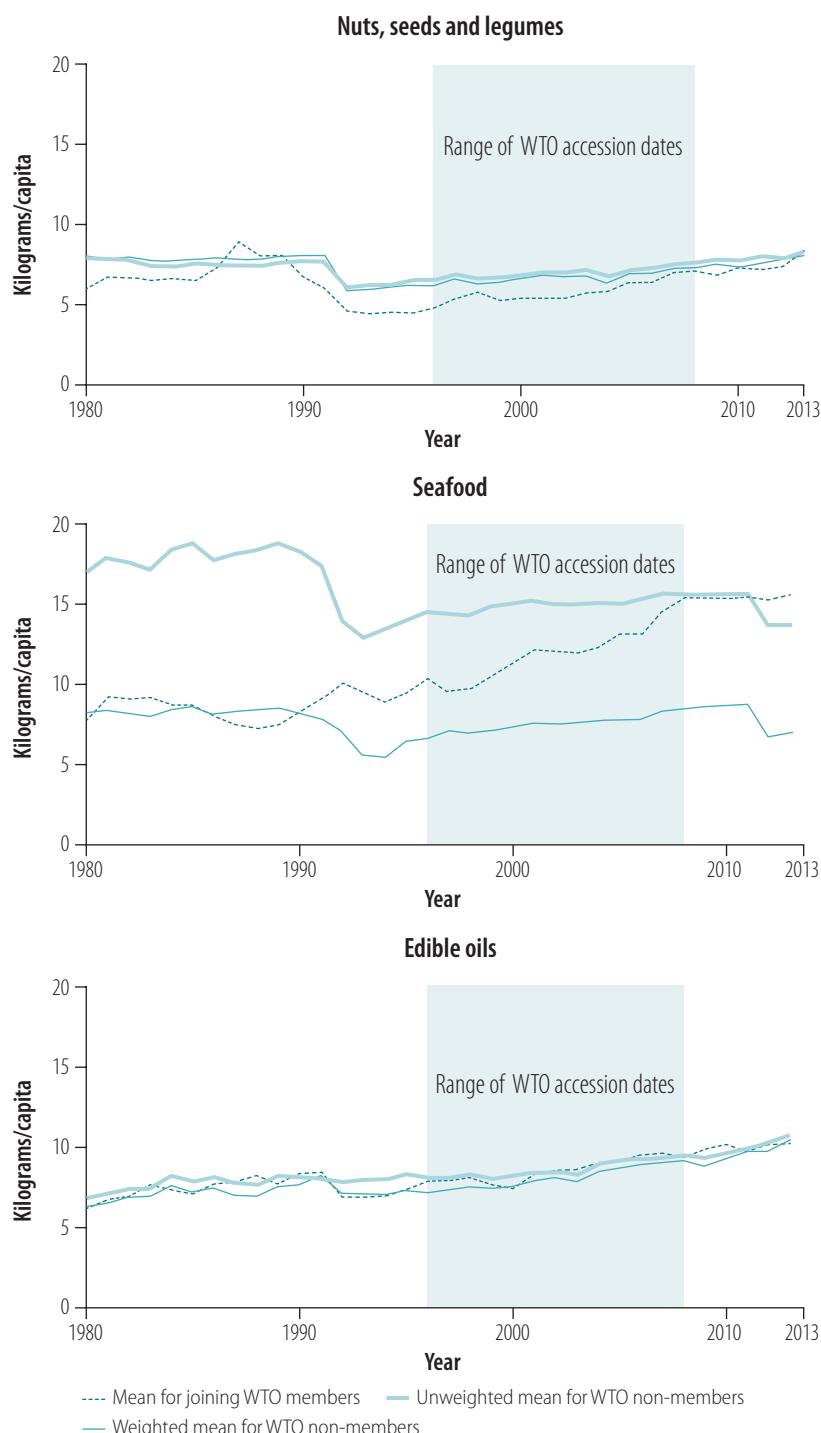
Our findings are suggestive but not conclusive, warranting additional exploration and we suggest several potential avenues for future research. For example, given substantial unexplained country-specific heterogeneity indicated by country random effects in all models, additional analyses of smaller groups of countries and individual countries are needed. The effects of WTO membership may differ by level of economic development and other country-specific factors, such as geography and climate, which affect the baseline supply of various food groups, tobacco and types of alcohol. Researchers could recreate this analysis with one income group at a time and a similar analysis of selected low- and middle-income countries with substantial noncommunicable disease burdens may provide further insight into the links between WTO membership and changes in noncommunicable disease risk factors. Single country studies could permit more nuanced understanding, for example, by looking at tariff changes for specific products and subsequent changes in their supply. Another area for future studies is to examine differences associated with specific provisions in WTO accession agreements and other trade and investment policies, as specific concessions differ. Understanding which components of these treaties have the greatest influence on noncommunicable disease risk factors and other aspects of public health is important when tailoring future agreements to be more health-promoting. Further, researchers should also conduct similar analyses for other products that contribute to noncommunicable diseases, particularly unhealthy foods high in fat, salt and sugar.

This study both supports and contradicts findings from previous research. We were not able to confirm findings showing increases in consumption of meat<sup>10</sup> and edible oils<sup>47</sup> following trade liberalization. Discrepancies may be due to differences in the sample; previous studies examined only one to five countries in the same geographical region. Studies showing trade-related

increases in sugar-sweetened beverage consumption<sup>13,48</sup> are somewhat supported by our weak finding that the domestic supply of sugars increases steadily over time following WTO ac-

cession. Our results confirm previous findings of increased tobacco<sup>7,12</sup> and alcohol<sup>5</sup> consumption associated with trade liberalization. Finally, few studies have examined fruits and vegetables

Fig. 6. Changes in the supply of nuts, seeds and legumes; seafood; and edible oils, by joining WTO members and non-member states, 1980–2013



WTO: World Trade Organization.

Notes: The grey box represents the range of accession dates for countries and territories joining WTO. Aberrations in trends starting in 1992 likely reflect the changing composition of countries in each exposure group due to data availability for former Soviet Union countries. We obtained weighted means by applying commodity-specific propensity score weights.

consumption in the context of trade liberalization, but our findings support the results of an analysis showing that changes in trade policies led to an increase in imported fruit in five Central American countries.<sup>10</sup>

This study has limitations. A primary limitation is the comparability of countries joining versus not joining WTO. We assumed that trends would have been similar between the two groups if none of the countries joined WTO. However, differences in trends could be due to the influence of other unobserved events correlated with WTO accession and the outcomes of interest or innate characteristics of countries in either group.

Another key limitation is the quality of the commodity data, which measure

the available supply of each commodity and are only a proxy for consumption, the true measure of importance for health. In addition, there was substantial missing data for certain items summed to create commodity variables, which may affect the validity of the data for these categories. The commodities analysed were also limited by the available product categories; importantly, this did not allow us to distinguish changes in trends in the availability of specific foods high in fat, salt or sugar, an important determinant of obesity and noncommunicable diseases.<sup>49</sup> Finally, for tobacco and alcohol, illicit sales and homemade varieties are not captured in this data, which may comprise substantial portions of supply and consumption in certain countries.

In conclusion, changes in domestic supply of alcohol, tobacco and fruits and vegetables could have important implications for public health, particularly for the development and prevention of noncommunicable diseases. Overall, findings indicated substantial country-level heterogeneity. Therefore, additional exploration of variations across countries is critical to identify factors that mitigate the negative role and enhance the positive role of trade and investment agreements in the global noncommunicable disease burden. ■

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**Competing interests:** None declared.

## ملخص

### عضوية منظمة التجارة العالمية والتغيرات في عوامل خطر الأمراض غير المعدية: تحليل سلاسل زمنية متقطعة، ما بين عامي 1980 و2013

النتائج بعد الانضمام إلى منظمة التجارة العالمية، شهدت الدول الأعضاء زيادات فورية في الإمداد المحلي من الفواكه والخضروات ووصلت إلى 55 جم للشخص الواحد في اليوم في المتوسط، مقارنة بالدول غير الأعضاء. أظهر التحليل زيادات تدريجية في المتوسط الهندسي لإمدادات التبغ والكحول بنسبة 6.2% و 3.6% في السنة على الترتيب. لم تكشف أي تغيرات جوهرية في توافر اللحوم الحمراء، أو الدهون الحيوانية، أو المأكولات البحرية، أو المكسرات، أو البذور والباقوليات، أو النشويات، أو الزيوت الصالحة للأكل، وكانت النتائج للسكريات غير متناسبة عبر تنوعات النموذج.

الاستنتاج يشير النتائج إلى أن عضوية منظمة التجارة العالمية قد تؤدي إلى زيادة في كل من العوامل الضارة والوقائية للأمراض غير المعدية، ولكن هناك تعزيز لمزيد من استكشاف الاختلافات الخاصة بكل بلد.

الغرض دراسة العلاقة بين الانضمام إلى منظمة التجارة العالمية (WTO) وتوافر العديد من السلع ذات التأثيرات الضارة والوقائية من أجل تطوير الأمراض غير المعدية.

الطريقة استخدمنا تصميم التجربة الطبيعية لمقارنة الاتجاهات في الإمداد المحلي للتبغ والكحول وسبع مجموعات غذائية، بين عامي 1980 و2013، في 21 دولة أو منطقة انضمت إلى منظمة التجارة العالمية بعد عام 1995 و 26 دولة غير أعضاء، باستخدام أوزان درجات النزوع. طبقنا إطاراً زمنياً متسلسلاً مقارناً متقطعاً، باستخدام نماذج خطية ذات تأثيرات عشوائية متعددة، معدلة للناتج المحلي الإجمالي للفرد، والنسبة المئوية لسكان الحضر ومشاركة المرأة في القوى العاملة. في نموذج التبغ، قمنا بالمالافية في الدول الأعضاء التي صدقت على الاتفاقية الإطارية لمكافحة التبغ وفي نموذج الكحول، النسبة المئوية لسكان الذين يعرفون أنفسهم بأنهم مسلمين.

## 摘要

**世界贸易组织成员国与非传染性疾病风险因素的变化：**目的 旨在调查加入世界贸易组织 (WTO) 与获取若干商品（此类商品对非传染性疾病的形成兼具有害因素和保护因素）之间的关系。

**方法** 我们使用自然实验设计、倾向评分权重来比较 1980 年至 2013 年期间，在 1995 年之后加入 WTO 的 21 个国家或地区以及 26 个非成员国的烟草、酒精和七类食品组在各国内的供应趋势。我们采用断续时间序列框架，使用多变量随机效应线性模型，根据人均国内生产总值、城市人口百分比和女性劳动力参与进行调整。在烟草模型中，我们控制了已批准《烟草控制框架公约》的成员国，在酒精模型中，我们控制了自认为穆斯林国家所占的比例。

### 一项断续时间序列比较分析，1980–2013 年

**结果** 成员国加入世贸组织后，与非成员国相比，平均每人每天的水果和蔬菜国内供应量立即增长 55 克。分析显示，烟草和酒精每年的供应量以几何平均数的形式逐渐递增，分别为每年 6.2% 和 3.6%。我们尚未发现获取红肉和动物脂肪有任何重大变化；海鲜；坚果、种子和豆类；淀粉；或食用油；以及与糖相关的结果在不同模型中是不一致的。

**结论** 结果表明，成为 WTO 成员国可能会导致非传染性疾病的有害因素和保护因素增加，但仍需进一步探索其针对具体国家的不同变化。

## Résumé

### **Adhésion à l'Organisation mondiale du commerce et évolution des facteurs de risque de maladies non transmissibles : analyse comparative de séries chronologiques interrompues, 1980–2013**

**Objectif** Étudier le lien entre l'adhésion à l'Organisation mondiale du commerce (OMC) et la disponibilité de différentes denrées avec des effets à la fois nocifs et protecteurs pour le développement des maladies non transmissibles.

**Méthodes** Nous avons utilisé un plan d'expérience dans les conditions naturelles pour comparer, entre 1980 et 2013, l'évolution de l'offre nationale de tabac, d'alcool et de sept groupes d'aliments dans 21 pays ou territoires devenus membres de l'OMC après 1995 et 26 pays non membres, à l'aide de pondérations par le score de propension. Nous avons appliqué un cadre comparatif de séries chronologiques interrompues, à l'aide de modèles linéaires à effets aléatoires multivariés, rajustés pour tenir compte du produit intérieur brut par habitant, du pourcentage de la population urbaine et de la participation des femmes à la vie active. Dans le modèle relatif au tabac, nous avons tenu compte des États membres ayant ratifié la Convention-cadre pour la lutte antitabac, tandis que dans le modèle relatif à l'alcool, nous avons tenu

compte du pourcentage de la population s'identifiant comme étant de foi musulmane.

**Résultats** À la suite de leur adhésion à l'OMC, les États membres ont connu une augmentation immédiate de l'offre nationale de fruits et légumes de 55 g par personne et par jour en moyenne, par rapport aux pays non membres. L'analyse a révélé une augmentation progressive de la moyenne géométrique de l'offre de tabac et d'alcool de 6,2% et 3,6% par an, respectivement. Nous n'avons pas constaté de changements importants concernant la disponibilité de viandes rouges et graisses d'origine animale ; de produits de la mer ; de noix, graines et légumineuses ; de féculents ; ou d'huiles alimentaires ; et les résultats relatifs aux sucres variaient d'un modèle à l'autre.

**Conclusion** Les résultats suggèrent que l'adhésion à l'OMC peut entraîner une augmentation des facteurs à la fois nocifs et protecteurs pour les maladies non transmissibles, mais il convient de réaliser de nouvelles recherches sur les variations par pays.

## Резюме

### **Членство во Всемирной торговой организации и изменения в факторах риска неинфекционных заболеваний: сравнительный анализ прерванных временных рядов, 1980–2013 гг.**

**Цель** Членство во Всемирной торговой организации и изменения в факторах риска неинфекционных заболеваний: сравнительный анализ прерванных временных рядов, 1980–2013 гг.

**Методы** Авторы использовали естественный эксперимент для сравнения тенденций внутренних поставок табака, алкоголя и товаров семи продовольственных групп в период с 1980 по 2013 год в 21 стране или территории, которые вступили в ВТО после 1995 года, и в 26 странах, не являющихся членами этой организации. Анализ проводился с использованием весовых коэффициентов предрасположенности. Авторы применили методику сравнительных прерванных временных рядов и многовариантные линейные модели случайных воздействий, скорректированные по валовому внутреннему продукту на душу населения, процентной доле городского населения и участию женщин в трудовой деятельности. В модели для табака контролировались государства-члены ВТО, ратифицировавшие Рамочную конвенцию по борьбе против табака, а в модели

для алкоголя — доля населения, идентифицирующая себя как мусульмане.

**Результаты** После вступления в ВТО в государствах-членах наблюдался немедленный прирост внутренних поставок фруктов и овощей (в среднем до 55 г в день на человека) по сравнению со странами, не являющимися ее членами. Анализ показал постепенное увеличение среднего геометрического значения поставок табака и алкоголя на 6,2 и 3,6% в год соответственно. Авторы не обнаружили существенных изменений в доступности мяса домашнего скота и животных жиров, морепродуктов, орехов, семян и бобовых, а также крахмала или пищевых масел. Что касается сахара, в разных моделях были получены несовпадающие результаты.

**Вывод** Результаты позволяют предположить, что членство в ВТО может привести к увеличению как полезных, так и вредных факторов распространения неинфекционных заболеваний, но необходимо проведение дальнейших исследований вариаций в различных странах.

## Resumen

### **Composición de la Organización Mundial del Comercio y cambios en los factores de riesgo de las enfermedades no contagiosas: un análisis comparativo de series cronológicas interrumpidas, 1980-2013**

**Objetivo** Investigar la relación entre la adhesión a la Organización Mundial del Comercio (OMC) y la disponibilidad de varios productos básicos con efectos tanto perjudiciales como protectores para el desarrollo de enfermedades no contagiosas.

**Métodos** Se utilizó un diseño de experimento natural para comparar las tendencias de la oferta interna de tabaco, alcohol y siete grupos de alimentos, entre 1980 y 2013, en 21 países o territorios que se incorporaron a la OMC después de 1995 y 26 países no miembros, mediante el uso de ponderaciones de propensión. Se aplicó un marco comparativo de series temporales interrumpidas, siguiendo modelos lineales de efectos aleatorios multivariados, ajustados según el producto interior bruto per cápita, los porcentajes de población urbana y la participación de la mujer en el mundo laboral. En el modelo del

tabaco, controlamos a los Estados miembros que habían ratificado el Convenio Marco para el Control del Tabaco y, en el modelo del alcohol, el porcentaje de la población que se identificaba como musulmana.

**Resultados** Tras la adhesión a la OMC, los Estados miembros experimentaron un aumento inmediato de la oferta interna de frutas y hortalizas de 55 kg por persona y día de media, en comparación con los países no miembros. El análisis mostró incrementos graduales en la media geométrica de la oferta de tabaco y alcohol del 6,2 % y el 3,6 % anual, respectivamente. No se detectaron cambios significativos en la disponibilidad de carnes rojas y grasas animales, mariscos, nueces, semillas y legumbres, almidones o aceites comestibles, y los resultados para los azúcares fueron inconsistentes entre las variaciones del modelo.

**Conclusión** Los resultados sugieren que la pertenencia a la OMC puede dar lugar a un aumento de los factores perjudiciales y protectores de

las enfermedades no contagiosas, pero es necesario seguir estudiando las variaciones específicas de cada país.

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# Modelling the impact of a tax on sweetened beverages in the Philippines: an extended cost-effectiveness analysis

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**Objective** To assess the potential impact of a new tax on sweetened beverages on premature deaths associated with noncommunicable diseases in the Philippines.

**Methods** In January 2018, the Philippines began imposing a tax of 6 Philippine pesos per litre (around 13%) on sweetened beverages to curb the obesity burden. Using national data sources, we conducted an extended cost-effectiveness analysis to estimate the effect of the tax on the numbers of premature deaths averted attributed to type 2 diabetes mellitus, ischaemic heart disease and stroke, across income quintiles over the period 2018–2037. We also estimated the financial benefits of the tax from reductions in out-of-pocket payments, direct medical costs averted and government health-care cost savings.

**Findings** The tax could avert an estimated 5913 deaths related to diabetes, 10339 deaths from ischaemic heart disease and 7950 deaths from stroke over 20 years. The largest number of deaths averted could be among the fourth and fifth (highest) income quintiles. The tax could generate total health-care savings of 31.6 billion Philippine pesos (627 million United States dollars, US\$) over 20 years, and raise 41.0 billion Philippine pesos (US\$ 813 million) in revenue per annum. The poorest quintile could bear the smallest tax burden increase (14% of the additional tax; 5.6 billion Philippine pesos) and have the lowest savings in out-of-pocket payments due to relatively large health-care subsidies. Finally, we estimated that 13 890 cases of catastrophic expenditure could be averted.

**Conclusion** The new sweetened beverage tax may help to reduce obesity-related premature deaths and improve financial well-being in the Philippines.

Abstracts in ، ، ، and at the end of each article.

## Introduction

Sugar-sweetened beverages are a driver of obesity,<sup>1–4</sup> and increasingly contribute to the burden of noncommunicable disease in low- and middle-income countries.<sup>5</sup> This is particularly true in the Philippines, where 31.1% (17.5 million) of the 56.3 million adults in 2013 were overweight and the percentage of overweight youth has nearly doubled, from 4.9% (0.9 million of 18.5 million) to 8.3% (1.7 million of 20.3 million), in 10 years.<sup>6</sup> This has left health officials looking for strategies to mitigate the burden of obesity.

On 19 December 2017, the Tax Reform for Acceleration and Inclusion Act was signed into law and was implemented in January 2018. This included a 6 Philippine pesos per litre excise tax on sweetened beverages made with caloric or non-caloric sweeteners and a 12 Philippine pesos per litre tax on beverages made with high-fructose corn syrup (equivalent to 0.12 United States dollars, US\$, and US\$ 0.24 in January 2018, respectively). This two-tiered levy represented retail price increases of approximately 13% from 45 to 51 Philippine pesos per litre of regular cola and 26% from 45 to 57 Philippine pesos per litre of cola made with high-fructose corn syrup, respectively. Milk, 100% natural fruit juice and 3-in-1 instant coffee were excluded.

The Philippines is one of 27 countries that has introduced a sweetened beverage tax, joining others such as Chile, France, Mexico, Spain and six municipalities in the United States of America.<sup>7</sup> This solution to curbing the rapid escalation of

obesity has been endorsed by the World Health Organization and others as a cost-effective policy solution, if retail prices increase sufficiently (10–20%) to reduce consumption.<sup>8,9</sup> However, evidence on the effectiveness and fairness of these new sweetened beverage taxes remains limited.

In this paper, we investigated the hypothetical impact of the new tax for different income groups in the Philippines using extended cost-effectiveness analysis.<sup>10</sup> This approach is important for a study in the Philippines, where economic inequalities persist and the consequences of public policy are not always clear. Some people, including industry representatives, have expressed concerns that taxes on direct consumption unfairly burden low-income consumers.<sup>11</sup> The evidence on sweetened beverage taxation is insufficient to support this claim. This study therefore sought to fill a gap in the global pool of knowledge by examining the relative impact of the new tax<sup>12–17</sup> on the health and financial well-being of households in the Philippines.

## Methods

### Overview

We used a method of extended cost-effectiveness analysis based on studies of increased tobacco taxes and other interventions.<sup>10,18–20</sup> Extended cost-effectiveness analysis is a policy assessment method for estimating the impact on three major outcomes: (i) health benefits (i.e. the reduction in premature

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mortality); (ii) elimination of out-of-pocket expenditure by patients, reduced government expenditure on health and the financial risk protection associated with those reduced expenditures; and (iii) the consequences across socioeconomic groups (e.g. income quintiles). We applied the method to ascertain the consequences for different income groups of imposing a sweetened beverage tax in the Philippines.

## Estimation methods

### Beverage tax, price elasticity and consumption

We converted the 6 Philippine pesos tax to a percentage (13%) based on a price of 45 Philippine pesos per litre of a regular cola drink, which was the mean price of sugar-sweetened soft drinks in the Philippines (available in the data repository).<sup>21</sup> We then multiplied the percentage change in price with price elasticities to obtain the percentage change in quantity of cola consumed. In line with evidence from other low- and middle-income countries, we assumed that 100% of the price increase would be paid by consumers instead of by distributors or manufacturers (i.e. pass-through rate of 100%).<sup>22</sup>

We multiplied the cola consumption in each quintile by the own-price elasticity estimate for its respective quintile. Own-price elasticity is the change in quantity of a product purchased in response to a change in its price. As we did not have local price elasticity estimates, we used elasticity estimates of demand for sugar-sweetened beverages by income quintile from another middle-income country, Mexico<sup>23</sup> (which are similar to estimates from Chile; available in the data repository).<sup>21</sup> We used the pre-tax per capita daily consumption of sugar-sweetened beverages by age, sex and income quintiles from the Philippines Food and Nutrition Research Institute (available in the data repository).<sup>21</sup>

### Disease incidence

We used a previously published mathematical model<sup>16,24</sup> to estimate the effect of reduced consumption of sugar-sweetened beverages on disease incidence over the 20-year period 2018–2037. This model has been used to estimate

the impact of sugar taxes on disease incidence and mortality in Australia,<sup>15</sup> Canada<sup>17</sup> and South Africa.<sup>12–14</sup>

Following previous methods,<sup>12,16</sup> we first calculated the effect of reduced consumption on body mass index (BMI) by converting change in consumption into change in energy intake and translating this into impact on body weight. We assumed that sugar-sweetened beverages have an energy density of 1800 kilojoules (kJ) per litre.<sup>13</sup> Reduction in consumption and energy intake was converted into change in body weight using an energy balance equation which stated that a daily energy change of 94 kJ was associated with a change of 1 kg in body weight for adults, assuming no change in physical activity.<sup>25</sup> We used the change in body weight and average height of individuals in each age quintile category to obtain the change in BMI by age quintile (available in the data repository).<sup>21</sup> BMI was modelled as lognormal distribution and a change in BMI will change the mean of the distribution.

Second, the changes in BMI were converted into incidence of type 2 diabetes mellitus, ischaemic heart disease and stroke using the potential impact fraction, defined as the “proportional reduction in the incidence of a certain disease, resulting from a specific change in distribution of a risk factor in the population at risk.”<sup>26</sup> We obtained the baseline age-and sex-specific incidence, prevalence and case-fatality rates of the diseases from DisMod II software package (World Health Organization, Geneva, Switzerland). We used data on the relative risk of type 2 diabetes mellitus, ischaemic heart disease and stroke due to a unit increase in BMI from the Global Burden of Disease study<sup>27</sup> and the change in BMI by age quintile category (from the first step) to derive the age-and sex-specific potential impact fraction estimates using the EpiGearXL add-in for Microsoft Excel, version 14.0 (EpiGear International Pty Ltd, Brisbane, Australia). The baseline incidence rate was scaled by the potential impact fraction to obtain the incidence and mortality rate due to the intervention. The changes in the incidence and mortality rate after the intervention then formed the inputs into the cohort life-tables. Using Erstaz add-in to Microsoft Excel version 14.0 (EpiGear Interna-

tional Pty Ltd, Brisbane, Australia) the population was simulated to 100 years of lifetime or death to estimate the reduction in disease incidence, premature deaths and health-care costs over a 20-year period 2018–2037.

### Health expenditure

We calculated the reduction in health expenditure associated with the reduction in disease incidence for both the households and the government. The Philippines Health Insurance Corporation (PhilHealth), a parastatal organization that operates the national health insurance scheme, provided the case rate for type 2 diabetes mellitus-related hospital admissions (International statistical classification of diseases and related health problems,<sup>28</sup> ICD codes: E11.0, E11.1, E11.5 and E11.6), ischaemic heart disease (ICD code: I25) and stroke (ICD codes: I60, I61, I62, I63, I66, I67.4). The mean annual costs for these three admissions were 12 424 Philippine pesos, 10 468 Philippine pesos and 30 302 Philippine pesos, respectively. Due to lack of detailed age-, sex- and sector-specific costs in the PhilHealth database, we assumed that the mean cost applied uniformly across all age groups.

To estimate out-of-pocket payments by patients and government expenditure through subsidies to patients, we apportioned the health-care costs in each income quintile by the level of government financing and co-payment under insurance for each quintile. Health insurance is largely provided by PhilHealth and out-of-pocket payments are determined by age, employment and income. Out-of-pocket payments form a major proportion of health care financing in the Philippines, and attempts have been made to address this, especially for the lowest income quintiles. As a result, the bottom quintile only pays 20% of their health-care costs out-of-pocket, whereas the highest quintile pays up to 83% of the costs. Government share of financing health-care costs also varies by income quintiles and while government provides 67% of financing for the lowest income quintile, its share of financing drops to only 8% for the highest income quintile.<sup>29</sup> Using this estimate of out-of-pocket payments and

government financing as a proportion of health-care costs, we estimated the reduction in out-of-pocket payments and government expenditure for each averted case of type 2 diabetes mellitus, ischaemic heart disease and stroke.

### Financial risk protection

For financial risk protection, we estimated catastrophic health expenditure (disease expenditure exceeding 10% of total yearly household expenditure) and the number of individuals avoiding disease-related catastrophic health expenditure after implementation of the tax.<sup>30</sup>

### Additional tax revenues

We estimated the total change in tax revenue due to the tax and calculated the proportion of this change borne by each income quintile. We used sugar-sweetened beverage consumption at baseline and the mean price (45 Philippine pesos) of a litre of sugar-sweetened beverages to calculate the post-policy tax revenue.

### Data sources

We obtained the total population by age and sex, and income quintile for 2013 from the Philippines Statistics Authority and the distribution by income quintile

from the Philippines Demographic and Health Survey 2013. We obtained the BMI, the mean height of the population and sugar-sweetened beverages consumption by age, sex and income quintile from the Philippines National Nutrition Survey 2013. The baseline characteristics and the inputs are shown in Box 1.

### Sensitivity analysis

We conducted three univariate sensitivity analyses. First, we reduced the pass-through effect from 100% to 50%. Second, we increased the pass-through effect to 150%. The pass-through effect could vary substantially across countries, across retailers within the country and across time. A study in the United States showed that retail prices of sugar-sweetened beverages in areas where a tax was implemented increased by 61% in the first month followed by 93% in the second month.<sup>22</sup> Third, we used a uniform price elasticity measure across all income quintiles by applying a mean price elasticity of -1.166 across all income quintiles. We obtained this figure by calculating a simple average of elasticity values across the five income quintiles from Mexico (available in the data repository).<sup>21</sup> This helped us to see the health effect due to differences in consumption and risk factors at baseline and on health-care costs due to differences in subsidy levels across the income quintiles.

### Box 1. Input parameters used in the extended cost–effectiveness analysis of the sweetened beverages tax in the Philippines

#### Size of population

98.2 billion (Philippines Statistics Authority, 2013).

#### Daily consumption of sugar-sweetened beverages, by income quintile

Quintile 1 (poorest): 0.13 L; quintile 2: 0.18 L; quintile 3: 0.21 L; quintile 4: 0.26 L; quintile 5 (richest): 0.29 L (National Nutrition Survey, 2013).

#### Average proportion of health-care costs as out-of-pocket payments, by income quintile

Quintile 1: 20% (Philippine pesos 424/2093); quintile 2: 37% (Philippine pesos 932/2528); quintile 3: 52% (Philippine pesos 1741/3358); quintile 4: 71% (Philippine pesos 4211/5945); quintile 5: 83% (Philippine pesos 11640/14007; Philippines National Health Account, 2013 as cited in Racelis et al.).<sup>29</sup>

#### Income per capita quintiles

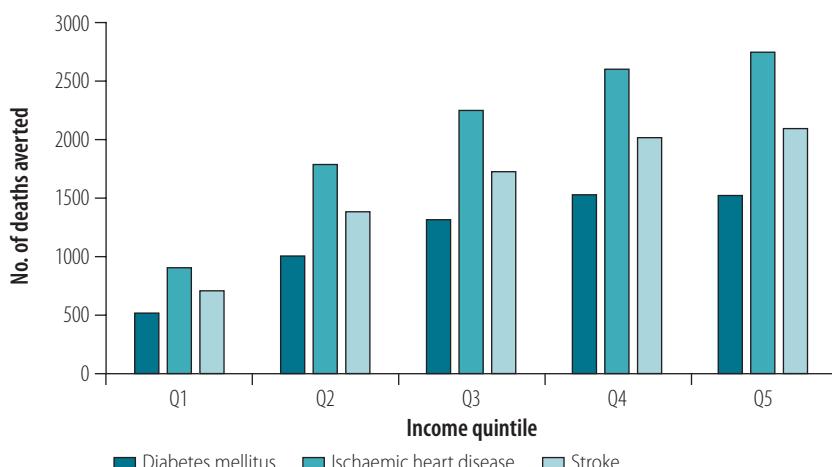
Quintile 1: Philippine pesos ≤ 23 523 (US\$ 470); quintile 2: Philippine pesos 23 524–35 886 (US\$ 470–718); quintile 3: Philippine pesos 35 887–53 943 (US\$ 718–1079); quintile 4: Philippine pesos 53 944–91 136 (US\$ 1079–1823); quintile 5: Philippine pesos > 91 136 (US\$ 1823; Family Income and Expenditure Survey 2015).

#### Gross domestic product (nominal price)

15 806.4 billion Philippine pesos (Philippines Statistics Authority, 2015).

US\$: United States dollars.

**Fig. 1. Projected potential deaths averted due to diabetes mellitus, ischaemic heart disease and stroke after implementation of the sweetened beverages tax in the Philippines, 2018–2037**



Notes: Q1: lowest income quintile, Q5: highest income quintile. From January 2018 the tax on sweetened beverages was levied at 6 Philippine pesos per litre (United States dollars: 0.12).

## Results

We present the results by income quintile on the number of premature deaths due to type 2 diabetes mellitus, ischaemic heart disease and stroke; the reduction in out-of-pocket payments; the additional tax revenue generated; and the financial risk protection obtained. The estimates for health-care costs and tax revenues are in nominal terms, meaning that they do not account for price inflation. We also did not apply a discount rate to convert future costs into present value.

Fig. 1 shows the number of premature deaths averted due to the new tax, projected over 20 years. We estimated that 5913 type 2 diabetes mellitus-related deaths, 10 339 ischaemic heart disease-related deaths and 7950 stroke-related deaths could be averted. The impact was more pronounced in the fourth and fifth income quintiles of the

**Table 1. Summary findings for the extended cost–effectiveness analysis of the sweetened beverages tax in the Philippines**

Variable	Total	Quintile 1	Quintile 2	Quintile 3	Quintile 4	Quintile 5
No. of diabetes mellitus incident cases averted	299 540	28 917	55 289	66 045	76 960	72 329
No. of diabetes mellitus deaths averted over 20 years	5 913	522	1 006	1 321	1 532	1 532
No. of ischaemic heart disease incident cases averted	40 882	3 594	7 149	8 881	10 280	10 978
No. of ischaemic heart disease deaths averted over 20 years	10 339	908	1 794	2 259	2 616	2 762
No. of stroke incident cases averted	19 858	1 768	3 454	4 302	5 013	5 321
No. of stroke deaths averted over 20 years	7 950	705	1 387	1 732	2 022	2 104
Total health-care savings <sup>a</sup> over 20 years, billion Philippine pesos	31.6	3.0	5.7	6.9	8.2	7.8
Total reduction in out-of-pocket payments over 20 years, billion Philippine pesos	18.6	0.6	2.1	3.6	5.8	6.4
Changes in annual tax revenues, billion Philippine pesos	41.0	5.6	7.0	8.0	9.9	10.5
No. of cases of catastrophic expenditure averted	13 890	8 269	1 953	2 184	1 484	0

<sup>a</sup> Total health-care savings include savings on government costs and patients' out-of-pocket payments.

Notes: The estimates for health-care costs and tax revenues do not account for discounting and are in nominal terms. From January 2018 the tax on sweetened beverages was levied at 6 Philippine pesos per litre (United States dollars: 0.12). We projected effects over the 20-year period 2018–2037

population, with around half of the overall deaths averted in these two quintiles. The smallest effect, with around 10% of overall deaths averted, was among the lowest quintile, who had relatively lower consumption of sugar-sweetened beverages at baseline.

We projected a reduction of 31.6 billion Philippine pesos (US\$ 627 million) in health-care costs over the 20-year period (Table 1) and a total out-of-pocket cost savings of 18.6 billion Philippine pesos (US\$ 369 million) over the same period (Table 2). Given the unequal distribution of out-of-pocket payments across quintiles, the highest income quintile could save the most (6.4 billion Philippine pesos; 35% of total out-of-pocket savings) while the lowest income quintile could save the least (0.6 billion Philippine pesos; 3% of total out-of-pocket savings; Fig. 2).

Projected government contributions to health-care costs also differed across income quintiles. Due to progressive policy, government expenditure on health (government schemes and compulsory contributory health-care financing schemes) contributed to 67% (37 403 of 55 557 Philippine pesos) of health-care costs in the lowest quintile and 8% (16 117 of 190 521 Philippine pesos) for the highest quintile, with an overall contribution of 28% (130 028 of 465 241 Philippine pesos) across the quintiles (Table 2). This distribution of funding across quintiles is reflected in the distribution of savings across quintiles, as the tax could contribute to 10 billion Philippine pesos (US\$ 198 million) in savings over 20 years and 57% (3.1 billion + 2.6 billion Philippine pesos) of these savings could be from quintiles 2 and 3 (Fig. 3).

In addition, we estimated that there could be a net increase in annual tax revenues, with the government receiving an additional 41.0 billion Philippine pesos per annum (0.26% of the 2015 nominal gross domestic product of 15 806.4 billion Philippine pesos). Fig. 4 shows that the lowest income quintile could bear the smallest proportion (14%, 5.6 billion Philippine pesos) of this increase in tax burden while the highest income quintile could bear the largest share (26%, 10.5 billion Philippine pesos).

To measure financial risk protection, we estimated that the tax could avert 13 890 cases of catastrophic health expenditure.

## Sensitivity analysis

When we reduced the pass-through effect to the lower bound of 50%, we observed changes in effects in both absolute terms and in the distribution across income quintiles. First, we estimated that the number of type 2 diabetes mellitus-related premature deaths averted over 20 years could be reduced to 3091 (a reduction of 47%), while ischaemic heart disease and stroke-related deaths decline to 5574 (46% reduction) and 4280 (46% reduction), respectively (Table 2). In contrast to the reduction in premature deaths, we projected an increase in tax revenues to 44.7 billion Philippine pesos. Lastly, we estimated that 7483 cases of catastrophic health expenditure would be averted (an 46% reduction).

Applying a price elasticity of -1.166 across all income quintiles we projected that the proportion of overall type 2 diabetes mellitus deaths averted for quintile 5 could increase to 30% (1811 of 6056 deaths) from 26% (1532 of 5913 deaths) in the baseline scenario (Table 3). A similar pattern was observed for stroke and ischaemic heart disease-related deaths, and the shift occurred from quintile 2 to quintile 5. The total tax revenue and distribution of its burden across income quintiles was roughly similar to the baseline scenario.

## Discussion

Our analysis showed that an excise tax of around 13% on sweetened beverages in the Philippines may generate

Table 2. Summary findings for the sensitivity analysis of the pass-through effect for the extended cost–effectiveness analysis of the sweetened beverages tax in the Philippines

Variable	Total	Quintile 1	Quintile 2	Quintile 3	Quintile 4	Quintile 5
<b>Pass-through effect reduced to 50%</b>						
No. of diabetes mellitus incident cases averted	164 162	15 729	30 294	36 305	42 153	39 681
No. of diabetes mellitus deaths averted over 20 years	3 091	251	514	702	814	810
No. of ischaemic heart disease incident cases averted	22 037	1 934	3 887	4 801	5 522	5 893
No. of ischaemic heart disease deaths averted over 20 years	5 574	488	976	1 221	1 405	1 484
No. of stroke incident cases averted	10 691	949	1 873	2 311	2 712	2 846
No. of stroke deaths averted over 20 years	4 280	378	752	930	1 094	1 126
Total health-care cost savings <sup>a</sup> over 20 years, billion Philippine pesos	17.3	1.6	3.1	3.8	4.5	4.2
Total reduction in out-of-pocket payments over 20 years, billion Philippine pesos	10.2	0.3	1.2	2.0	3.2	3.5
Changes in annual tax revenues, billion Philippine pesos	44.7	6.1	7.8	8.8	10.7	11.3
No. of cases of catastrophic expenditure averted	7 483	4 490	1 048	1 124	821	0
<b>Pass-through effect increased to 150%</b>						
No. of diabetes mellitus incident cases averted	410 108	40 156	75 161	89 891	104 876	100 024
No. of diabetes mellitus deaths averted over 20 years	8 225	759	1 401	1 819	2 106	2 140
No. of ischaemic heart disease incident cases averted	57 185	5 030	9 912	12 389	14 371	15 483
No. of ischaemic heart disease deaths averted over 20 years	14 466	1 277	2 486	3 150	3 657	3 896
No. of stroke incident cases averted	27 819	2 499	4 802	5 990	7 043	7 485
No. of stroke deaths averted over 20 years	11 137	997	1 927	2 410	2 842	2 961
Total health-care cost savings <sup>a</sup> over 20 years, billion Philippine pesos	43.3	4.2	7.8	9.4	11.2	10.7
Total reduction in out-of-pocket payments over 20 years, billion Philippine pesos	25.5	0.8	2.9	4.9	7.9	8.9
Changes in annual tax revenues, billion Philippine pesos	37.3	5.1	6.2	7.2	9.0	9.7
No. of cases of catastrophic expenditure averted	19 202	11 513	2 667	2 974	2 048	0

<sup>a</sup> Total health-care savings include savings on government costs and patients' out-of-pocket payments.

Notes: The estimates for health care costs and tax revenues do not account for discounting and are in nominal terms. From January 2018, the tax on sweetened beverages was levied at 6 Philippine pesos per litre (United States dollars: 0.12). We projected effects over the 20-year period 2018–2037. Pass-through rate determines how much of the increase in tax is passed to consumers as an increase in retail prices instead of being absorbed or paid by distributors or manufacturers. Due to rounding, percentages may not total 100%.

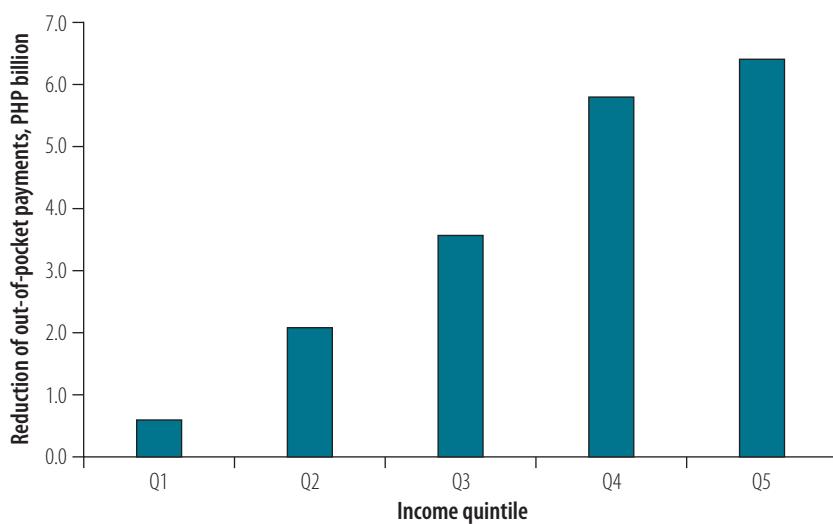
population-level health gains. We demonstrated that the wealthiest quintiles will be most affected by the tax. This differs from a recent study in Mexico that demonstrated that the reductions in consumption were higher among the lower socioeconomic status group (10%) than among the high socioeconomic status group (6%)<sup>31,32</sup> and the maximum

reduction in BMI was obtained in the lowest levels of socioeconomic status.<sup>33</sup> Similarly, in Australia, it was estimated that a 20% tax would lead to almost 50% of the gains within the lowest income quintiles.<sup>15</sup> While the findings from our study differ from those studies, as to which segment of the population benefits, they all illustrate that improvements

can be made in health-care promotion through taxation.

This analysis of the relative impact of such a tax illustrates the power of regulation of sugar consumption in the studied contexts. On the one hand, sugar plays a powerful role in fuelling the obesity burden and related health conditions. On the other hand, regu-

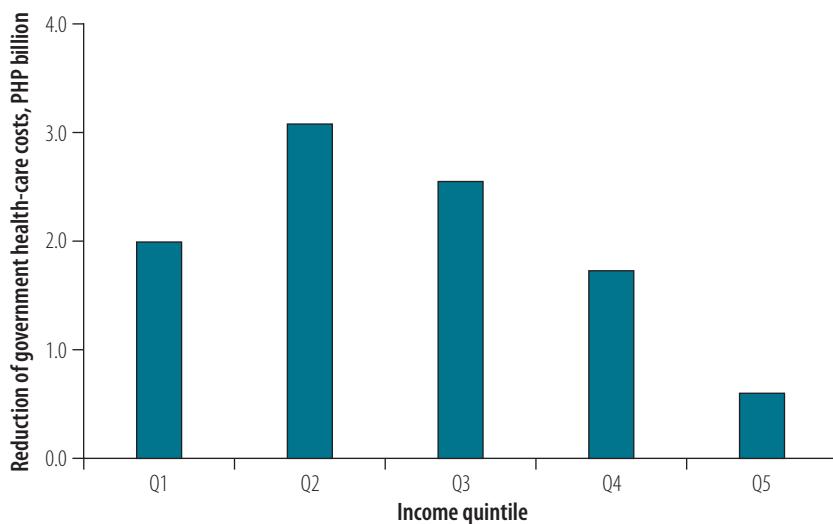
**Fig. 2. Projected reduction of out-of-pocket health-care payments by income quintile after implementation of the sweetened beverages tax in the Philippines, 2018–2037**



PHP: Philippine pesos.

Notes: Q1: lowest income quintile, Q5: highest income quintile. From January 2018 the tax on sweetened beverages was levied at 6 Philippine pesos per litre (United States dollars: 0.12).

**Fig. 3. Projected reduction of government health-care costs by income quintile after implementation of the sweetened beverages tax in the Philippines, 2018–2037**



PHP: Philippine pesos.

Notes: Q1: lowest income quintile, Q5: highest income quintile. From January 2018 the tax on sweetened beverages was levied at 6 Philippine pesos per litre (United States dollars: 0.12).

lating sugar proves to be an effective tool for curbing consumption, and importantly this tax does not appear to function as a regressive imposition on the poor. In fact, the tax evaluated in this study reflects pro-poor health financing in the Philippines. As such, the tax burden would progressively increase, with the bottom two income quintiles

bearing about 30% of the tax burden. This is especially important in low- and middle-income countries, where non-communicable diseases are rising.<sup>34</sup>

Therefore, our research contributes timely evidence to suggest that sugar-sweetened beverage taxes are not universally regressive and can be compatible with health-system goals that include

the progressive attainment of universal health coverage. Our findings suggest that distributional benefits of these taxes reflect not only a country's underlying level of domestic consumption, but also the degree to which the health system has installed measures of financial protection for low-income households. Furthermore, sugar-sweetened beverage taxes are a way for countries to raise revenues, a hard-to-achieve policy priority of low- and middle-income countries' health systems.

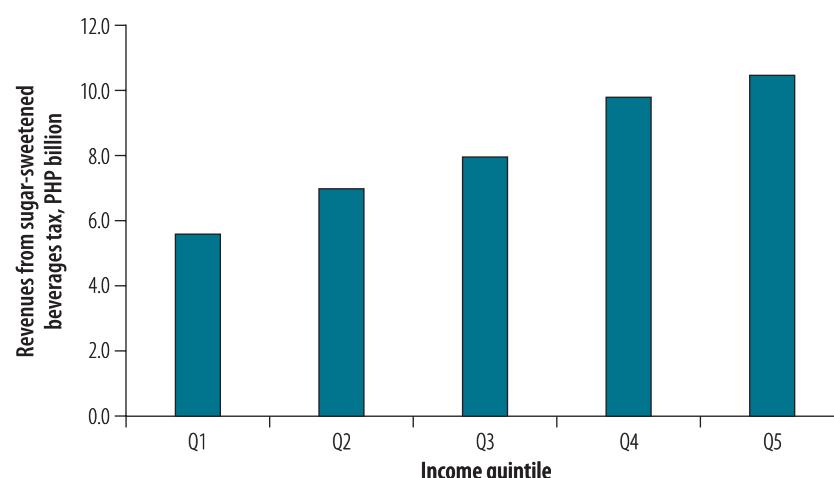
Taxing sugar-sweetened beverages is a political undertaking. Taxation policy development involves cooperation among an array of influential actors who have different interests. Many countries combatting the growing threat of non-communicable diseases also benefit economically through domestic sugar production, consumption and international trade. These forces are historical, socially contingent and often path-dependent as they are tied to the political trajectories of decision-makers, including elected officials. Nevertheless, in this new area of research, we still do not know enough about how industry and the government can work together to strengthen the health and well-being of citizens.<sup>35</sup> Of all the policy interventions to curb consumption of harmful products, from marketing restrictions to warning labels and manufacturing regulations, taxing sugar-sweetened beverages may prove to be the most useful at present. Some countries are experimenting with tax structures to incentivize reformulation of sugar-sweetened drinks<sup>36</sup> and the possibility of taxation may even facilitate self-regulation by the beverage industry.<sup>37</sup>

Early evidence suggests that health advocates need to remain vigilant to ensure that sugar-sweetened beverage taxes endure. In the United States, a tax in Cook County (which includes the metropolitan area of Chicago) was repealed after two months.<sup>38</sup> Beverage manufacturers undermined Berkeley, California's sugar-sweetened beverage tax by passing a pre-emptive state-wide ban on other local sugar-sweetened beverage taxes.<sup>39</sup> Borrowing tactics from tobacco and alcohol, the food and beverage industry in Mexico continues its efforts to counteract the Mexican sugar-sweetened beverage tax in several ways.<sup>40</sup> All indications are that the sugar-

sweetened beverage tax in the Philippines will face similar challenges. For example, an influential sugar-sweetened beverage manufacturer in the Philippines announced layoffs of employees only weeks after passage of the new tax.<sup>41</sup> Similarly, an international producer of sugary powder mixes has threatened to relocate its manufacturing business elsewhere in response to the Philippines tax.<sup>42</sup> These examples underscore the importance of using sound evidence to provide arguments in support of sugar-sweetened beverage taxation and its role in reducing noncommunicable diseases.

Our study has several limitations. First, we did not have direct estimates of the price elasticity of sugar-sweetened beverage consumption by income quintile for the Philippines. Instead, we used estimates from Mexico because the countries are similar in important ways, such as their tropical geographical locations that underpins food-chains, shared colonial legacy that affects culture, diet and language, and common trade partners that influence dietary patterns. Second, we did not have cross-price elasticity estimates for substitutes such as milk and fruit juices. We do not expect that individuals would switch to

**Fig. 4. Projected annual revenues from the sweetened beverages tax by income quintile in the Philippines, per annum, 2018–2037**



PHP: Philippine pesos.

Notes: Q1: lowest income quintile, Q5: highest income quintile. From January 2018 the tax on sweetened beverages was levied at 6 Philippine pesos per litre (United States dollars: 0.12).

non-caloric drinks such as water but would likely switch to other untaxed drinks. Third, we did not include the 12 Philippine pesos per litre tax on sugar-sweetened beverages made with high-fructose corn syrup because we did not have access to data on the composition

of all sugar-sweetened beverages available in the Philippines. The two-tiered tax structure may encourage product reformulation, which our model is unable to accommodate. Fourth, we did not have data on variations in health-care use by income quintile and disease

**Table 3. Summary findings for the sensitivity analysis for elasticity for the extended cost–effectiveness analysis of the sweetened beverages tax in the Philippines, 2018–2037**

Variable	Total	Quintile 1	Quintile 2	Quintile 3	Quintile 4	Quintile 5
<b>Mean elasticity of –1.166 applied across quintiles</b>						
No. of diabetes mellitus incident cases averted	305 269	29 946	46 495	62 377	81 316	85 135
No. of diabetes mellitus deaths averted over 20 years	6 056	546	835	1 244	1 620	1 811
No. of ischaemic heart disease incident cases averted	42 087	3 717	6 018	8 396	10 932	13 024
No. of ischaemic heart disease deaths averted over 20 years	10 646	940	1 510	2 135	2 782	3 279
No. of stroke incident cases averted	20 427	1 833	2 911	4 037	5 352	6 294
No. of stroke deaths averted over 20 years	8 172	731	1 167	1 624	2 160	2 490
Total health-care cost savings over 20 years, billion Philippine pesos <sup>a</sup>	32.2	3.1	4.8	6.5	8.7	9.1
Total reduction in out-of-pocket payments over 20 years, billion Philippine pesos	19.5	0.6	1.8	3.4	6.1	7.6
Changes in annual tax revenues, billion Philippine pesos	40.9	5.6	7.3	8.1	9.7	10.2
No. of cases of catastrophic expenditure averted	13 826	8 556	1 632	2 011	1 627	0

<sup>a</sup> Total health-care savings include savings on government costs and patients' out-of-pocket payments.

Notes: The estimates for health care costs and tax revenues do not account for discounting and are in nominal terms. From January 2018 the tax on sweetened beverages was levied at 6 Philippine pesos per litre (United States dollars: 0.12). We projected effects over the 20-year period 2018–2037. Own price elasticity of demand of a good is the change in quantity demanded of the good in response to a change in its own price. We obtained the mean elasticity of –1.166 by calculating a simple average of elasticity values across the five income quintiles from Mexico (–1.12 in Q1, –1.41 in Q2, –1.24 in Q3, –1.09 in Q4, –0.97 in Q5 (available in the data repository).<sup>21</sup>

condition and we assumed 100% utilization of health-care facilities by those with any disease condition. Fifth, due to lack of data on costs in primary-care setting we used health-care costs associated with inpatient settings, whereas for several noncommunicable diseases, the care could be, and often is, managed in primary-care settings. Lastly, we did not consider non-medical costs such as loss of productivity, transportation costs and caregiver costs.

This study contributes to the growing base of evidence<sup>43</sup> to suggest that sugar-sweetened beverage taxation can be a cost-effective means of addressing the growing threat of noncommunicable disease in low- and middle-income countries. However, there remains a need for empirical research from the

Philippines and elsewhere to understand the impact of new sweetened beverage taxes on different income groups after implementation. How this evidence is used to inform debate in the Philippines and in other countries is political and difficult to predict. Nevertheless, we argue that methods such as extended cost-effectiveness analysis can help inform the discourse on health-system strengthening and its role in poverty alleviation globally. ■

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**Competing interests:** Authors AS, ADK, LLR, and BJ declare no competing interests. Authors IAA and MC are employed by the Food and Nutrition Research Institute (FNRI) within the Philippines Department of Science and Technology. In this capacity, they have advocated for the sweetened beverages tax before its passage and FNRI may benefit from revenue generated by the new tax.

## ملخص

استخدام نماذج توضح آثار فرض ضرائب على المشروبات المحلاة في الفلبين: تحليل موسع لمدى فعالية التكلفة الإقفارى، و 7950 حالة وفاة بسبب السكتة الدماغية على مدى 20 عاماً. يمكن أن يكون أكبر عدد من الوفيات التي تم تفادياها بين الخمسين الرابع والخامس (الأعلى) من الدخل. ويمكن أن تؤدي الضرائب إلى إيجالي من التوفير في الرعاية الصحية قدره 31.6 مليار بيزو (6.27 مليون دولار أمريكي) على مدى 20 عاماً، كما تؤدي لزيادة في العائد بقيمة 41.0 مليار بيزو (8.13 مليون دولار أمريكي) سنوياً. يمكن لأفرق خمس أن يتحمل أصغر زيادة في عبء الضرائب (14٪) من الضرائب الإضافية؛ 5.6 مليار بيزو (ولديها أقل مستوى من مدخلات في مدفوعات الجيب بسبب الدعم الضخم نسبياً للرعاية الصحية). وفي النهاية، قدرنا أنه يمكن تفادي 13890 حالة من النفقات الكارثية.

الاستنتاج قد تساعد الضرائب الجديدة على المشروبات المحلاة على تقليل الوفيات المبكرة المرتبطة بالسمنة، وتحسين الرفاهية المالية في الفلبين.

الغرض تقسيم الآثر المحتمل لفرض ضريبة جديدة على المشروبات المحلاة على الوفيات المبكرة المرتبطة بالأمراض غير المعدية في الفلبين.

الطريقة في يناير/كانون ثاني 2018، بدأت الفلبين فرض ضرائب بقيمة 6 بيزو فلبيني لكل لتر (حوالي 13٪) على المشروبات المحلاة للحد من عبء السمنة. باستخدام مصادر البيانات الوطنية، قمنا بإجراء تحليل موسع لمدى فعالية التكلفة وذلك لتقدير آثر الضرائب على أعداد الوفيات المبكرة التي تم تفادياها والتي تعزى إلى النوع الثاني من داء السكري ومرض القلب الإقفارى والسكتة الدماغية، عبر خمسية الدخل خلال الفترة 2018 إلى 2037. كما قدرنا الفوائد المالية للضرائب والناتجة عن التخفيفات في مدفوعات الجيب، والتكاليف الطبية المباشرة التي تم تفادياها، ومقدار التوفير في تكاليف الرعاية الصحية الحكومية.

النتائج أدت الضريبة إلى تجنب ما يقدر بنحو 5913 حالة وفاة مرتبطة بداء السكري، و 10339 حالة وفاة بسبب مرض القلب

## 摘要

### 建模分析菲律宾对甜味饮料征税的影响：扩展成本效益分析法

**目的** 旨在评估菲律宾对甜味饮料征收新税与非传染性疾病过早死亡间的潜在影响。

**方法** 2018年1月，菲律宾开始对甜味饮料征收每升6菲律宾比索（约13%）的消费税，以遏制肥胖负担。我们采用扩展成本效益分析法来分析国家数据来源，研究对2018至2037年间收入五等分位的人群征税，并估计由于征税而避免因II型糖尿病、缺血性心脏病和中风过早死亡的人数。我们还通过减少自付费用、避免直接医疗费用和节省政府医疗费用来估算税收的经济效益。

**结果** 20年内，征税可避免约5913人死于糖尿病，10,339人死于缺血性心脏病，7950人死于中风。因征税政策而免于死亡的人数最多的人群可能位于第四和

第五（最高）收入五分位。20年内，征税可节约总计316亿比索（6.27亿美元，US\$）的医疗保健额，并且每年的税收收入可提高410亿比索（8.13亿美元）。最贫困的五分之一人群可以承担最低的税负增加（额外税收的14%；56亿比索），并且由于相对较高的医疗补贴，自付费用最低。最后，我们估计可避免13,890起灾难性卫生支出案例。

**结论** 对甜味饮料征收新税可能有助于减少与肥胖相关的过早死亡，从而改善菲律宾的健康状况。

## Résumé

### Modéliser l'impact d'une taxe sur les boissons sucrées aux Philippines: analyse coût-efficacité approfondie

**Objectif** Évaluer le potentiel impact d'une nouvelle taxe sur les boissons sucrées sur les décès prématuress associés à des maladies non transmissibles aux Philippines.

**Méthodes** En janvier 2018, les Philippines ont commencé à imposer une taxe de 6 pesos philippins par litre (environ 13%) sur les boissons sucrées afin de réduire le fardeau de l'obésité. À partir de sources de données nationales, nous avons réalisé une analyse coût-efficacité approfondie pour estimer l'effet de cette taxe sur le nombre de décès prématuress évités imputables au diabète sucré de type 2, à une maladie cardiaque ischémique ou à un accident vasculaire cérébral, pour tous les quintiles de revenu, sur la période 2018-2037. Nous avons également estimé les avantages financiers de la taxe découlant de la diminution des débours, des coûts médicaux directs évités et des économies de coûts des soins de santé réalisées par le gouvernement.

**Résultats** Nous avons estimé que sur 20 ans, la taxe permettrait d'éviter 5913 décès liés au diabète, 10 339 décès dus à une maladie

cardiaque ischémique et 7950 décès attribuables à un accident vasculaire cérébral. Le plus grand nombre de décès évités pourrait se situer dans les quatrième et cinquième quintiles de revenu (les plus hauts). La taxe pourrait générer des économies totales en soins de santé de 31,6 milliards de pesos philippins (627 millions de dollars des États-Unis) sur 20 ans, et rapporter des recettes de 41,0 milliards de pesos philippins (813 millions de dollars des États-Unis) par an. Le quintile le plus pauvre pourrait supporter la plus faible augmentation de la charge fiscale (14% de la taxe additionnelle; 5,6 milliards de pesos philippins) et afficher la plus faible diminution de débours en raison de subventions pour les soins de santé relativement élevées. Enfin, nous avons estimé que 13 890 cas de dépenses ruineuses pourraient être évités.

**Conclusion** La nouvelle taxe sur les boissons sucrées pourrait contribuer à diminuer le nombre de décès prématuress liés à l'obésité et améliorer le bien-être financier aux Philippines.

## Резюме

### Моделирование влияния акциза на подслащенные напитки на Филиппинах: расширенный анализ экономической эффективности

**Цель** Оценить потенциальное влияние нового акциза на подслащенные напитки на показатели преждевременной смертности на Филиппинах, связанной с неинфекционными заболеваниями.

**Методы** В январе 2018 года Филиппины ввели акциз в размере 6 филиппинских песо за литр (около 13%) подслащенных напитков с целью уменьшения числа людей, страдающих ожирением. Используя национальные источники данных, авторы провели расширенный анализ экономической эффективности по квинтилям дохода за период 2018–2037 гг., чтобы оценить влияние акциза на преждевременную смертность, связанную с сахарным диабетом 2-го типа, ишемической болезнью сердца и инсультом. Авторы также оценили экономическую выгоду от введения акциза за счет сокращения собственных расходов пациентов на медицинское обслуживание, предотвращения прямых медицинских расходов и сокращения государственных расходов на здравоохранение.

**Результаты** Введение акциза могло бы предотвратить предположительно 5913 смертных случаев, связанных с

диабетом, 10 339 смертных случаев от ишемической болезни сердца и 7950 смертных случаев от инсульта в течение 20 лет. Предотвращение наибольшего числа смертных случаев может произойти среди четвертого и пятого (самого высокого) квинтилей дохода. В целом введение акциза поможет сэкономить 31,6 млрд филиппинских песо (627 млн долл. США) в течение 20 лет за счет сокращения расходов на здравоохранение и увеличить ежегодный доход страны на 41,0 млрд филиппинских песо (813 млн долл. США). Для самого бедного квинтиля увеличение налоговой нагрузки будет минимальным (14% от дополнительного акциза, 5,6 млрд филиппинских песо), а экономия собственных средств пациентов достигнет самого низкого показателя из-за относительно больших субсидий на здравоохранение. Кроме того, авторы считают, что можно предотвратить 13 890 случаев запредельных расходов на здравоохранение.

**Вывод** Новый акциз на подслащенные напитки поможет снизить преждевременную смертность, связанную с ожирением, и улучшить финансовое благополучие на Филиппинах.

## Resumen

### Elaboración de un modelo del impacto de un impuesto a las bebidas endulzadas en Filipinas: un análisis ampliado de la relación coste y efectividad

**Objetivo** Evaluar el impacto potencial de un nuevo impuesto a las bebidas endulzadas en las muertes prematuras asociadas con las enfermedades no contagiosas en Filipinas.

**Métodos** En enero de 2018, Filipinas comenzó a imponer un impuesto de 6 pesos filipinos por litro (alrededor de un 13%) a las bebidas endulzadas para reducir la carga de la obesidad. A partir de fuentes de datos nacionales, se realizó un análisis de ampliado de coste y efectividad para estimar el efecto del impuesto en el número de muertes prematuras evitadas atribuidas a la diabetes mellitus tipo 2, la cardiopatía isquémica y el accidente cerebrovascular, en todos los quintiles de ingresos durante el periodo 2018-2037. También se estimaron los beneficios financieros del impuesto a partir de las reducciones en los pagos directos, los costes

médicos directos evitados y los ahorros en los costes de la atención sanitaria para el gobierno.

**Resultados** El impuesto podría evitar unas 5913 muertes relacionadas con la diabetes, 10339 muertes por cardiopatía isquémica y 7950 muertes por accidente cerebrovascular en 20 años. El mayor número de muertes evitadas podría encontrarse entre los quintiles cuarto y quinto (más altos) de ingresos. El impuesto podría generar un ahorro total en la atención sanitaria de 31 600 millones de pesos filipinos (627 millones de USD) en 20 años y recaudar hasta 41 000 millones de pesos filipinos (813 millones de USD) en ingresos anuales. El quintil más pobre podría soportar el menor aumento de la carga tributaria (14 % del impuesto adicional; 5600 millones de pesos filipinos) y ser quien menos ahorrarse

en los pagos directos debido a los subsidios relativamente grandes para la atención sanitaria. Por último, se estima que podrían evitarse unos 13 890 casos de gastos catastróficos.

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**Conclusión** El nuevo impuesto a las bebidas endulzadas podría ayudar a reducir las muertes prematuras relacionadas con la obesidad y mejorar el bienestar financiero en Filipinas.

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## Legal capacities required for prevention and control of noncommunicable diseases

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**Abstract** Law lies at the centre of successful national strategies for prevention and control of noncommunicable diseases. By law we mean international agreements, national and subnational legislation, regulations and other executive instruments, and decisions of courts and tribunals. However, the vital role of law in global health development is often poorly understood, and eclipsed by other disciplines such as medicine, public health and economics. This paper identifies key areas of intersection between law and noncommunicable diseases, beginning with the role of law as a tool for implementing policies for prevention and control of leading risk factors. We identify actions that the World Health Organization and its partners could take to mobilize the legal workforce, strengthen legal capacity and support effective use of law at the national level. Legal and regulatory actions must move to the centre of national noncommunicable disease action plans. This requires high-level leadership from global and national leaders, enacting evidence-based legislation and building legal capacities.

Abstracts in *عربي*, *中文*, *Français*, *Русский* and *Español* at the end of each article.

### Introduction

Noncommunicable diseases, including cardiovascular disease, cancer, respiratory diseases and diabetes, cause an estimated 41 million deaths each year.<sup>1</sup> Fifteen million of these deaths occur in people aged 30–69 years,<sup>1</sup> at a time of life when people are working and more likely to have dependants. Over 12 million (85%) of these premature deaths occur in low- and middle-income countries, where health systems may be fragile and access to treatments suboptimal.<sup>1</sup> So far, progress towards global goals (**Box 1**) and political commitments on noncommunicable diseases has been disappointing.<sup>4</sup> Unless urgent action is taken, the burden of mortality and disability from noncommunicable diseases will increase substantially, driven by population growth, longer life-expectancies and the global diffusion of risk factors such as tobacco use, harmful alcohol use, obesity, poor diet and sedentary lifestyles.<sup>5</sup>

The effective use of law and regulation lies at the heart of successful national noncommunicable disease action plans.<sup>6</sup> Law includes international agreements, national and subnational legislation, subsidiary legislation (also known as regulations) and other executive instruments, and decisions of courts and tribunals. As a broader concept, regulation includes legislation, fiscal policies (such as taxes and subsidies) and other legally binding standards. Recognizing the power of law to improve the public's health, the World Health Organization (WHO) offers technical assistance to governments on appropriate legal strategies (**Box 2**). Constraints and challenges in using law effectively at the national level include the lack of personnel with legal training or expertise, lack of resources for enforcement, and the influence of vested commercial interests in drafting, implementing and enforcing laws. Despite these challenges, law remains an important tool for taking action to reduce the burden of these diseases. Encouragingly, heads of state and governments have committed to promoting and

implementing “policy, legislative, and regulatory measures, including fiscal measures”<sup>10</sup> to address noncommunicable disease risk factors and to developing legal expertise to integrate “public health-related legal issues into noncommunicable disease country support.”<sup>11</sup>

This paper identifies some important areas of intersection between law and prevention and control of noncommunicable diseases, arguing that law lies at the centre of effective action. We suggest actions that WHO and other health development partners could take to strengthen national legal capacities and accelerate implementation of legal and regulatory strategies.

### Law and noncommunicable diseases

#### Implementing preventive policies

In 2017, the World Health Assembly endorsed an updated set of policy options and cost-effective interventions for reducing the burden of noncommunicable diseases, including minimizing the major risk factors (consumption of tobacco, alcohol, unhealthy foods and drinks high in sugar).<sup>12</sup> Many of these recommended policies are legal interventions, requiring legislation or executive actions for effective implementation (**Box 3**). Sales of tobacco, alcohol, processed foods and sugar-sweetened drinks have expanded rapidly in low- and middle-income countries because of trade and investment liberalization, leading to greater foreign direct investment, imports and advertising.<sup>14,15</sup> Implementing WHO's evidence-based, highly cost-effective policy interventions (called best-buys) should be a priority for governments, but requires political commitment, funding and strong legal capacity.

The force of law is needed to implement effective policies for prevention and control of noncommunicable disease risks because voluntary implementation will rarely be in the commercial interests of food, alcohol and tobacco companies. There are similarities in the ways these industries

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seek to influence not only legislative outcomes, but also the perceptions of politicians and the public, the framing of issues for debate and the generation of favourable evidence.<sup>16,17</sup> A growing literature illustrates the ways in which these industries, their allies and proxies, lobby governments, donate to political campaigns and undermine scientific evidence, seeking to shift the public focus from healthy public policies towards personal responsibility and fears of paternalism.<sup>16,17</sup> Industry may also seek to pre-empt enforceable standards by implementing weaker, self-regulatory codes or may lobby to increase industry influence through partnerships and co-regulatory approaches.<sup>18</sup> When regulating and dealing with these industries, governments and international institutions should implement rigorous conflict-of-interest policies to avoid inappropriate forms of influence.<sup>16</sup>

Apart from seeking to reduce non-communicable disease risk factors, law is an important tool for establishing institutional and governance mechanisms to support public health functions. For example, Samoa's Health Promotion Act, enacted in 2013, established the Samoa Health Promotion Foundation, giving it a legislative mandate to engage in health promotion, fund research and advise the health minister.<sup>19</sup> Through executive action, governments can also establish a national coordination mechanism to implement a whole-of-government approach to policy implementation that ensures policy coherence and mutual accountability of those ministries that have a bearing on noncommunicable disease risks. An example is Mexico's National Council for the Prevention and Control of Chronic Noncommunicable Diseases, which brings together the heads of national executive agencies to coordinate cross-sectoral actions and policies.<sup>20</sup> The WHO Independent High-level Commission on noncommunicable diseases has emphasized that action must start at the top, with the president or prime minister of a country leading a multisectoral national response.<sup>4</sup>

## Constitutional rights

The constitution of many countries guarantees health-related rights to their population.<sup>21</sup> Constitutional rights not only limit parliamentary powers, but

### Box 1. Global targets for reductions in noncommunicable disease risk factors

#### Global Monitoring Framework on noncommunicable diseases (World Health Organization)<sup>2</sup>

Overall target:

- by 2025, a 25% relative reduction in mortality from cardiovascular disease, cancer, diabetes and chronic respiratory diseases in persons aged 30–70 years.

Eight supporting targets:

- 10% relative reduction in harmful use of alcohol;
- 10% relative reduction in prevalence of physical inactivity;
- 30% relative reduction in mean average population salt intake;
- 30% relative reduction in prevalence of tobacco use (persons older than 15 years);
- 25% relative reduction in raised blood pressure;
- 0% increase in diabetes and obesity;
- 50% coverage for drug therapy and counselling for those at risk for cardiovascular disease;
- 80% coverage of affordable technologies and essential medicines for treating noncommunicable diseases in both public and private facilities.

#### Sustainable development goal 3 (United Nations)<sup>3</sup>

Target 3.4:

- by 2030, reduce by one third premature mortality from noncommunicable diseases through prevention and treatment and promote mental health and wellbeing.

### Box 2. Scope of technical work on law and noncommunicable diseases by the World Health Organization

The World Health Organization's (WHO) work at the intersection of law and noncommunicable diseases includes:

- supporting governments to develop laws and regulations on health matters through technical assistance, training and provision of technical resources;
- comparative analysis of laws in different jurisdictions for WHO publications, including biannual reports on the global tobacco burden;
- analysing litigation and industry opposition to policies and laws, and integrating lessons learnt into technical assistance and resources;
- gathering evidence in support of effective public health laws and policies in Member States;
- providing assistance to Member States in litigation matters;
- intervening in legal disputes; for example, through the amicus briefs filed in disputes over tobacco control laws<sup>7–9</sup>; and
- engaging with other inter-governmental organizations on legal and normative issues.

may permit individuals or groups to claim remedies for interference with their rights. In such countries, health-related rights may provide one avenue for challenging actions (and omissions) by governments and corporations that are harmful to health, as seen in India and Uganda (Box 4).<sup>22–24</sup>

On the other hand, national constitutions typically protect a range of non-health-related rights that may conflict with public health policies. In some countries, the right to freedom of expression protects commercial speech, which may undermine efforts to restrict the marketing of tobacco, alcohol, unhealthy food and drinks, and breastmilk substitutes. Civil society organizations have also relied successfully on the right to freedom of expression to resist efforts

to suppress information about the health effects of sugary drinks, as illustrated by an example from Colombia (Box 4).<sup>25</sup>

## International human rights

International law can also influence national policies on noncommunicable disease prevention and control. For example, parties to the WHO Framework Convention on Tobacco Control have assumed an obligation under international law to implement policies on reduction in demand and supply of tobacco products.<sup>27</sup> Most countries have also ratified at least one international agreement recognizing the right to health or other health-related rights. Such agreements include the WHO Constitution, various United Nations (UN) conventions (e.g. the Interna-

### Box 3. Legally oriented best-buys and policy interventions for noncommunicable disease prevention and control

Highly cost-effective policy interventions (best-buys) recommended by the World Health Organization include:

- increasing excise taxes and prices of tobacco products and alcoholic beverages;
- eliminating peoples' exposure to second-hand tobacco smoke in all indoor workplaces, public places and public transport;
- comprehensive bans on tobacco advertising, promotion and sponsorship;
- implementing plain tobacco packaging and/or graphic health warnings on all tobacco packages;
- comprehensive bans or restrictions on alcohol advertising across multiple forms of media;
- enforcing restrictions on the physical availability of alcohol via reduced hours of sale in retail outlets;
- mandatory product reformulation and front-of-pack labelling to help people to reduce salt intake.

Other cost-effective policy interventions include:

- implementing and enforcing drink-driving laws and blood alcohol concentration limits via sobriety checkpoints;
- eliminating industrial trans-fats through legislation banning their use in food manufacturing;
- taxation of sugar-sweetened beverages at a rate high enough to encourage people to reduce sugar consumption.

Other recommended, legally-oriented policy options include:

- measures to minimize illicit trade in tobacco products;
- bans on cross-border tobacco advertising;
- setting minimum alcohol prices;
- enforcing a minimum age for purchase of alcoholic beverages;
- reducing the density of retail alcohol outlets;
- restricting or banning promotions of alcoholic beverages targeting young people;
- requiring labels for alcoholic beverages to include information about the harm caused by alcohol;
- implementing subsidies to increase people's intake of fruits and vegetables;
- replacing trans-fats and saturated fats with unsaturated fats through mandatory reformulation, product labelling, fiscal or agricultural policies;
- implementing nutrition labelling to encourage people to reduce consumption of energy, sugars, sodium and fats;
- improving urban environments to ensure ease of walking, connectivity and access to public transport to encourage people to engage in more physical activity.

Source: World Health Organization.<sup>13</sup>

tional Covenant on Economic, Social and Cultural Rights; the Convention on the Rights of the Child; the Convention on the Elimination of All Forms of Discrimination Against Women) and regional agreements (e.g. the African Charter on Human and People's Rights).

Unlike the WHO Framework Convention on Tobacco Control, health-related provisions in human rights treaties are often expressed in general terms and were not framed with non-communicable disease risk factors in mind.<sup>28</sup> Nevertheless, the Committee on Economic, Social and Cultural Rights, the treaty-monitoring body for the International Covenant on Economic, Social and Cultural Rights, has identified core obligations arising under the

right to health that are directly relevant to noncommunicable diseases. These include the obligation to ensure access to health services without discrimination; nutritionally adequate food; safe and potable water; and essential medicines.<sup>29</sup> Under the Covenant, UN Member States also have an obligation to respect, protect and fulfil the right to health. The obligation to protect requires countries to prevent third parties, including corporations, from violating this right. Member States must also remedy regulatory failures, such as "failure to discourage production, marketing and consumption of tobacco, narcotics and other harmful substances."<sup>29</sup> The obligation to fulfil the right to health addresses the problem of inaction by Member

States, requiring them to adopt "legislative, administrative, budgetary, judicial, promotional and other measures" towards full realization of the right.<sup>29</sup>

Each country's compliance with its human rights obligations is reviewed through a process known as Universal Periodic Review, overseen by the UN Human Rights Council. Universal Periodic Review provides an impetus for governments to strengthen health-related rights,<sup>30</sup> and may assist governments defending rights-based claims made by corporations, such as freedom of expression or property rights. During this process, human rights treaty bodies may draw attention to priority risk factors, urging Member States to implement effective policies on noncommunicable diseases. For example, concerned about increasing food insecurity (including its link with obesity) and low levels of breastfeeding, the Committee urged the United Kingdom of Great Britain and Northern Ireland to implement national policies on breastfeeding in accordance with World Health Assembly resolutions and the International Code of Marketing of Breast-milk Substitutes; increase taxes on unhealthy foods and sugar-sweetened drinks; and "consider adopting strict regulations on the marketing of such products, while ensuring improved access to healthy diets."<sup>31</sup> Similarly, in 2014, the Committee expressed concern about tobacco addiction in Indonesia, recommending indoor smoking bans in public buildings and workplaces, and a ban on tobacco advertising and sponsorship.<sup>32</sup> In 2007, the Committee on the Rights of the Child recommended that Chile "take necessary measures to reduce and prevent the incidence of obesity among children."<sup>33</sup> This report could strengthen Chile's position in counteracting litigation initiated by food producers against the country's restrictions on marketing to children.

International human rights law and practice is a neglected resource for governments seeking to reduce the burden of noncommunicable diseases. Analysis of specific health rights within international human rights agreements provides important guidance in many areas, such as tobacco control and marketing of foods and beverages.<sup>34</sup> International treaty bodies could make greater use of the WHO Framework Convention on Tobacco Control<sup>27</sup> and authoritative sources of guidance on risk factors, including the Global Ac-

tion Plan on Prevention and Control of noncommunicable diseases,<sup>2</sup> when evaluating Member States' compliance with their obligations under human rights treaties.

## Trade and investment agreements

International trade law is another important area of law that impacts on risk factors for noncommunicable diseases. International trade and investment agreements can affect noncommunicable disease risk factors in complex ways; for example, by reducing prices, increasing competition, and facilitating international trade and investment in harmful products, such as tobacco and alcohol.<sup>35</sup>

In legal terms, trade and investment agreements discipline how states can regulate. For example, World Trade Organization (WTO) law establishes core principles of trade law, including prohibiting discriminatory regulation, requiring that regulation be not more trade restrictive than necessary to protect health, and requiring minimum standards of protection for intellectual property rights. The WTO panels have applied these principles in adjudicating legal disputes concerning tobacco control. For example, a WTO panel held that United States legislation banning flavoured tobacco, but exempting menthol-flavoured products discriminated in favour of domestic products.<sup>36</sup> More recently, a WTO panel upheld Australia's tobacco plain packaging laws as not more trade restrictive than necessary and not an unjustifiable encumbrance on the use of trademarks.<sup>7</sup> WTO committees have also discussed legal measures to reduce harmful alcohol use<sup>37</sup> and improve healthy diets,<sup>38</sup> although such measures have not resulted in WTO disputes.

Regional trade agreements are increasingly important. Customs unions, such as the European Union, can lead to harmonization of laws, such as through the 2014 European Tobacco Products Directive.<sup>39</sup> However, rules concerning free movement of goods, state aid and communications can also be used to challenge fiscal and regulatory measures. Examples include the (recent unsuccessful) challenge to the introduction of minimum unit pricing on alcoholic beverages in Scotland,<sup>40</sup> limitations on Sweden's ability to restrict

### Box 4. Examples of constitutional rights litigation affecting noncommunicable disease risk factors

Constitutional rights may provide remedies for groups harmed by government or corporate actions or omissions:

#### India

In India, individuals may petition the Supreme Court to enforce fundamental rights and liberties in the Indian Constitution. The Supreme Court has ruled that the exposure of non-smokers to tobacco smoke violates the constitutional right to life and personal liberty.<sup>22</sup> The Court issued an order, subsequently implemented through national legislation, required federal and state governments to implement smoking bans in several public settings. The Supreme Court has also held that the right to life in the Constitution encompasses a right to live with human dignity, which encompasses the right to food. In a series of orders, the Court has expanded coverage and legal entitlements under food assistance programmes.<sup>23</sup>

#### Uganda

The High Court of Uganda has ruled that the emission of tobacco smoke, dust and smell from a tobacco factory in a residential area violates the right to a healthy and clean environment, as protected in the Ugandan Constitution.<sup>24</sup> Finding that the National Environment Management Authority had failed in its responsibilities, the court ordered the relocation of the factory.

#### Colombia

A Colombian civil society organization, Educar Consumidores, successfully challenged an order given by a regulatory authority, the Superintendence of Industry and Commerce, directing Educar Consumidores to cease transmission of a television and radio campaign that pointed to the quantities of sugar in sugary drinks and their harmful effects. Educar Consumidores and representatives of another civil society organisation successfully petitioned for review by the Colombian Constitutional Court, which held that the ban violated consumers' constitutional right to receive information – and to inform others – about the health risks of sugary drinks.<sup>25</sup>

On the other hand, constitutional rights may conflict with public health policies on noncommunicable diseases:

#### United States of America

The city of San Francisco passed a local ordinance requiring billboards advertising soda drinks to display a warning that added sugars contribute to obesity, diabetes and tooth decay. In response, the American Beverage Association obtained an injunction on the basis that a mandatory warning infringed their First Amendment rights to free speech.<sup>26</sup> An appeals court has agreed to re-hear this case.

alcohol marketing originating in the United Kingdom,<sup>41</sup> and the scrapping of a Finnish confectionary tax because of rules concerning state aid.<sup>42</sup>

Investment treaties, whether bilateral or as investment chapters in trade agreements, can also impact on legislation concerning noncommunicable diseases. The tobacco company Philip Morris International recently challenged tobacco control laws in Australia and Uruguay. These claims, which were unsuccessful but expensive to defend, concerned plain tobacco packaging, health warnings and other labelling requirements implemented in response to the WHO Framework Convention on Tobacco Control.<sup>8,9</sup>

## Litigation and complaints mechanisms

Challenges to policies for prevention and control of noncommunicable diseases are frequently resolved in national courts and tribunals, as illustrated again by the alcohol industry's 5-year attempt to overturn Scotland's legislation

on minimum alcohol pricing.<sup>43</sup> The tobacco, food and alcohol industries are increasingly suing governments, relying on constitutional and human rights guarantees, although with mixed success.<sup>44</sup>

On the other hand, litigation and use of other complaints mechanisms can be used to hold industry to account for harm caused by their products, to improve access to medicines and to vindicate other health-related rights.<sup>6</sup> Tobacco litigation in the United States has had a major impact. A Department of Justice lawsuit found that for half a century the tobacco industry engaged in a pattern of fraudulent conduct to deceive the American public about the effects of cigarettes on health.<sup>45</sup> Complaints made under consumer protection laws are another underused tool. For example, an Australian court imposed a fine of more than 2 million Australian dollars against the Heinz food company for engaging in false and misleading conduct by advertising that a chewy fruit snack, containing about

#### Box 5. Examples of innovation in legal and regulatory approaches to prevention and control of noncommunicable diseases

##### Chile

In 2015, the Chilean Ministry of Health published regulations on the nutritional composition of food products, implementing an earlier law passed in 2012.<sup>47,48</sup> These laws require packaged food that exceeds limits set (per 100 g or per 100 mL) for energy, sodium, sugar or saturated fat, respectively, to be prominently labelled as "high in" each of these nutrients. The same law prohibits food advertising that is directed at children younger than 14 years where the food exceeds the limits for energy, sodium, sugar or saturated fat. Finally, foods that exceed the cut-off points for over-consumed nutrients cannot be sold in pre-school, primary or secondary school.

##### Mexico

Mexico's 1 peso per litre tax on sugar-sweetened drinks, implemented in 2014, resulted in a seasonally adjusted reduction in consumption of taxed beverages of 5.5% in 2014, and 9.7% in 2015, compared with estimates based on trends in consumption before the implementation of the tax.<sup>49</sup>

##### South Africa

In 2013, South Africa introduced regulations under its Foodstuffs, Cosmetics and Disinfectants Act to impose maximum limits for sodium across 13 categories of food including bread, breakfast cereal and porridge, processed meat, savoury snacks and potato chips.<sup>50</sup> These limits took effect in June 2016, with lower limits to be phased in from 30 June 2019. One study estimated these regulations could avoid 5600 cardiovascular disease deaths per year.<sup>51</sup>

##### United Kingdom of Great Britain and Northern Ireland

Effective from April 2018, the soft drinks levy introduced in the United Kingdom has two tax levels that apply according to the sugar content: 18 pence for drinks with > 5 g sugar per 100 mL, and 24 pence for drinks with > 8 g sugar per 100 mL.<sup>52</sup> The levy incentivized reformulation of products by soft-drink manufacturers even before the tax took effect, reducing expected revenues from pounds sterling (£) 520 to £240 million in the first year of the law.

##### United States of America

Six States (California, Hawaii, Maine, Massachusetts, New Jersey, Oregon) and more than 350 cities and counties, including New York city, have raised the minimum purchasing age for tobacco from 18 to 21 years.<sup>53</sup> In California and New York city, a minimum age of 21 years is required to purchase both cigarettes and electronic cigarettes.<sup>54,55</sup>

two-thirds sugar, was beneficial to the health of children aged 1–3 years.<sup>46</sup>

### Effective use of law

Legislation and executive actions are essential for noncommunicable disease prevention and control, while many of the challenges to effective national plans, such as defending litigation initiated by industry, also call for technical legal expertise. However, governments face major obstacles to using law effectively, including lack of trained personnel, lobbying by powerful industry groups and uncertainty about the extent of their country's obligations under trade and investment agreements.<sup>16</sup> Nevertheless, as Box 5 illustrates, governments can overcome these challenges and pass innovative laws for prevention and control of noncommunicable disease risk factors.

Public health advocates have called on the World Health Assembly to make bold use of its legal powers, through a convention on alcoholic beverages<sup>56</sup> or obesity<sup>57</sup> and unhealthy diets. A global coordinating agency for noncommuni-

cable diseases has also been proposed, to encourage public and private financing, aligned with the sustainable development goals.<sup>58</sup> However, even in the absence of these major reforms, we see opportunities for governments and their development partners, including WHO, to strengthen national noncommunicable disease prevention and control.

### Sharing good practices

The WHO Independent High-level Commission on noncommunicable diseases encouraged governments to use their "full legal and fiscal powers to achieve public health goals."<sup>4</sup> This includes regulating harmful products and practices, and strengthening the institutions, functions and official roles that are needed to ensure compliance with legal standards.<sup>6</sup> Effective use of law requires budgetary resources for enforcement, including training. Distinct from its law-making role, WHO's power to develop soft (non-binding) normative standards, together with its capacity to convene and disseminate expert knowledge, remain powerful tools. WHO is already developing technical resources

to support regulatory actions by governments; for example, implementing plain packaging of tobacco products<sup>59</sup> and the International Code of Marketing of Breast-milk Substitutes.<sup>60</sup> WHO, with its development partners, should invest further to increase technical resources in law and regulation.

WHO could also facilitate the diffusion of policy across Member States by creating opportunities for governments that are leading the way to share their practical experiences of drafting, implementing and enforcing laws and fiscal policies.<sup>10</sup> Since legal systems vary widely, such exchanges among officials and stakeholders in different countries are likely to be more productive than exhaustively cataloguing health laws or promoting model legislation. Recent experience with plain packaging of tobacco products shows that technical activities such as training workshops, online platforms linking people who work in a common field and comparative analysis of laws and litigation can also facilitate policy diffusion.

### Mobilizing the legal workforce

Building legal capacity means mobilizing a workforce with the technical skills to navigate legal issues arising in key areas of noncommunicable disease prevention and control.<sup>61</sup> Such efforts could help to translate evidence and WHO guidance into country-level action. Creating a platform for lawyers, legislators, educators and public health experts to interact may not only improve the exchange of advice and information across governments, civil-society organizations and academia, but also provide mentors for young leaders working on reform of laws on noncommunicable diseases in low-resource countries.

Leadership requires greater investment in legal capacity within WHO and other agencies working in health development, and careful assembling of a legal workforce. Donor funding for a dedicated public health law programme within WHO to support countries in implementing best-buy policy interventions could have a substantial impact.<sup>62</sup> Within available resources, we see two key areas where global leadership could strengthen legal capacities.

First, WHO could facilitate professional exchanges and mutual support among those who use legal knowledge in key practice areas. Fostering such a transnational network could be achieved

online, with support for legal practitioners working in key thematic areas, countries and regions, and in different languages. With appropriate support, these communities of practice will grow and evolve, seeking out strategic opportunities, developing novel legal arguments, providing expert evidence in litigation (through filing of amicus briefs), documenting case studies and developing technical resources in areas of need.

Second, knowledge provides the foundation for action. In the context of tobacco control, for example, databases of case law and legislation facilitate comparative analysis and assist lawyers and health professionals to anticipate tobacco industry strategies.<sup>63</sup> No comparable resource exists for taking action on unhealthy diets or harmful use of alcohol. Consequently, industry legal arguments are neither systematically tracked nor easily anticipated.

### Building on local innovations

Although prevention and control of noncommunicable diseases ideally require a national response, state, city

and local governments can be powerful innovators (Table 1). Unlike national governments, smaller, defined localities often have more homogeneous constituencies, smaller and more efficient administrations and less time-consuming legislative processes. In response to political activism, social mobilization and specific social, economic and demographic factors, local and city administrations can become laboratories for innovation, trialling new legal approaches. The impact of these local innovations can be evaluated, disseminated and implemented both horizontally (to other localities) and vertically (at state and national levels).<sup>64</sup>

Local governments have been leaders in many areas of noncommunicable disease policy. In the United States, local jurisdictions were the first to impose higher taxes, marketing restrictions and bans on smoking in public places, among other interventions.<sup>65</sup> Some cities and towns have adopted a range of additional strategies, such as banning trans-fatty acids from the food supply, raising the minimum purchasing age for tobacco products

and imposing health-based taxes on sugar-sweetened drinks.<sup>66</sup>

### Coordinating regional action

Regionally coordinated action can accelerate the implementation of legislation, particularly by smaller countries. The best opportunities exist in regions that have a strong history of cooperative action. WHO's regional offices and other regional political groupings (e.g. the Pacific Community, the Caribbean Community, the African Union, the Association of Southeast Asian Nations or the Organization of American States) could lead, coordinate and support national noncommunicable disease policies. Deliberate, planned, regional action could benefit small, remote and vulnerable populations whose governments may otherwise engage in prevention and control in a piecemeal fashion and at a slower rate. Regional action allows more efficient use of legal resources, although careful groundwork is needed to create a shared vision and agreed principles for action. Box 6 summarizes an example from WHO's Regional Office for the Eastern Mediterranean.

Table 1. Examples of local innovations in prevention and control of noncommunicable diseases in the United States of America

Policy innovation and example	Description	Reference
<b>Information disclosure</b>		
Calorie labelling rules	Restaurant chains and food retailers in New York city must disclose calorie counts on menu boards for standard menu items	New York City Health Code §81.50 (2017)
Soda warning rule	Billboards advertising sugar-sweetened drinks in San Francisco city must contain a health warning about the impact of added sugars on obesity, diabetes and tooth decay	San Francisco Health Code art. 42 §4203(a) (2015)
Haemoglobin A1C registry	New York city's health code makes glycated haemoglobin (a measure of blood sugar control) a reportable condition by pathology laboratories. The registry helps to identify patients with poorly controlled diabetes or who need follow-up care	New York City Health Code §13.07 (2006)
<b>Marketing restrictions</b>		
School advertising law	Maine was the first state to prohibit brand-specific advertising of food or beverages in school buildings or on school grounds	Title 20-A Maine Rev. Stat. Ann §6662 (2007)
Healthy food incentives ordinance	Fast-food restaurants in San Francisco city are prohibited from providing free toys in children's meals	San Francisco Health Code art. 8 §§471.1 to 471.9 (2011)
<b>Taxation</b>		
Sugar-sweetened beverage tax	The city of Berkeley was the first jurisdiction in the country to impose an excise tax of 1 cent per ounce on sugar-sweetened drinks	Berkeley Municipal Code Chapter 7.72 (2014)
Sugar-sweetened beverage tax	Philadelphia was the first major city to levy a tax of 1.5 cents per ounce on sugar-sweetened drinks and to earmark tax revenue for improvements to parks, libraries and recreation centres	Philadelphia Code §§19-4101 to 4108 (2016)
<b>Built environment: zoning</b>		
Urban agriculture incentives	California State's Urban Agriculture Incentive Zones Act reduces property taxes for landowners who enter a contract to permit small-scale agriculture or animal husbandry for at least 5 years on vacant lands	Cal Govt Code §51042 (2017)
Ordinance to control prevalence of fast-food outlets	The city of Los Angeles limits new fast-food restaurants in areas with an over-concentration of fast-food outlets	L.A. Cal. Ordinance 180103 (2008)

§: section; §§: sections.

#### Box 6. Example of effective and regionally relevant legal interventions for control of noncommunicable diseases by WHO

The World Health Organization Regional Office for the Eastern Mediterranean (WHO-EMRO), partnered with the O'Neill Institute for National and Global Health Law at Georgetown University, Washington, United States of America, to spur legal reform for noncommunicable disease prevention and control. The project identified affordable, feasible and cost-effective legislative and regulatory interventions that were suitable for implementation in the Eastern Mediterranean Region.

The comprehensive dashboard of legal interventions proposed that WHO-EMRO Member States prioritize interventions in three key domains: (i) noncommunicable disease governance mechanisms requiring multisectoral collaboration, accountability and transparency; (ii) tobacco control laws in compliance with the WHO Framework Convention on Tobacco Control;<sup>27</sup> and (iii) laws to promote healthier diets, such as reducing consumption of sodium and sugar.<sup>67</sup>

WHO-EMRO committed to support Member States to enact and enforce population health improvements through these priority interventions. The project includes implementation guidance tools as well as capacity-building initiatives led by multidisciplinary teams of legislators and public health experts.<sup>68</sup> The EMRO–O’Neill Institute partners published a detailed description of the evidence-based legal policies to reduce noncommunicable disease prevalence in the Region.<sup>69</sup>

### Conclusion

Legislative and regulatory actions lie at the heart of successful national and local strategies for noncommunicable disease prevention and control. However, the role of law as a public policy tool, translating scientific evidence

and normative guidance into action, receives inadequate attention amid the dominance of other disciplines in global health development. This needs to change. Rapid progress in tobacco control has not been accidental, but reflects agreement about the critical importance of law to tobacco control – leading,

in turn to adoption of strong, legally-binding standards at international and national levels. The rapid progress also reflects global investment in capacity-building, technical assistance to WHO Member States, and expansion of legal resources, assisted by organizations such as Bloomberg Philanthropies and the Bill & Melinda Gates Foundation. These factors, which have accelerated progress in tobacco control, are not yet present for other noncommunicable disease risk factors such as unhealthy diets and harmful use of alcohol. Legal and regulatory action must move to the centre of national noncommunicable disease action plans. This requires high-level leadership at global and national levels, developing evidence-based legislation through transparent processes, enforcing it, evaluating its effectiveness and building legal capacities. ■

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### ملخص

#### الصلاحيات القانونية المطلوبة للوقاية من الأمراض غير المعدية ومكافحتها

لتنفيذ سياسات الوقاية والتحكم في عوامل الخطر الرئيسية. نحن نحدد الإجراءات التي يمكن أن تتخذها منظمة الصحة العالمية وشركاؤها لتبني القوى العاملة القانونية وتعزيز الصالحيات القانونية ودعم الاستخدام الفعال للقانون على المستوى الوطني. يجب أن تكون الإجراءات القانونية والتنظيمية في قلب خطط العمل الوطنية للأمراض غير المعدية. ويطلب ذلك قيادة عالية المستوى من القادة العالميين والوطنيين وسن تشريعات قائمة على الأدلة وبناء الصالحيات القانونية.

يمثل القانون حجر الزاوية بالنسبة لاستراتيجيات الوطنية الناجحة للوقاية من الأمراض غير المعدية ومكافحتها. والمقصود بالقانون هو الاتفاقيات الدولية والتشريعات الوطنية ودون الوطنية واللوائح وغيرها من الوسائل الإدارية وقرارات المحاكم والهيئات القضائية. ورغم ذلك فإن الدور الحيوى للقانون في مجال التنمية الصحية العالمية غالباً ما يكون غير مفهوم بشكل جيداً ويتفوق عليه التخصصات الأخرى مثل الطب والصحة العامة وعلم الاقتصاد. يجدد هذا البحث المجالات الرئيسية للتدخل بين القانون والأمراض غير المعدية بدءاً من دور القانون كأداة

### 摘要

#### 预防和控制非传染性疾病所需的法律能力

法律是成功制订预防和控制非传染性疾病的国家战略核心。我们所说的法律是指国际协议、国家和地方法律、法规和其它执行文书，以及法院和法庭的判决。但是，人们对法治在全球卫生发展中的重要作用知之甚少，且法学的作用往往被医学、公共卫生和经济学等其它学科所替代。本文确定了法律与非传染性疾病交叉的关键领域，以法治工具作为实施预防和控制主

要风险因素政策的开端。我们明确世界卫生组织及其合作伙伴可以采取行动来动员合法劳动力，加强法律能力并支持法律在国家层面上的有效利用。法律和法规行为必须转向国家非传染性疾病行动计划的中心。这需要在国际和国家层面上实施基于实证的立法和建设法律能力的高层领导。

## Résumé

### Capacités juridiques requises pour prévenir et maîtriser les maladies non transmissibles

Le droit est au cœur des stratégies nationales efficaces de lutte contre les maladies non transmissibles. Par droit, nous entendons les accords internationaux, les législations nationales et infranationales, les réglementations et autres instruments exécutifs, et les décisions des cours et des tribunaux. Cependant, le rôle vital du droit dans le développement de la santé à l'échelle mondiale est souvent mal compris, et éclipsé par d'autres disciplines telles que la médecine, la santé publique et l'économie. Cet article définit des domaines d'intersection clés entre le droit et les maladies non transmissibles, en commençant par le rôle du droit en tant qu'outil pour mettre en œuvre des politiques

visant à prévenir et maîtriser les principaux facteurs de risque. Nous mettons en évidence des mesures que l'Organisation mondiale de la Santé et ses partenaires pourraient prendre pour mobiliser les professionnels du droit, renforcer les capacités juridiques et soutenir une utilisation efficace du droit au niveau national. Des mesures juridiques et réglementaires doivent être placées au centre des plans d'action nationaux pour la lutte contre les maladies non transmissibles. Cela nécessite un leadership de haut niveau de la part des dirigeants internationaux et nationaux, à travers l'adoption de lois fondées sur des données scientifiques et un renforcement des capacités juridiques.

## Резюме

### Правовой потенциал, необходимый для профилактики и борьбы с неинфекционными заболеваниями

Закон лежит в основе успешных национальных стратегий по профилактике и борьбе с неинфекциоными заболеваниями. Под законом подразумеваются международные соглашения, национальное и субнациональное законодательство, нормативные акты и другие постановления исполнительных органов, а также решения судов и трибуналов. Однако исключительно важная роль закона в области развития глобального здравоохранения часто плохо осознается и перекрывается такими дисциплинами, как медицина, общественное здравоохранение и экономика. Настоящий документ определяет основные области пересечения между законом и лечением неинфекционных заболеваний, начиная

с роли закона как инструмента для реализации стратегий по профилактике и борьбе с ведущими факторами риска. Авторы определяют меры, которые могут быть предприняты Всемирной организацией здравоохранения и ее партнерами по мобилизации юридического персонала, укреплению правоспособности и поддержке эффективного использования закона на национальном уровне. Правовые и нормативные меры должны стать основой для разработки национальных планов действий по борьбе с неинфекциоными заболеваниями. Для этого необходимо заручиться поддержкой мировых и национальных лидеров, обеспечить принятие научно обоснованных законов и развитие правового потенциала.

## Resumen

### Fortalecer la capacidad jurídica para la prevención y el control de las enfermedades no contagiosas

La ley es la clave del éxito de las estrategias nacionales para la prevención y el control de las enfermedades no contagiosas. Por ley entendemos los acuerdos internacionales, la legislación nacional y subnacional, los reglamentos y otros instrumentos ejecutivos, así como las decisiones de los tribunales y las cortes de justicia. Sin embargo, el papel vital de la ley en el desarrollo de la salud mundial a menudo no se comprende bien y se ve eclipsado por otras disciplinas como la medicina, la salud pública y la economía. Este documento identifica las áreas clave de intersección entre la ley y las enfermedades no contagiosas, empezando por el papel de la ley como herramienta para implementar políticas de

prevención y control de los principales factores de riesgo. Se determinan las medidas que la Organización Mundial de la Salud y sus asociados podrían adoptar para movilizar al personal legal, fortalecer la capacidad jurídica y apoyar el uso eficaz de la legislación a nivel nacional. Las acciones legales y reglamentarias deben pasar a ser el centro de los planes de acción nacionales para las enfermedades no contagiosas. Esto requiere un liderazgo de alto nivel por parte de los líderes mundiales y nacionales, para promulgar una legislación basada en pruebas y crear capacidades jurídicas.

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# The palm oil industry and noncommunicable diseases

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**Abstract** Large-scale industries do not operate in isolation, but have tangible impacts on human and planetary health. An often overlooked actor in the fight against noncommunicable diseases is the palm oil industry. The dominance of palm oil in the food processing industry makes it the world's most widely produced vegetable oil. We applied the commercial determinants of health framework to analyse the palm oil industry. We highlight the industry's mutually profitable relationship with the processed food industry and its impact on human and planetary health, including detrimental cultivation practices that are linked to respiratory illnesses, deforestation, loss of biodiversity and pollution. This analysis illustrates many parallels to the contested nature of practices adopted by the alcohol and tobacco industries. The article concludes with suggested actions for researchers, policy-makers and the global health community to address and mitigate the negative impacts of the palm oil industry on human and planetary health.

Abstracts in      at the end of each article.

## Introduction

Public health discourse increasingly focuses on the role of alcohol, tobacco and sugar in the growing burden of noncommunicable diseases. Increasingly this dialogue highlights how, in the pursuit of increased profits, the industries involved in these products aim to shape public and political opinion as well as influence research outcomes to influence policies that endanger public health.<sup>1,2</sup> The palm oil industry is missing from this dialogue.

Palm oil is one of the world's most commonly used vegetable oils, present in around half of frequently used food and consumer products, from snacks to cosmetics.<sup>3,4</sup> Worldwide production of the oil has increased from 15 million tonnes in 1995 to 66 million tonnes in 2017. The rapid expansion in use is attributed to yields nearly four times other vegetable oil crops, with similar production costs; favourable characteristics for the food industry (its relatively high smoke point and being semisolid state at room temperature); and strategies aimed at ensuring government policies are supportive to the expansion of palm oil cultivation, production and use.<sup>5</sup> While these factors associated with palm oil offer clear advantages for the processed food industry, the oil contains a much higher percentage of saturated fats compared to other vegetable oils.<sup>6</sup> Although its negative health impacts are contested,<sup>7</sup> a meta-analysis of increased palm oil consumption in 23 countries found a significant relationship with higher mortality from ischaemic heart disease.<sup>8</sup> Another systematic review found that palm oil consumption increased blood levels of atherogenic low-density lipoprotein cholesterol.<sup>6</sup> As early as 2003, the World Health Organization (WHO) and the Food and Agriculture Organization (FAO) described the evidence linking saturated fat consumption with increased risk of cardiovascular disease as convincing.<sup>9</sup>

The indirect health impacts of oil-palm cultivation are less contested; clearing land for plantations by slash-and-burn practices has led to recurring episodes of harmful haze in South-East Asia.<sup>10</sup> The most recent occurrence, in 2015, led

to an estimated 100 000 premature deaths in the region from pollutants and documented increases in respiratory, eye and skin diseases.<sup>11</sup> The impact of the industry on planetary health, that is, "the health of human civilisation and the state of the natural systems on which it depends",<sup>12</sup> through the cultivation practices of oil-palm trees has also been well-documented. This entails large-scale deforestation, including loss of up to 50% of trees in some tropical forest areas; endangerment of at-risk species; increased greenhouse gas emissions (due to deforestation and drainage of peat bogs); water and soil pollution; and the rise of certain invasive species.<sup>13,14</sup>

Estimations suggest that more than two-thirds of the palm produced goes to food products, making the processed food industry's relationship with the palm oil industry critical.<sup>15</sup> With the United States Food and Drug Administration's ban on trans-fatty acids (TFA) due to their potential adverse health impacts in 2015,<sup>16</sup> and a similar recommendation by the WHO in 2018,<sup>17</sup> an increase in the use of palm oil as a potential replacement for TFA in ultra-processed foods could be anticipated. This paper aims to describe the relationship between the palm oil and processed food industries and how these interconnect with public and planetary health. **Box 1** lists the key terminology in the palm oil industry.

## Approach

The commercial determinants of health are defined as "strategies and approaches used by the private sector to promote products and choices that are detrimental to health".<sup>18</sup> We adapted a 2016 framework on the commercial determinants of health (**Fig. 1**) and applied it to the palm oil industry to review the three domains: (i) drivers (internationalization of trade and capital, expanding outreach of corporations and demands of economic growth); (ii) channels (marketing, supply chains, lobbying and corporate citizenship); and (iii) outcomes (on the environment, consumers and health). The environment component was adapted from the initial framework to expand the scope beyond the social environment.

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## Drivers

### Internationalization of trade and capital

Oil-palm plantations cover over 27 million hectares worldwide, an area approximately the size of New Zealand. The industry is estimated to be worth 60 billion United States dollars (US\$) and employs 6 million people,<sup>7</sup> with an additional 11 million people indirectly dependent on it, particularly in rural areas where jobs can be scarce. In 2014, Indonesia and Malaysia accounted for over 53.3 million (85%) of the 62.4 million tonnes of global palm oil production and have rapidly expanded their farming and exports. Indonesia, for example, increased production from 19.2 tonnes in 2008 to 32.0 tonnes in 2016. The largest importers of palm oil are India, China, the European Union countries, Malaysia and Pakistan.<sup>20</sup>

The palm oil and processed food industries have mutually benefitted from increased sales and consumption of products through rapid internationalization and trade. This trend is likely to continue as low- and middle-income countries increasingly move from eating fresh, minimally processed foods to ultra-processed products.<sup>21</sup> Sales by manufacturers of ultra-processed foods containing palm oil have been expanding.<sup>22</sup>

### Expanding outreach of corporations

Although many companies use palm oil, processing and refining is concentrated in a limited number of corporations. Companies source their supply from their own concessions, from a large number of third-party suppliers and smallholders, both independent and tied through partnership agreements.<sup>23</sup> Increasingly, large corporations are expanding palm-oil refining capacity, expanding the scope of industry concentration.<sup>24</sup> Indonesia and Malaysia have used government policies, including subsidies and land incentives, to assist industry expansion and facilitate greater investment.<sup>23</sup>

More than half the plantations in Indonesia are industrial estates of >6000 hectares owned by private companies, with 40% smallholders with plantations <25 hectares and 7% state-owned.<sup>13</sup> When attempts are made to regulate oil-palm cultivation, industry leaders have

### Box 1. Key terminology in the palm oil industry

Haze: smoke from biomass burnings, where resulting fine particulate matter reduces air quality to hazardous levels.

Palm oil: palm oil is harvested from the fruit of oil-palm trees (species: *Elaeis guineensis*). Common alternative labels for palm oil include: vegetable oil, vegetable fat, palm kernel, palm kernel oil, palm fruit oil, palmitate, palmitate, palmolein, glycerol, stearate, stearic acid, elaeis guineensis, palmitic acid, palm stearine, palmitoyl oxostearamide, palmitoyl tetrapeptide-3, sodium lauryl sulfate, sodium lauryl sulfate, sodium kernelate, sodium palm kernelate, sodium lauryl lactylate/sulfate, hydrated palm glycerides, ethyl palmitate, octyl palmitate, palmityl alcohol.<sup>18</sup>

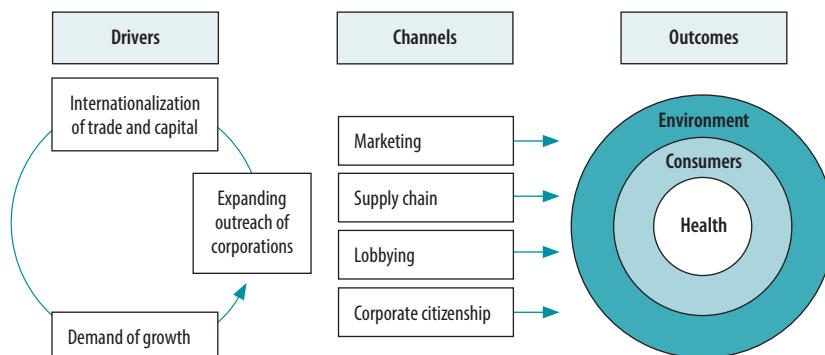
Slash and burn: method of farming where forests are cut and any residue is burnt.

Smoke point: temperature at which oil produces a continuous, clearly visible smoke. Important indicator of the stability of oil, a higher smoke point allows more versatility in cooking.

Trans fatty acids: type of unsaturated fat associated with raising low-density lipoprotein cholesterol that is known to increase the risk for heart disease and stroke.

Ultra-processed foods: processed substances extracted or refined from whole foods, (such as fruits, crops or grains) e.g. oils, hydrogenated oils and fats, flours and starches, variants of sugar, and cheap parts or remnants of animal foods usually with little nutritional value compared to the original whole food.<sup>17</sup>

Fig. 1. Commercial determinants of health



Source: Republished with permission from Kickbusch et al. 2016.<sup>19</sup>

highlighted the threat to smallholders' livelihoods, making palm oil production a controversial political issue.<sup>25</sup>

### Demands of growth

The palm oil industry is projected to reach a production value of US\$ 88 billion by 2022.<sup>20</sup> The increasing availability of palm oil, alongside increasing numbers of countries banning TFA in processed foods,<sup>26,27</sup> means that palm oil will likely remain the food industry's preferred vegetable oil in ultra-processed foods. With China and India continuing to import palm oil for consumption, the growth in its use is anticipated to continue.

### Channels

#### Marketing

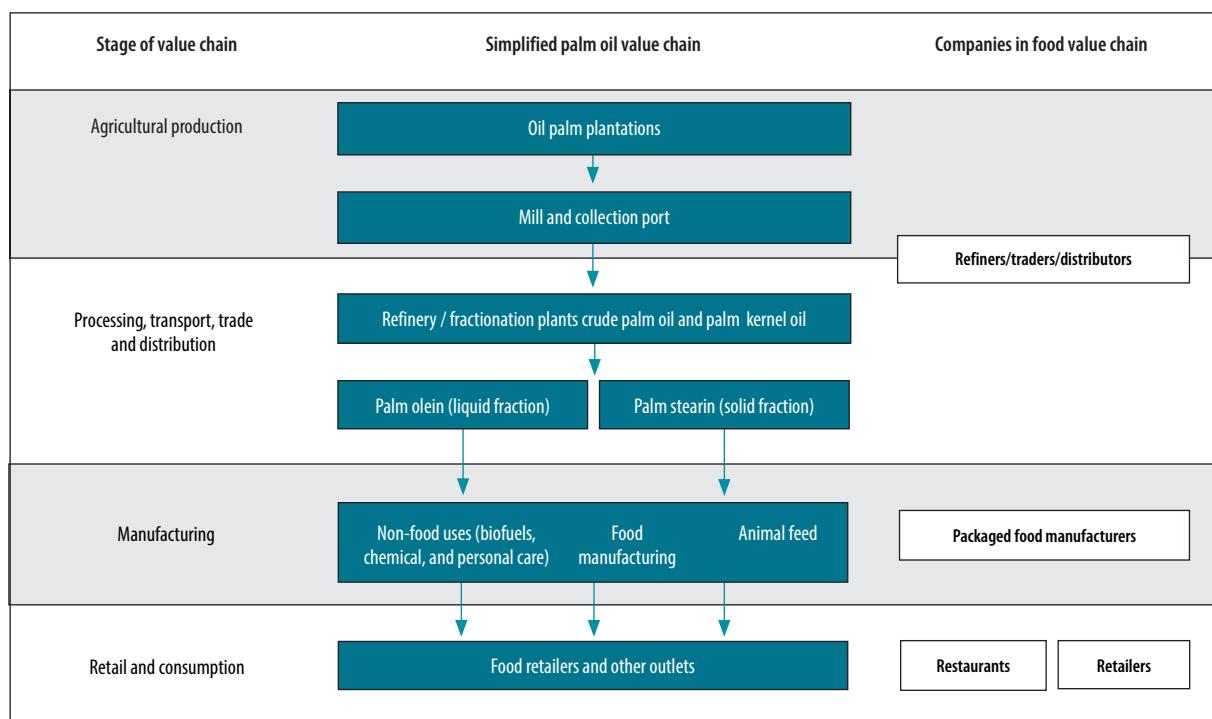
Marketing of palm oil does not occur in the traditional sense. Responding to a backlash against accusations of poor

environmental and labour practices, the industry has sought to portray its products as sustainable, while highlighting the contribution to poverty alleviation. For example, in advance of the European Union's 2020 ban on palm oil as a biofuel, the industry launched advertisements featuring smallholder farmers whose livelihoods would be lost.<sup>25</sup> There is also a mutual benefit for the palm oil and processed food industry, with the latter targeting advertisements for ultra-processed foods towards children (similar to efforts by the tobacco and alcohol industries in targeting children and adolescents)<sup>28,29</sup> and the palm oil refining industry benefiting from the corresponding increase in sales of foods containing palm oil.<sup>30-33</sup>

#### Supply chain

The global palm oil supply chain has many businesses, systems and structures, making it difficult to draw a clear

Fig. 2. Global palm oil supply chain



Source: Adapted with permission from Ceres, 2018.<sup>34</sup>

line between the different components and identify the impact of each actor.<sup>23</sup> For example, a recent brief by the nongovernmental organization (NGO) Ceres, unpacks the key elements of the supply chain and the American industries and companies linked to them (Fig. 2).<sup>34</sup> Unilever PLC, who claim to be the largest user of physically certified palm oil in the consumer goods industry,<sup>35</sup> recently published details of its entire palm oil supply chain; this included 300 direct suppliers and 1400 mills used in its food, personal care and biofuel products.<sup>26,27</sup> The scale of the supply chain is massive and, even by the company's own admission, social and environmental issues persist.<sup>26</sup> The supply chain demonstrates a strong association between the palm oil and processed food industries. Global food processing corporations are further venturing into palm oil refining, creating blurred lines across the supply chain, making it difficult to hold individual actors accountable for any adverse outcomes.

### Lobbying

Apart from establishing a strong lobbying presence in the European Union,<sup>1</sup> the palm oil industry has fostered partnerships with policy and research institutes providing policy recommendations

against regulation.<sup>36</sup> For example, the industry-backed World Growth Institute criticised the World Bank's framework for palm-oil engagement – which seeks prioritisation of smallholders over large corporations and cultivation of plantations on degraded land instead of forested land – as 'anti-poor'.<sup>37</sup> The palm oil industry has also sought to influence global health policy-making. For example, during the drafting of the 2003 WHO/FAO report on Diet, Nutrition and Prevention of Chronic Diseases, the Malaysian Palm Oil Promotion Council questioned the palm oil-related health concerns raised by the report and suggested that any efforts to curb consumption would threaten several million peoples' livelihoods.<sup>33</sup> These tactics, establishing lobbying structures in political and economic hubs, fighting regulations, attempting to undermine reliable sources of information and using poverty alleviation arguments, are similar to those pursued by the tobacco and alcohol industries.<sup>38,39</sup>

### Corporate citizenship

Several major companies and countries have joined to create industry associations to showcase their sustainability efforts. These are membership organizations composed of oil-palm growers,

palm oil producers, consumer goods manufacturers, retailers, investors and NGOs which certify sustainability and fair labour standards and include entities such as the Roundtable on Sustainable Palm Oil and country-specific groups in Indonesia and Malaysia. In 2017, the Roundtable certified approximately 13.4 tonnes (approximately 20%) of the global production as sustainable. The Roundtable also has partnerships with the United Nations Economic and Social Council, United Nations Environment and United Nations Children's Fund, aimed at improving its members' business practices. Twelve of the 16 Roundtable board members are representatives of palm oil processors, manufacturers, retailers, banks, investors or international food processing companies. The sustainability certification effort has been linked to limited amounts of reduced deforestation, with a recent study finding little impact on forest loss and fire detection.<sup>40</sup> Other studies have found that the Roundtable's board members were still associated with companies involved in mass deforestation.<sup>41</sup> Investigations by NGOs have found child labour and human rights violations at Roundtable members' plantations.<sup>42</sup>

Despite some positive initiatives by the palm oil and processed food industries to cultivate, produce and source palm oil through sustainable, ethical practices, challenges remain. Agencies entering partnerships with industry-led initiatives are at risk of becoming complicit in detrimental practices. Indeed, NGOs such as Palm Oil Investigations withdrew support for the Roundtable after evidence of harmful business practices emerged.<sup>43</sup>

## Outcomes

Given the importance of assessing the outcomes of the palm oil industry, we conducted a rapid review of the literature to better understand the impact on the environment, consumers and health. We made a keyword search initially via the PubMed® online database to identify peer-reviewed articles and subsequently via Google search engine to identify other sources of information (Box 2). The review was conducted in June and July 2018 and updated in October 2018. Of 435 articles identified and scanned, we included 40 peer-reviewed articles and eight articles from the grey literature (Fig. 3; Table 1).

### Box 2. Search strategy for the rapid review of the literature on the impact of palm oil on the environment, consumers and health

We made an online search via the PubMed® database using the keyword "palm oil" in conjunction with relevant terms (AND "environment" OR "pollution" OR "climate change" OR "consumer" OR "health" OR "disease"). The review was conducted in June and July 2018 and updated in October 2018. The criteria for inclusion were articles published after 2000, in English language, of relevance to human health (through studies on humans or animal studies that drew conclusions on potential implications for human health), consumers or the environment. Articles were excluded if they were linked to animal husbandry practices, speculative in nature (e.g. profitability analyses), primarily aimed at industrial processes (e.g. monetizing palm oil mill effluent<sup>a</sup>) or drew conclusions of limited relevance to the topic (e.g. zoo-based conservation education).

While five articles initially appeared to be of relevance to palm oil and consumers, on further review, they were excluded. We therefore complemented the "consumer" keyword search with a review of the non-peer-reviewed literature, identified through search by the Google search engine using the same keywords. We limited the search to sources from governments, international agencies, NGOs and trusted media sources. Some of the results for "consumer" also yielded additional references relevant to environment and health, due to the intersection between human and planetary health, consumer practices and palm oil cultivation. Much of the grey literature related to consumers and the environment was focused on advocacy campaigns and calls for palm oil boycotts by NGOs and were therefore excluded as being beyond this paper's scope.

NGO: nongovernmental organization.

<sup>a</sup> Highly polluting wastewater by-product of the palm oil production process.

## Environment

Forest, peatland and biodiversity losses, increased greenhouse gas emissions and habitat fragmentation as well as pollution are environmental concerns

continually linked to the palm oil industry.<sup>5,10,12,46,52,53,63,69,75,77</sup> In response, countries including Indonesia and Malaysia are increasing industry regulation, seeking to prevent slash-and-burn prac-

Fig. 3. Flowchart of articles selected for the rapid review of the literature on the impact of palm oil on the environment, consumers and health

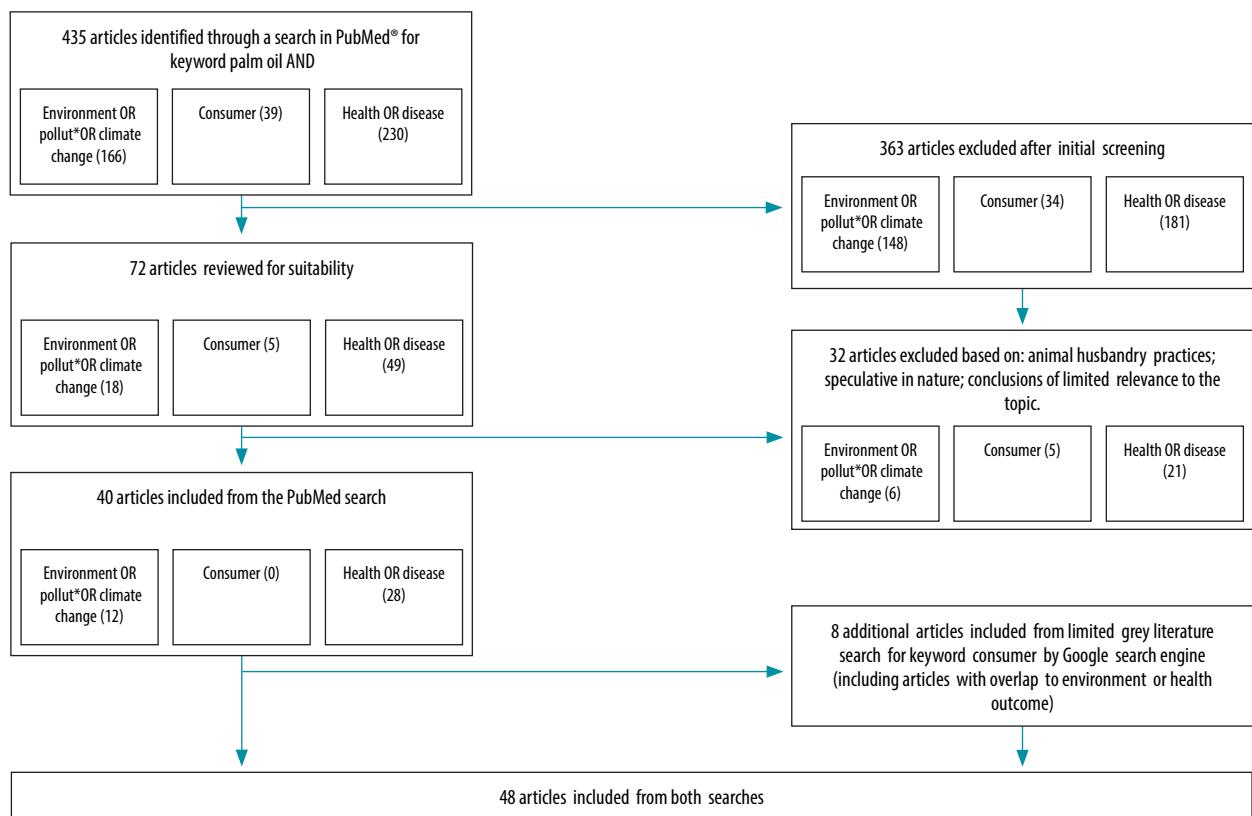


Table 1. Articles included from a rapid review of the literature on palm oil and environment, consumer and health outcomes

Author, Year	Type of article	Title
Edem, 2002 <sup>44</sup>	Review	Palm oil: biochemical, physiological, nutritional, hematological, and toxicological aspects: a review
Sundram et al., 2003 <sup>45</sup>	Review <sup>a</sup>	Palm fruit chemistry and nutrition
World Health Organization-Food & Agriculture Organization, 2003 <sup>49</sup>	Report	Joint WHO-FAO expert consultation on diet, nutrition, and the prevention of chronic diseases <sup>b</sup>
Fitzherbert et al., 2008 <sup>46</sup>	Research	How will oil palm expansion affect biodiversity?
Mukherjee & Mitra, 2009 <sup>7</sup>	Review	Health effects of palm oil
Oguntibeju et al., 2009 <sup>47</sup>	Review	Red palm oil: nutritional, physiological and therapeutic roles in improving human wellbeing and quality of life
Bester et al., 2010 <sup>48</sup>	Research	Cardiovascular effects of edible oils: a comparison between four popular edible oils
Hayes et al., 2010 <sup>49</sup>	Review	Replacing trans fat: the argument for palm oil with a cautionary note on interesterification
Loganathan et al., 2010 <sup>50</sup>	Review	Health promoting effects of phytonutrients found in palm oil
Oyewole et al., 2010 <sup>51</sup>	Review	Public health nutrition concerns on consumption of red palm-oil (RPO): the scientific facts from literature
Persson et al., 2010 <sup>52</sup>	Research	Preserving the world's tropical forests – a price on carbon may not do
Chen et al., 2011 <sup>8</sup>	Systematic review	Multi-country analysis of palm oil consumption and cardiovascular disease mortality for countries at different stages of economic development: 1980–1997
Anonymous, 2012 <sup>53</sup>	Commentary	The other oil problem. The world's growing appetite for cheap palm oil is destroying rain forests and amplifying climate change
Downs et al., 2013 <sup>54</sup>	Research	Reformulating partially hydrogenated vegetable oils to maximise health gains in India: is it feasible and will it meet consumer demand?
Fattore et al., 2014 <sup>55</sup>	Systematic review	Palm oil and blood lipid-related markers of cardiovascular disease: a systematic review and meta-analysis of dietary intervention trials
Ho et al., 2014 <sup>56</sup>	Research	Impact of 2013 South Asian haze crisis: study of physical and psychological symptoms and perceived dangerousness of pollution level
May et al., 2014 <sup>57</sup>	Review <sup>a</sup>	Research advancements in palm oil nutrition: recent advancements in palm oil nutrition
Downs et al., 2015 <sup>58</sup>	Research	The need for multisectoral food chain approaches to reduce trans fat consumption in India
Hosseini et al., 2015 <sup>14</sup>	Research	Pollutant in palm oil production process
Mancini et al., 2015 <sup>59</sup>	Review	Biological and nutritional properties of palm oil and palmitic acid: effects on health
Odia et al., 2015 <sup>60</sup>	Review	Palm oil and the heart: a review
Sun et al., 2015 <sup>6</sup>	Meta-analysis	Palm oil consumption increases LDL cholesterol compared with vegetable oils low in saturated fat in a meta-analysis of clinical trials
Whitmee et al., 2015 <sup>12</sup>	Research	Safeguarding human health in the Anthropocene epoch: report of The Rockefeller Foundation–Lancet Commission on planetary health
Boateng et al., 2016 <sup>61</sup>	Review	Coconut oil and palm oil's role in nutrition, health and national development: a review
Crippa et al., 2016 <sup>62</sup>	Research	Population exposure to hazardous air quality due to the 2015 fires in Equatorial Asia
Koplitz et al., 2016 <sup>63</sup>	Research	Public health impacts of the severe haze in Equatorial Asia in September–October 2015: demonstration of a new framework for informing fire management strategies to reduce downwind smoke exposure
UNICEF Indonesia, 2016 <sup>64</sup>	Report	Palm oil and children in Indonesia: exploring the sector's impact on children's rights <sup>b</sup>
Vijay et al., 2016 <sup>5</sup>	Research	The impacts of oil palm on recent deforestation and biodiversity loss
World Bank, 2016 <sup>11</sup>	Report	The cost of fire: an economic analysis of Indonesia's 2015 fire crisis <sup>b</sup>
Hermes, 2017 <sup>65</sup>	Online media article	Lack of consumer demand for sustainable palm oil <sup>b</sup>
Karthik et al., 2017 <sup>10</sup>	Research	Understanding the Southeast Asian haze
Lebbie et al., 2017 <sup>66</sup>	Research	Predictors of hypertension in a population of undergraduate students in Sierra Leone
Loganathan et al., 2017 <sup>67</sup>	Review <sup>a</sup>	Health-promoting effects of red palm oil: evidence from animal and human studies
Paddison, 2017 <sup>68</sup>	Online media article	70% of brands in Malaysia and Singapore don't disclose palm oil use <sup>b</sup>

(continues. . .)

(.. .continued)

Author, Year	Type of article	Title
Paterson et al., 2017 <sup>69</sup>	Review	Climate change affecting oil palm agronomy, and oil palm cultivation increasing climate change, require amelioration
Shankar et al., 2017 <sup>70</sup>	Stakeholder analysis	Policies for healthy and sustainable edible oil consumption: a stakeholder analysis for Thailand
Sheldon et al., 2017 <sup>71</sup>	Research	The impact of Indonesian forest fires on Singaporean pollution and health
Singh et al., 2017 <sup>72</sup>	Research	Prevalence and correlates of hypertension in a semi-rural population of Southern India
Coriakula et al., 2018 <sup>73</sup>	Research	The development and implementation of a new import duty on palm oil to reduce non-communicable disease in Fiji
Di Genova et al., 2018 <sup>74</sup>	Review	Pediatric age palm oil consumption
Gallardo et al., 2018 <sup>75</sup>	Research	Current and future effects of global change on a hotspot's freshwater diversity
Ismail et al., 2018 <sup>76</sup>	Systematic review	Systematic review of palm oil consumption and the risk of cardiovascular disease
Meijaard et al., 2018 <sup>13</sup>	Situation analysis	Oil palm and biodiversity: a situation analysis by the IUCN Oil Palm Task Force
Nicholas et al., 2018 <sup>77</sup>	Research	Palm oil in Myanmar: a spatiotemporal analysis of the effects of industrial farming on biodiversity loss
Sin Teh et al., 2018 <sup>78</sup>	Review <sup>a</sup>	sn-2 hypothesis: a review of the effects of palm oil on blood lipid levels
Palm Oil Investigations, accessed 2018 <sup>79</sup>	Online factsheet	Names for palm oil <sup>b</sup>
World Wildlife Fund, accessed 2018 <sup>80</sup>	Online factsheet	Palm oil: The hidden truth lurking in your home <sup>b</sup>
World Wildlife Fund, accessed 2018 <sup>18</sup>	Online factsheet	Which everyday products contain palm oil? <sup>b</sup>

<sup>a</sup> Denotes articles authored by the Malaysian Palm Oil Board.<sup>b</sup> Denotes grey literature – all other articles are from peer-reviewed sources.

tices and restoring peatlands.<sup>11</sup> Although the results are limited, companies are attempting to engage in more sustainable palm oil cultivation and production practices.<sup>13</sup> Nevertheless, plantations with palm sustainability certification only encompass a fifth of all oil-palm cultivation, certification does not yield the desired benefits and there is limited consumer demand for sustainable palm oil.<sup>65</sup>

## Consumers

In recent years, there have been campaigns by NGOs to increase consumer awareness about palm oil production practices, although success appears limited.<sup>65,80</sup> From the processed food industry and health perspective, much work remains to be done. Palm oil derivatives in food, household and cosmetic products can be listed in any one or more of its 200 alternate names.<sup>79</sup> Some countries such as Australia and New Zealand only require peanut, sesame and soy oils to be explicitly labelled, while palm oil can fall under a generic category of vegetable oil.<sup>79</sup> The World Wildlife Fund lists more than 25 common alternatives to palm oil labelling found in food products (Box 1).<sup>18</sup> With its inclusion in many everyday products, unclear food labelling and sometimes conflicting information on health impacts, it can be difficult to know how to identify palm oil in foods. Consumers may be unaware of what they are eating or its safety.

## Health

Reports of the health impacts of palm oil consumption in foods are mixed.<sup>44,49,51,55,59,61,66,74,76</sup> Some studies link consumption of palm oil to increased ischaemic heart disease mortality, raised low-density lipoprotein cholesterol, increased risk of cardiovascular disease and other adverse effects.<sup>6,8,9</sup> Other studies show no negative effects<sup>7</sup> or even favourable health outcomes from palm oil consumption.<sup>7,45,47,48,50,57,60,67,78</sup> Four of the nine studies in our literature search showing overwhelmingly positive health associations were authored by the Malaysian Palm Oil Board, again drawing parallels with the tobacco and alcohol industries<sup>38,39</sup> and calling into question the credibility of claims in favour of increased palm oil consumption. The contested nature of the evidence suggests the need for independent, comprehensive studies of the health impact of palm oil consumption. Countries such as Fiji, India and Thailand have initiated policy dialogues and analyses aimed at better understanding the role of palm oil in diets and best approaches to reducing saturated fats in the food-chain, but these discussions are far from conclusive.<sup>54,58,70,72,73</sup>

More unequivocally, land-clearing practices for oil palm cultivation have major public health consequences. Since the 1990s, air pollution from slash-and-

burn practices have affected the health of populations in South-East Asia, especially the most vulnerable groups of the population, such as infants and children.<sup>11,56</sup> Haze episodes, even across country borders, have been linked to premature deaths and increased respiratory illness as well as cardiovascular diseases.<sup>62,71</sup> Of major concern is the effect of exposure to particulate matter on fetal, infant and child mortality, as well as children's cognitive, educational and economic attainment.<sup>81,82</sup> The direct and indirect impact of the palm oil cultivation industry on children, including child labour practices, is especially concerning. In Indonesia, around half of 4 million people employed in the industry are estimated to be women. Even when they are not directly employed, children dependent on palm oil workers are adversely affected by inadequate maternity protection, low breastfeeding rates, lack of child-care opportunities, poor maternal health and nutrition, and difficulty in accessing education.<sup>64</sup>

## Discussion

This paper illustrates how the palm oil industry, in close connection with the processed food industry, impacts human and planetary health. The impact also cuts across other sectors, such as education, child protection, as well as having implications for gender-related

**Box 3. Suggested actions to address the palm oil industry's impact**

**Address impact on health**

Researchers

- Investigate the health impact of ultra-processed foods, including specific ingredients such as palm oil;
- study the long-term consequences of daily consumption of unhealthy, ultra-processed foods and their ingredients, including the effects on children; and
- research the effect of combinations of ingredients in ultra-processed foods.

Policy-makers

- Identify and address industries that adversely impact noncommunicable diseases and the broader human and planetary health agenda;
- develop and enforce stricter labelling requirements for ultra-processed foods, including listing of ingredients and their potential harmful effects;
- regulate the palm oil supply chains across sectors such as health, environment, labour, and child protection, including needed gender-related policies and practices; and
- consider measures to reduce the production and consumption of unhealthy, ultra-processed foods.

Global health community

- Tackle the issue of unhealthy mass-produced and processed foods and beverages synergistically instead of discretely by ingredient (e.g. palm oil, sugar, fats); and
- facilitate consumer awareness and action on the negative impacts of palm oil cultivation, production and consumption.

**Mitigate industry influences**

Researchers

- Drawing on experience with the tobacco and alcohol industries, understand and mitigate the influence of industries involved in palm oil production and manufactured foods; and
- exercise caution when engaging in research activities using funding from the palm oil and related industries.

Policy-makers

- Avoid the influence of lobbying by food industries whose practices adversely impact human and planetary health;
- develop and enforce strict regulations that avoid political patronage or related practices (i.e. elected officials sitting on industry boards); and
- introduce measures to reduce the population's consumption of unhealthy, ultra-processed foods (e.g. by taxation, restricting advertising) and to increase the consumption of healthier, whole foods.

Global health community

- When considering partnerships with the palm oil industry or their related entities, ensure public health priorities are not co-opted by private sector agendas; and
- avoid the risk of perceived or real complicity, including avoiding funding or partnership opportunities for health that might come at the expense of other sectors such as environment or labour.

**Work across SDGs**

Researchers

- Study interlinkages across complex systems of the palm oil and related industries aimed at identifying cross-sectoral solutions.

Policy-makers

- Design policies that do not sacrifice longer-term health, environmental and social concerns for immediate economic gains and profits.

Global health community

- Identify allies across sectors such as environment, child protection, labour and gender that can join in evidence generation and advocacy around the detrimental impacts of palm oil on human and planetary health; and
- reform global health governance structures and funding mechanisms with the aim of promoting intersectoral action instead of narrow disease-specific programmes.

SDG: sustainable development goal.

policies and practices. A limitation of our rapid review is that not all the information from these industries is publicly available and, with limited peer-reviewed materials available on the palm oil industry, we included media reports, environmental activist web sites and other grey literature. This article is not meant to be exhaustive and therefore does not avert the need for an extensive systematic review of the human and

planetary health outcomes of the palm oil industry, spanning other sectors such as labour, gender and use as biofuel.

The palm oil industry is an overlooked actor in discussions on non-communicable diseases. The current widespread use of palm oil draws attention to the ultra-processed unhealthy food system and the need to deepen and expand existing research on the industry. However, we need to care-

fully consider practical policy options and their implications. For example, encouraging use of oils with lower saturated fat content in ultra-processed foods could have a greater detrimental impact on the environment than palm oil, through further deforestation and loss of biodiversity (given the need for more natural resources to cultivate such crops). Policy-makers may therefore need to consider ways to reduce the de-

mand for oils more specifically and for unhealthy ultra-processed foods more broadly. Such actions would benefit not only the noncommunicable disease agenda, but also human and planetary health as part of the sustainable development goals (SDGs).

### Suggestions for action

Addressing the palm oil industry's impact goes beyond a single industry, product or sector. Taking a multifaceted approach, we suggest three sets of actions for researchers, policy-makers and the global health community (NGOs and international organizations; Box 3).

#### *Understand impact on health*

We need to better understand and address the content, health impact and supply chains of palm oil products. The evidence on health remains mixed. Furthermore, the so-called cocktail effect remains unknown; individual ingredients of ultra-processed foods may be harmless alone, but consumed in combination, daily, could be damaging.<sup>83</sup> This also includes understanding the associated supply chains and the needed accountability measures aimed at addressing potential determinantal actions from the palm oil and related industries.

#### *Mitigate industry influences*

We need to mitigate the influence of the palm oil and related industries on public health policies and programmes. The relationship between the palm oil and processed food industries, and the tactics they employ, resembles practices adopted by the tobacco and alcohol industries. However, the palm oil industry receives comparatively little scrutiny. Palm oil use will likely continue, given the relatively low production costs of palm oil, high profit margins of ultra-processed foods, abundant use of palm oil in processed foods and prevalence of palm oil use in several industries (without a current viable alternative). As seen with recent examples, the public health community, whether multilateral agencies<sup>84</sup> or research institutes<sup>85</sup>, is not immune to industry influence. Political ties to industries merit further exploration.<sup>86</sup>

#### *Work across the SDGs*

Palm oil use in ultra-processed foods follows a long, complex chain. Even as the direct health impact remains unclear, cultivation and production and related practices contribute to environmental pollution, respiratory illnesses and loss of biodiversity. Furthermore, with documented forced and

child labour and human rights abuses, as well as gender-related issues, such as inadequate maternity protections in palm oil plantations, understanding and addressing the influence of the palm oil industry cuts across different sectors and different SDGs. Therefore, narrow, health-specific measures cannot be implemented in isolation.

### Conclusions

As the most prevalent vegetable oil in food manufacturing, palm oil is an integral component of the food supply chain. While the direct health effects of palm oil remain contested, the indirect health impacts of cultivating this product are many. Commercial determinants play a vital role in a complex system that leads to the production and consumption of foods detrimental to human health. The discourse on noncommunicable diseases and human health can no longer be separated from the dialogue on planetary health. ■

**Competing interests:** None declared.

## ملخص

### صناعة زيت النخيل والأمراض غير المعدية

لا تعمل الصناعات واسعة النطاق في عزلة، بل يكون لها تأثيرات ملموسة على صحة الإنسان وسلامة الكوكب. من بين العوامل التي غالباً ما يتم إغفالها في مكافحة الأمراض غير السارية، هي صناعة زيت النخيل. إن سيطرة زيت النخيل في صناعة تجهيز الأغذية يجعله الزيت النباتي الأكثر إنتاجاً في العالم. لقد قمنا بتطبيق العناصر التجارية المحددة لإطار العمل الصحي لتحليل صناعة زيت النخيل. كما نقوم بتسلیط الضوء على علاقة مربحة للطرفين في هذه الصناعة مع صناعة الأغذية المصنعة، وأثرها على صحة الإنسان وسلامة الكوكب، بما يشمل الممارسات الزراعية

الضارة التي ترتبط بأمراض الجهاز التنفسى، وإزالة الغابات، وفقدان التنوع البيولوجي، والتلوث. يوضح هذا التحليل العديد من أوجه التشابه بين الطبيعة المتنازع عليها للممارسات التي تنتهجها صناعات الكحوليات والتبغ. وختمت المقال بإجراءات مقترنة للباحثين وواعضي السياسات والمجتمع الصحى العالمي للتعامل مع الآثار السلبية لصناعة زيت النخيل على صحة الإنسان والكوكب، والتخفيف منها.

## 摘要

### 棕榈油行业与非传染性疾病

大规模行业通常不是孤立进行的，相反地，它会对人类与地球健康产生切实影响。在与非传染性疾病作斗争的过程中，棕榈油行业通常会被忽视。棕榈油在食品加工行业占据主导地位，是目前世界上生产量最大的植物油品种。我们采用影响健康的商业因素框架来分析棕榈油行业。我们强调该行业与食品加工行业之间的互惠互利关系及其对人类和地球健康所产生的影

响，包括与呼吸系统疾病、森林砍伐、生物多样性丧失和污染有关的有害耕作实践。该分析表明酒精和烟草行业所采用的实践与其争议性的本质存在诸多相似之处。本文为研究人员、政策制定者和全球卫生社区工作者总结了建议行动方案，以解决和减轻棕榈油行业对人类和地球健康带来的负面影响。

## Résumé

### L'industrie de l'huile de palme et les maladies non transmissibles

Les grandes industries ne fonctionnent pas en vase clos; elles ont des effets tangibles sur la santé des individus et de la planète. Un acteur souvent négligé dans la lutte contre les maladies non transmissibles est l'industrie de l'huile de palme. Étant donné sa prédominance dans l'industrie alimentaire, l'huile de palme est l'huile végétale la plus largement produite au monde. Nous avons appliqués les déterminants commerciaux de la santé pour analyser l'industrie de l'huile de palme. Nous mettons en évidence la relation mutuellement profitable entre cette industrie et l'industrie des aliments transformés ainsi que ses effets

sur la santé des individus et de la planète, et notamment des pratiques culturelles néfastes liées à des maladies respiratoires, la déforestation, la diminution de la diversité biologique et la pollution. Cette analyse établit de nombreux parallèles avec la nature contestée de pratiques adoptées par les industries de l'alcool et du tabac. L'article se conclut par des propositions d'action pour que les chercheurs, les responsables politiques et la communauté mondiale de la santé examinent et atténuent les effets négatifs de l'industrie de l'huile de palme sur la santé des individus et de la planète.

## Резюме

### Производство пальмового масла и неинфекционные заболевания

Крупные предприятия функционируют не в изоляции, и результаты их деятельности оказывают ощущимое воздействие на здоровье и благополучие человека и планеты. Одним из факторов, который часто упускают из вида в борьбе с неинфекциональными заболеваниями, является производство пальмового масла. Преобладание пальмового масла в пищевой промышленности делает его наиболее распространенным растительным маслом в мире. Для анализа производства пальмового масла авторы использовали коммерческие детерминанты системы здравоохранения. Авторы подчеркивают взаимовыгодную связь этой индустрии с пищевой промышленностью и ее влияние на

здравье и благополучие человека и планеты, включая методы культивирования, имеющие такие негативные последствия, как респираторные заболевания, уничтожение лесов, сокращение биологического разнообразия и загрязнение окружающей среды. Этот анализ иллюстрирует многие параллели со спорным характером практик, применяемых в алкогольной и табачной промышленности. В статье авторы предлагают исследователям, высшему руководству и мировому сообществу специалистов здравоохранения действия по устранению и смягчению негативных последствий производства пальмового масла для здоровья и благополучия человека и планеты.

## Resumen

### La industria del aceite de palma y las enfermedades no contagiosas

Las industrias a gran escala no operan de forma aislada, sino que tienen un impacto tangible en la salud humana y del planeta. Un agente que a menudo se ignora en la lucha contra las enfermedades no contagiosas es la industria del aceite de palma. El predominio del aceite de palma en la industria del procesamiento de alimentos lo convierte en el aceite vegetal más producido del mundo. Se han aplicado los determinantes comerciales del marco de la salud para analizar la industria del aceite de palma. Cabe destacar la relación mutuamente beneficiosa de la industria con la industria de los alimentos procesados y su impacto en la salud

humana y del planeta, incluidas las prácticas de cultivo perjudiciales que están relacionadas con las enfermedades respiratorias, la deforestación, la pérdida de biodiversidad y la contaminación. Este análisis ilustra muchos paralelos con la naturaleza controvertida de las prácticas adoptadas por las industrias del alcohol y el tabaco. El artículo concluye con varias sugerencias de posibles medidas para que los investigadores, los responsables de la formulación de políticas y la comunidad mundial de la salud aborden y mitiguen los impactos negativos de la industria del aceite de palma en la salud humana y del planeta.

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# Implementation of national action plans on noncommunicable diseases, Bhutan, Cambodia, Indonesia, Philippines, Sri Lanka, Thailand and Viet Nam

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**Abstract** By 2016, Member States of the World Health Organization (WHO) had developed and implemented national action plans on noncommunicable diseases in line with the *Global action plan for the prevention and control of noncommunicable diseases (2013–2020)*. In 2018, we assessed the implementation status of the recommended best-buy noncommunicable diseases interventions in seven Asian countries: Bhutan, Cambodia, Indonesia, Philippines, Sri Lanka, Thailand and Viet Nam. We gathered data from a range of published reports and directly from health ministries. We included interventions that addressed the use of tobacco and alcohol, inadequate physical activity and high salt intake, as well as health-systems responses, and we identified gaps and proposed solutions. In 2018, progress was uneven across countries. Implementation gaps were largely due to inadequate funding; limited institutional capacity (despite designated noncommunicable diseases units); inadequate action across different sectors within and outside the health system; and a lack of standardized monitoring and evaluation mechanisms to inform policies. To address implementation gaps, governments need to invest more in effective interventions such as the WHO-recommended best-buy interventions, improve action across different sectors, and enhance capacity in monitoring and evaluation and in research. Learning from the Framework Convention on Tobacco Control, the WHO and international partners should develop a standardized, comprehensive monitoring tool on alcohol, salt and unhealthy food consumption, physical activity and health-systems response.

Abstracts in ، ، ، and at the end of each article.

## Introduction

Noncommunicable diseases, such as cardiovascular diseases, cancers, chronic respiratory diseases and diabetes, claim a high proportion of overall mortality, pushing many people into poverty due to catastrophic spending on medical care.<sup>1</sup> Yet noncommunicable diseases are mostly preventable. The United Nations (UN) General Assembly has adopted a series of resolutions<sup>2</sup> which reflect the high-level commitment to prevention and control of noncommunicable diseases. In 2013, Member States of the World Health Organization (WHO) resolved to develop and implement national action plans, in line with the policy options proposed in the *Global action plan for the prevention and control of noncommunicable diseases (2013–2020)*.<sup>3</sup> Noncommunicable diseases are also embedded in sustainable development goal (SDG) target 3.4, that is, to reduce by one-third the premature mortality from noncommunicable diseases by 2030, and are linked to other SDGs,

notably SDG 1 to end poverty.<sup>4</sup> In 2017, the WHO Global Conference on Noncommunicable Diseases<sup>5</sup> reaffirmed non-communicable diseases as a sustainable development priority in the *Montevideo roadmap 2018–2030*.<sup>6</sup>

The WHO estimates an economic return of 7 United States dollars (US\$) per person for every dollar spent on so-called best buys – evidence-based, highly cost-effective policy interventions which tackle noncommunicable diseases.<sup>7</sup> There could also be a reduction of 8.1 million premature deaths by 2030 if these best-buy options were fully implemented, which represents 15% of the total premature deaths due to noncommunicable diseases.<sup>7</sup> Despite the rising burden of these diseases in low- and middle-income countries, only an estimated 1% of health funding in these countries is dedicated to prevention and clinical management.<sup>7</sup> This level of spending is unlikely to have a significant impact.

Country-level gaps in legislative, regulatory, technical and financial capacities impede the translation of global com-

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mitments into national action. Most low- and middle-income countries have weak health systems, with limited domestic and international funding for prevention and health promotion interventions. Between 2000 and 2015, only 1.3% (US\$ 5.2 billion) of total global development assistance for health was contributed to noncommunicable disease programmes.<sup>8</sup> The problems are compounded by a lack of coordinated action across the relevant sectors within and outside governments.<sup>9–11</sup> WHO has recommended that innovative sources of domestic financing be explored.<sup>12</sup> Yet in most low- and middle-income coun-

tries, inadequate government funding and high out-of-pocket payments often prevent poorer people from accessing treatment for noncommunicable diseases.<sup>8,13</sup>

We assessed the implementation status of best-buy interventions in seven Asian countries, which have participated in collaborative studies of noncommunicable diseases: Bhutan, Cambodia, Indonesia, Philippines, Sri Lanka, Thailand and Viet Nam. We also assessed gaps in institutional capacity and provided suggestions for improving policy implementation. All countries in this analysis are currently classified by the World

Bank as lower-middle income, except Thailand, which is classified as upper-middle income.<sup>14</sup> Population size ranges from under 1 million in Bhutan to more than 250 million in Indonesia. There are large variations in the prevalence of risk factors for noncommunicable disease, its associated burden and measures to tackle them across these seven countries (Table 1).

Although these seven countries have a similar pace of socioeconomic development, they are diverse in terms of population size, health-system structure and decentralization of governance for health (fully devolved to local govern-

**Table 1. Profile of seven Asian countries included in the analysis of best-buy interventions for the prevention and control of noncommunicable diseases in July 2018**

Variable	Bhutan	Cambodia	Indonesia	Philippines	Sri Lanka	Thailand	Viet Nam
Total population, millions in 2017	0.8	16	258	102	21	69	94 (2016)
<b>Economic and fiscal measures<sup>15</sup></b>							
GDP per capita in 2017, current US\$	3110	1384	3847	2989	4065	6594	2343
Government revenue, excluding grants in 2016, % of GDP	18.9	17.4	12.5	15.2	14.2	20.0	21.5 (2013)
<b>Health expenditure<sup>15</sup></b>							
Current health expenditure per capita in 2015, current US\$	91	70	112	127	118	217	117
<b>Physical activity indicators<sup>16</sup></b>							
Prevalence of physical activity by adults age 18+ years in 2013, %							
Both sexes	91	NA	76	NA	76	70	76
Males	94	NA	75	NA	83	68	78
Females	88	NA	78	NA	70	72	74
Estimated deaths related to physical inactivity in 2013, %	14.0	NA	8.0	NA	6.9	5.1	4.1
<b>Alcohol indicators<sup>17</sup></b>							
Total alcohol consumption per capita by alcohol drinkers older than 15 years in 2010, litres of pure alcohol	6.9	14.2	7.1	12.3	20.1	23.8	17.2
National legal minimum age for on-premise sales of alcoholic beverages, years	18	None	None	18	21	20	18
National maximum legal blood alcohol concentration, %	0.08	0.05	Zero	0.05	0.08	0.05	Zero
<b>Tobacco indicators<sup>18</sup></b>							
WHO FCTC, year of signatory; year of ratification	2003; 2004	2004; 2005	Not signed or ratified	2003; 2005	2003; 2003	2003; 2004	2003; 2004
Prevalence of tobacco use among young people aged 13–15 years in 2016, %							
Both sexes	30.2	2.4	12.7	12.0	3.7	15.0	4.0
Males	39.0	2.9	23.0	17.6	6.7	21.8	6.9
Females	23.2	1.9	2.4	7.0	0.7	8.1	1.3
Prevalence of tobacco smoking among individuals older than 15 years in 2016, %							
Both sexes	7.4	21.8	NA	22.7	15.0	20.7	22.5
Males	10.8	33.6	64.9	40.3	29.4	40.5	45.3
Females	3.1	11.0	2.1	5.1	0.1	2.2	1.1
Total tobacco taxes, % of retail price	Tobacco banned	25.2	57.4	62.6	62.1	73.5	35.7

FCTC: Framework Convention on Tobacco Control; GDP: gross domestic product; NA: data unavailable; US\$: United States dollar.

ments in Indonesia and the Philippines, and partially devolved in Sri Lanka). Lessons from their experiences can be shared with other countries striving to implement their national action plans on noncommunicable diseases.

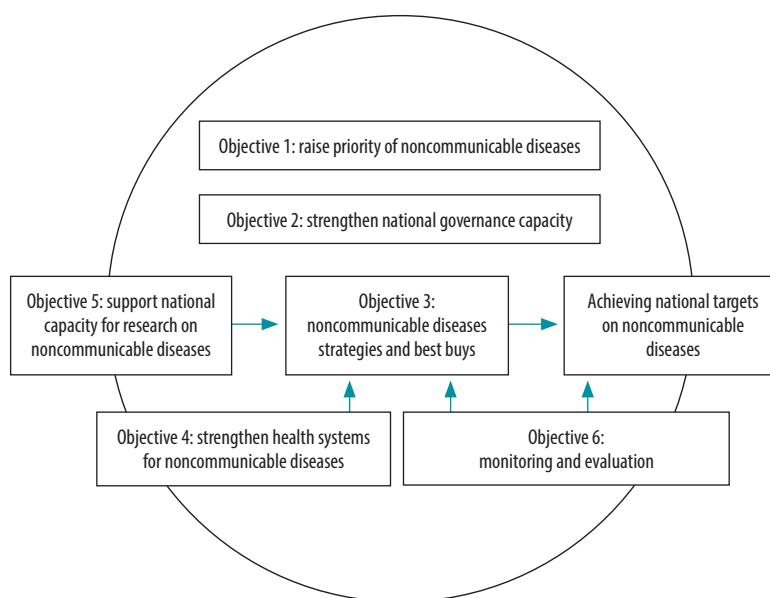
## Approach

We based our analysis on the policy options in the six objectives in the global action plan on noncommunicable diseases.<sup>3</sup> These objectives form the guiding framework for WHO Member States to develop their national action plans (Fig. 1). National research capacities (objective 5) and monitoring and evaluation (objective 6) provide evidence which supports the application of best-buy interventions (objective 3) and monitors progress towards achieving targets. Health-systems strengthening (objective 4) supports the implementation of the action plan. All four objectives (3, 4, 5 and 6) should be enhanced by good governance (objective 2) and a heightened non-communicable diseases priority that sustains the agenda across successive governments (objective 1).

Given the six objectives act in synergy to contribute to noncommunicable diseases prevention and control, we did not attempt to address all of them, but to focus on implementation of the best buys for four major noncommunicable diseases risk factors (tobacco, alcohol, unhealthy diet and physical activity) and for health-systems response.

In the first half of 2018, we gathered information from country profiles in a range of sources from the published literature: (i) the *WHO report on the global tobacco epidemic 2017* which was compiled by the Framework Convention on Tobacco Control (FCTC) secretariat;<sup>18</sup> (ii) the *WHO Global status report on alcohol and health 2018*;<sup>19</sup> (iii) the *WHO Global status report on noncommunicable diseases 2010*;<sup>20</sup> (iv) the *Non-communicable diseases progress monitor 2017*;<sup>21</sup> (v) national capacity survey data on physical activity, salt policy and health-systems response to developing treatment guidelines from the WHO *Global Health Observatory data repository*;<sup>22</sup> and (vi) the *Noncommunicable diseases country profiles 2018* report on availability of essential medicines for noncommunicable diseases.<sup>23</sup> Additional published literature was retrieved from a search of PubMed® and Scopus

**Fig. 1. Noncommunicable diseases global action plan framework: the interlinks between six objectives in achieving national targets on noncommunicable diseases**



Note: Based on the *WHO Global action plan for the prevention and control of noncommunicable diseases 2013–2020*.<sup>3</sup>

online databases. We used personal contacts with the health ministries in each respective country to obtain further information on the institutional capacity to address noncommunicable diseases.

## Implementation of best buys

**Table 2** provides a summary of the implementation status of best-buy interventions across the seven countries.

### Tobacco control

All six countries that are State Parties to the WHO FCTC,<sup>18</sup> and also Indonesia, which is not a State Party to the Convention, have implemented tobacco control interventions. There are five indicators to monitor progress as mandated by the Convention.

First, countries are required to increase excise taxes and prices on tobacco products to achieve the total tax rate between 51% and 75% of retail price of the most sold brand of cigarettes. By 2016, no country in our analysis had achieved the target of 75%. Thailand had the highest tax rate of 73.5%, while Cambodia had the lowest rate of 25.2%. Cigarettes were more affordable (defined according to the cost of cigarettes relative to per capita income) in 2016 than in 2008 in two countries, Indonesia and

Viet Nam, but less affordable in 2016 than in 2008 in the Philippines.

Second, countries are required to eliminate exposure to second-hand tobacco smoke in all indoor workplaces, public places and transport. Bhutan (which has a total ban on tobacco) had the highest compliance rate (score: 10 out of a maximum 10), followed by Thailand (score: 7/10), while Indonesia (score: 1/10) had yet to scale-up compliance to protect the health of non-smokers.

Third, countries are required to introduce plain or standardized packaging or large graphic health warnings on all tobacco packages. Thailand and Sri Lanka were the two best-performing countries, as text and pictorial health warnings covered 85% and 80% of the front and back areas of cigarettes package, respectively. Health warnings covered only 40% of package areas in Indonesia.

Fourth, countries are required to enact and enforce comprehensive bans on tobacco advertising, promotion and sponsorship. Bhutan had the highest level of compliance with a score of 10 out of 10 each for direct and indirect bans, followed by Viet Nam with a compliance score of 10/10 for a direct ban and 6/10 for an indirect ban. Indonesia had the lowest score (1/10) on eliminating exposure to second-hand tobacco smoke; the

Table 2. Implementation status of best-buy interventions for the prevention and control of noncommunicable diseases in seven Asian countries in July 2018

Best-buy intervention	Indicator description	Bhutan	Cambodia	Indonesia	Philippines	Sri Lanka	Thailand	Viet Nam
<b>Tobacco demand-reduction measures<sup>18</sup></b>								
1. Increase excise taxes and prices on tobacco products	Total taxes as % of the price of the most sold brand of cigarettes was maximum 75% and above, minimum 51% <sup>24</sup> .	Not applicable, as sale of tobacco banned in Bhutan	Total tax: 25.2% of retail price in 2016. Retail cigarette price affordable. No changes between 2008 and 2016	Total tax: 57.4% of retail price in 2016. Retail cigarette price affordable. Cigarettes more affordable in 2016 than 2008	Total tax: 62.6% of retail cigarette price in 2016. Cigarettes less affordable in 2016 than 2008	Total tax: 62.1% of retail cigarette price in 2016. Tobacco price affordable. No changes between 2008 and 2016	Total tax: 73.5% of retail price in 2016. Retail cigarette price affordable. No changes between 2008 and 2016	Total tax: 35.7% of retail cigarette price in 2016. Cigarettes more affordable in 2016 than in 2008
2. Eliminate exposure to second-hand tobacco smoke in all indoor workplaces, public places and public transport	Compliance score for smoke-free environments as per WHO report. <sup>18</sup> High compliance: 8–10; moderate compliance: 3–7; minimal compliance: 0–2	Compliance score: 10/10 in 2016. Not yet enforced compliance in cafés, pubs, bars, government facilities and universities	Compliance score: 5/10 in 2016. Not yet enforced compliance in restaurant and government facilities, indoor offices, restaurant, cafés, pubs and bars	Compliance score: 1/10 in 2016. Not yet introduced smoke-free regulation in indoor offices, restaurants, cafés, pubs and bars	Compliance score: 5/10 in 2016. Not yet introduced smoke-free regulation in indoor restaurants, cafés, pubs and bars	Compliance score: 6/10 in 2016. Not yet introduced smoke-free regulation in health-care facilities, educational facilities, universities, government facilities, indoor offices, restaurants, cafés, pubs and bars and public transport	Compliance score: 7/10 (score from 2013 MPOWER report <sup>25</sup> ). Complete compliance with smoke-free regulation in health-care facilities, educational facilities, universities, government facilities, indoor offices, restaurants, cafés, pubs and bars and public transport	Compliance score: 5/10 in 2016. Not yet introduced smoke-free regulation in indoor restaurants, cafés, pubs and bars
3. Implement plain or standardized packaging and/or large graphic health warnings on all tobacco packages	Mandates plain or standardized packaging or large graphic warnings with all appropriate characteristics	Not applicable	Mandates pictorial and text health warnings on packaging of cigarettes, other smoked tobacco and smokeless tobacco, covering 40% of front and back areas. Five specific health warnings approved	Mandates pictorial and text health warnings on packaging of cigarettes, other smoked tobacco and smokeless tobacco, covering 50% of front and back areas. Twelve specific health warnings approved	Mandates pictorial and text health warnings on packaging of cigarettes, other smoked tobacco and smokeless tobacco, covering 80% of front and back areas. (Ban on smokeless tobacco.) Four specific health warnings approved	Mandates text and pictorial health warnings on packaging of cigarettes, other smoked tobacco and smokeless tobacco. Ban on smokeless tobacco. Ten specific health warnings approved	Mandates text and pictorial health warnings on packaging of cigarettes, other smoked tobacco and smokeless tobacco. Ban on smokeless tobacco. Ten specific health warnings approved	Mandates text and pictorial health warnings on packaging of cigarettes, other smoked tobacco and smokeless tobacco. Ban on smokeless tobacco. Ten specific health warnings approved
4. Enact and enforce comprehensive bans on tobacco advertising, promotion and sponsorship	Compliance score as per WHO report. <sup>18</sup> High compliance: 8–10; moderate compliance: 3–7; minimal compliance: 0–2	Compliance score on direct advertising ban: 10/10; promotions and sponsorship ban: 10/10; indirect promotions ban: 10/10	Compliance score on direct advertising ban: 8/10. No ban on indirect promotions except on publicizing corporate social responsibility activities of tobacco companies	No ban on direct tobacco advertising in TV or radio, magazines, billboards, point-of-sales or the internet. Compliance score on free distribution ban: 3/10; promotional discounts on television ban: 0/10; non-tobacco products identified with tobacco brand names ban: 1/10	Compliance score on direct advertising ban: 8/10; promotions ban: 5–10/10; indirect promotions ban: 6/10	Comprehensive regulations on advertising, market promotion and sponsorship, and indirect promotions (no score reported in 2017 WHO MPOWER report <sup>25</sup> )	Compliance score on direct advertising ban: 8/10; promotions ban: 6/10	Compliance score on direct advertising ban: 6/10. No ban on promotions except appearance of tobacco brands on television or films (product placement) score: 9/10; indirect promotions ban: 6/10

(continues...)

...continued)

Best-buy intervention	Indicator description	Bhutan	Cambodia	Indonesia	Philippines	Sri Lanka	Thailand	Viet Nam
5. Implement effective mass-media campaigns that educate the public about the harms of smoking/tobacco use and second-hand smoke	Implemented a national anti-tobacco mass-media campaign designed to support tobacco control, of at least 3 weeks duration with all appropriate characteristics <sup>20</sup>	No national media campaign implemented between 2014 and 2016 Content and target audience guided by research, with post-campaign evaluation	National media campaign implemented on television and radio between 2014 and 2016. Content and target audience guided by research, with post-campaign evaluation	Media campaign implemented between 2014 and 2016. Content and target audience guided by research, with post-campaign evaluation	Comprehensive media campaign implemented between 2014 and 2016. Content and target audience guided by research, with post-campaign evaluation	No media campaign implemented between 2014 and 2016	Comprehensive media campaign implemented between 2014 and 2016. Content and target audience guided by research, with post-campaign evaluation	Comprehensive media campaign implemented between 2014 and 2016. Content and target audience guided by research, with post-campaign evaluation
<b>Harmful use of alcohol reduction measures<sup>19</sup></b>	National legal minimum age for on- and off-premise sales of alcoholic beverages <sup>19</sup> Restrictions for on- and off-premise sales of alcoholic beverages by hours, days, places of sale, density of outlets, for specific events, to intoxicated persons, at petrol stations <sup>19</sup> Legally binding regulations on alcohol advertising, product placement, sponsorship, sales promotion, health warning labels on advertisements and containers Excise tax on beer, wine and spirits	18 years Restrictions for all categories except density	No defined legal age No restrictions	21 years Restrictions only for hours and places	18 years Restrictions only for hours, places, density and specific events	21 years Restrictions for all categories	20 years Restrictions for all categories except density and specific events	18 years Restrictions only for hours, places, density and specific events
2. Enact and enforce bans or comprehensive restrictions on exposure to alcohol advertising (across multiple types of media)	Yes, except advertising on containers	Yes, except advertising on containers	Yes, except advertising on containers	Yes, except for health warning labels on alcohol advertisements and containers	Regulations only for health warning labels on alcohol advertisements and containers	Yes, except advertising on containers	Yes, except advertising on containers	Yes, except advertising on containers
3. Increase excise taxes on alcoholic beverages	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<b>Unhealthy diet reduction measures<sup>22</sup></b>	1. Adopt national policies to reduce population salt/sodium consumption	Adopted national salt policies	Applies voluntary or mandatory salt cut-offs on selected foods	No	No	No	Yes	No
				No	No	No	No	No
				No	No	No	No	No

( . .continued)

Best-buy intervention	Indicator description	Bhutan	Cambodia	Indonesia	Philippines	Sri Lanka	Thailand	Viet Nam
<b>Physical activity<sup>22</sup></b>	Country has implemented, within past 5 years, at least one recent national public awareness programme on physical activity	Yes	No	Yes	Yes	Yes	Yes	No
<b>Health systems<sup>24</sup></b>	Availability of national guidelines for the management of cardiovascular diseases, diabetes, cancer and chronic respiratory diseases	Yes	Yes	Yes	Yes	Yes	Yes	Yes

WHO: World Health Organization.  
Note: Affordability of cigarettes is defined by the percentage of per capita gross domestic product required to purchase 2000 cigarettes of the most sold brand.<sup>18</sup>

country had no bans on direct advertising or sponsorship; and low compliance (score 3/10) on banning free tobacco distribution,

Fifth, countries are required to implement effective mass-media campaigns to educate the public about the harms of smoking and second-hand smoke. All countries except Bhutan and Sri Lanka had comprehensive campaigns in the media in 2014 and 2016.

### Alcohol control

There are three indicators in the *Global status report on alcohol and health 2018*, that were used to monitor progress on reduction of harmful use of alcohol.<sup>19</sup>

First, countries need to enact and enforce restrictions on the physical availability of retailed alcohol. The legal minimum age for on- and off-premise sales of alcoholic beverages in 2018 was the highest in Indonesia and Sri Lanka (21 years), followed by Bhutan, Philippines and Viet Nam (18 years), while Cambodia did not have a defined legal age. All countries in this study except Cambodia had introduced restrictions on the on- and off-premise sales of alcoholic beverages by timing or place, although these was not yet comprehensive.<sup>19</sup>

Second, countries need to enact and enforce bans or comprehensive restrictions on exposure to alcohol advertising in all types of media, product placement, sponsorship and sales promotion, and implement health warning labels on alcohol advertisements and containers. We found that almost all countries had introduced regulations on advertising for all categories of media except on alcohol drinks containers.

Third, countries need to increase excise taxes on alcoholic beverages including beer, wine and spirits. The *Global status report on alcohol and health 2018*<sup>19</sup> does not provide detailed information, such as tax rates, trends of tax rates and changes of affordability of alcoholic beverages. However, most countries had imposed excise taxes for all alcoholic beverages, except on spirits in Bhutan. The available information would not be helpful for monitoring progress on changes of affordability and specific policy interventions.

### Unhealthy diet

The availability of a salt policy is currently the only indicator used by WHO to monitor progress on unhealthy

diet.<sup>21</sup> Salt policies cover four best buys interventions; (i) reformulating and setting target of salt in foods, (ii) promoting an enabling environment for lower sodium options, (iii) promoting behaviour change through media campaign, (iv) implementing front-of-pack labelling. Thailand had introduced a salt and sodium reduction policy for 2016–2025, focusing on labelling, legislation and product reformulation.<sup>24</sup> In 2016, Thailand adopted national policies to reduce population salt and sodium consumption, in the form of a voluntary salt reduction in processed food and snacks. Manufacturers who comply with the salt reduction recommendation (including those on fat and sugar) receive a healthier choice logo by the food and drug administration of the health ministry. A regulation was introduced in 2016 in Thailand, for mandatory package labelling (of salt, fat, sugar, energy and other contents) through the guideline daily amount. Bhutan and Sri Lanka have drafted salt reduction strategies, although an explicit policy on salt reduction was not yet available. Average daily salt intake was 10.8 g (in 2010) and 8.0 g (in 2012) in Thailand and Sri Lanka, respectively,<sup>26</sup> which is more than the 5 g recommended by the WHO.<sup>27</sup>

Population behaviour change actions, such as creating awareness on high salt intake and empowering people to change their behaviours, had been introduced in Bhutan and Sri Lanka.

### Physical activity

Implementing public education and awareness campaigns is the indicator for monitoring progress of promoting physical activity.<sup>21</sup> By 2016, Cambodia and Viet Nam had not implemented any programme activities that support behavioural change in the previous 5 years. The *Global action plan on physical activity (2018–2030)*, adopted by World Health Assembly resolution WHA71.6<sup>28</sup> in May 2018, urged the WHO Member States to implement the promotion of physical activity and requested the WHO to develop global monitoring and reporting systems.

### Health-systems response

Two indicators are proposed for monitoring health-systems response to non-communicable diseases: availability of treatment guidelines and availability of essential medicines at primary level facilities.<sup>21</sup> Access to essential medicines

supports reduction of premature mortality in SDG target 3.4.

By 2016, all seven countries had developed evidence-based national guidelines for the management of four major conditions through a primary health-care approach, although there was no detail on the scope and contents of guidelines. Three countries, Philippines, Sri Lanka and Thailand, reported that more than 50% of their primary health-care facilities offered cardiovascular risk management of patients at risk of heart attack and stroke. The remaining four countries reported fewer than 25% of their primary care facilities offered these services.

Indonesia and Sri Lanka reported that 11 out of 12 priority noncommunicable diseases medicines were available in more than 50% of their primary care facilities. Viet Nam and Cambodia needed to scale-up availability of these medicines, as only 2/12 and 3/12 medicines for noncommunicable diseases were available, respectively.

In addition to the cross-country analysis in **Table 2**, **Box 1** provides a synthesis of intra-country analysis of their noncommunicable diseases interventions, achievements and gaps.

### Institutional capacity

Translating the UN General Assembly resolutions into interventions with good outcomes requires institutional capacity to deliver these political promises. We obtained information directly from health ministries on their institutional capacities for noncommunicable diseases (**Table 3**).

All seven countries had designated a unit or equivalent body in their health ministry with responsibility for non-communicable diseases. The number of full-time equivalent professional staff in the unit ranged from four in Bhutan to 41 in Sri Lanka. As required by the WHO FCTC reporting, the number of full-time equivalent for tobacco control ranged from three in the Philippines to 41 in Thailand.

Funding for noncommunicable diseases interventions (including prevention, promotion, screening, treatment, surveillance, monitoring and evaluation, capacity-building, palliative care and research) were available in all seven countries, except for a research budget in Cambodia.

Data were not available on annual spending on noncommunicable

diseases, although all countries relied on government budget allocation and a small proportion of donor funding. Health insurance subsidized the cost of treatment in Cambodia, Indonesia, Philippines, Thailand and Viet Nam. A 2% additional surcharge from a tobacco and alcohol excise tax was earmarked and managed by the Thai Health Promotion Foundation<sup>29</sup> for comprehensive interventions for noncommunicable diseases and other risk factors. An earmarked tax from alcohol and tobacco sales in the Philippines is used to subsidize health care in general, for the 40% of

the population who are low income, and Viet Nam has earmarked the tobacco tax for the tobacco control programme. A great variation on annual spending on tobacco control was noted in these countries, ranging from US\$ 21 739 in the Philippines to US\$ 12 million in Viet Nam ([Table 3](#)).

## Challenges

### Implementation gaps

Institutional capacity assessment in the seven countries is constrained by several limitations. Disaggregated information

on the skill-mix of technical staff in countries' health ministry noncommunicable diseases units, and staff turnover rate, are not routinely recorded and reported. This evidence is critical for analysing gaps and strengthening the capacity of noncommunicable disease units. In the countries we analysed, information was also lacking on government spending on health promotion interventions. Using the WHO Health Accounts database,<sup>30</sup> we estimate that the global average investment on health promotion and public health interventions worldwide in 2012 was 4.3% of

### Box 1. Best-buy interventions for the prevention and control of noncommunicable diseases: summary of achievements and gaps in seven Asian countries in July 2018

#### Bhutan

Although smoking is illegal in Bhutan, the current prevalence of tobacco use among young people and adults is estimated to be 30.2% and 7.4%, respectively in 2016. The country has good performance in ensuring smoke-free public spaces (compliance score 10/10) and total bans on tobacco advertising, promotion and sponsorship. Although excise taxes and restrictions on the availability and advertising of alcohol are in place, the legal minimum age for sales of alcohol beverage (18 years old) is the lowest among the seven countries. Bhutan is developing strategies on reduction of daily salt consumption and promotion of physical activity. While clinical guidelines for the management of four major noncommunicable diseases are produced, only four out of 12 essential medicines for management of these diseases are available in more than 50% of primary care facilities.

#### Cambodia

Tobacco control policies need considerable improvement. The tobacco tax rate is the lowest among the seven countries, 25.2% of the retail price. No price changes between 2008 and 2016 means that cigarettes are affordable by the WHO definition.<sup>18</sup> There is room to strengthen compliance on smoke-free public spaces, increase the health warning areas on cigarette packages (55%) and introduce a ban on indirect marketing promotions. Cambodia needs to introduce a legal minimum age for sale of alcoholic beverages and to restrict alcohol availability, limit daily salt consumption and promote physical activity. The country needs to scale-up the availability of essential medicines in primary care facilities.

#### Indonesia

A very high prevalence of tobacco use was reported in Indonesia; 12.7% of young people and 64.9% of men are current tobacco users. Though not a State Party to the WHO Framework Convention on Tobacco Control, the government needs to increase the low tobacco tax rate (57.4%) and make cigarettes less affordable to discourage new smokers, scale-up the current low level (score 1/10) of compliance on smoke-free public spaces, increase health warning areas on cigarette packages (currently 40% of front and back areas), and introduce a ban on advertising and market promotion. Alcohol consumption is religiously prohibited and legal measures to reduce alcohol consumption are well-implemented. The legal minimum age for purchase is 21 years and restrictions of the times and places of alcohol availability and advertising are in place. Indonesia has yet to introduce a salt reduction policy. Health systems are responding well as 11 out of 12 essential medicines for noncommunicable diseases are available in primary care facilities.

#### Philippines

Although cigarettes were less affordable in 2016 than in 2008, the Philippines needs to further increase the tax rate (62.6%), improve compliance on smoke-free environments, increase the size of health warnings (50% of cigarette package areas) and increase compliance on bans on advertising and promotion. The country also needs to review the current legal minimum age (18 years) for sales of alcoholic beverages, introduce policies to limit daily salt consumption and increase the availability of essential medicines for clinical management in primary health care.

#### Sri Lanka

Although the tobacco tax rate is 62.1%, the lack of regular tax increases means that cigarettes are still affordable. Sri Lanka needs to further strengthen compliance on smoke-free environments and bans on advertising and promotion. The country is on the right path towards implementing salt reduction strategies and promotion of physical activity. Due to the strong emphasis on primary health care in the country, the availability of essential medicines at the primary care level has been ensured.

#### Thailand

Tobacco control is well-implemented with a high tax rate in place (73.5%), health warnings on 85% of the back and front package areas (which ranks third globally<sup>1</sup>) and comprehensive regulations on advertising, market promotion and sponsorship. However, Thailand needs to improve compliance on smoke-free environments. Due to Thailand's policy of universal health coverage, nine essential medicines for noncommunicable diseases are available at primary care facilities.

#### Viet Nam

Lack of regular increase in tax has resulted in more affordable cigarettes in 2016 than in 2008. Viet Nam therefore needs to increase its tax rate (35.7%) improve compliance on smoke-free environments and increase health warnings from the current 50% of package areas. Increasing the current minimum legal age for sales of alcoholic beverage (18 years) may prevent youth drinking. The country needs to introduce policies to reduce daily salt intake (currently only dietary guidelines are available and there is no front-of-package labelling<sup>1</sup>), promote physical activity, and ensure more essential noncommunicable diseases medicines are available in primary care facilities.

Note: See [Table 2](#) for more details and data sources. Affordability of cigarettes is defined by the percentage of per capita gross domestic product required to purchase 2000 cigarettes of the most sold brand.<sup>18</sup>

current per capita health spending (US\$ 38.6 of US\$ 989.2). Despite the well-established monitoring and evaluation system of the WHO FCTC, data on expenditure for tobacco control is not routinely updated for many countries. For example, the latest expenditure data on tobacco control in the Cambodia, Indonesia and Philippines were outdated, from 2008, 2008 and 2007, respectively.

Taxation on tobacco and alcohol has not reached the global targets in these seven countries, mainly due to the lack of multisectoral action to enforce legislative decisions on taxing these harmful products and counteracting industry interference. These concerns were highlighted by the UN Interagency Task Force on noncommunicable diseases conducted in these countries.<sup>31</sup> Furthermore, primary prevention efforts in the seven countries are hampered by weak regulatory capacities, inadequate legal consequences for law violation and conflicts of interests among government officials. Regulatory gaps were illustrated by poor enforcement of smoke-free environments or of bans on tobacco

advertising and promotion. Besides Sri Lanka and Thailand, integration of noncommunicable disease interventions at the primary care level need to be strengthened in the remaining five countries, to ensure essential medicines for clinical management, prevention of complications and premature mortality. Funding gaps for noncommunicable diseases, as reported by health ministries, remain an important national agenda in these countries and the governments need to invest more on effective interventions such as the recommended best buys, intersectoral actions and health-system responses for noncommunicable diseases.

Another possible explanation for insufficient progress of noncommunicable diseases prevention policy is industry interference.<sup>32</sup> There is evidence from other countries that the tobacco,<sup>33–35</sup> alcohol,<sup>36</sup> food and beverage industries<sup>37</sup> use tactics to interfere with policies aimed at reducing consumption of their unhealthy products.

The South East Asia Tobacco Control Alliance has pioneered the Tobacco

Industry Interference Index to monitor tobacco industry actions.<sup>38</sup> Viet Nam and Indonesia have demonstrated high levels of industry interference,<sup>39</sup> with marginal improvement between 2015 and 2016, which may be linked to the lack of progress on tobacco control in both countries. The tobacco industry has been more effective in promoting their products than governments have been in implementing effective interventions, as reflected by the slow progress in tobacco control efforts in the countries we analysed. In Indonesia, a non-State Party to the WHO FCTC, the level of tobacco industry interference is the highest, although the health ministry is drafting guidelines for interaction with the tobacco industry.<sup>40</sup> Article 5.3 of the WHO FCTC guides State Parties to protect their tobacco control policies from the vested interests of the tobacco industry.<sup>41</sup> Global experience shows how the tobacco industry's corporate social responsibility activities are a platform for government officials to participate directly in the industry's activities. All countries in this study have yet

Table 3. Institutional capacity for the prevention and control of noncommunicable diseases in seven Asian countries in July 2018

Indicator	Bhutan	Cambodia	Indonesia	Philippines	Sri Lanka	Thailand	Viet Nam
No. of full-time equivalent technical professional staff in noncommunicable diseases unit under health ministry <sup>a</sup>	4	7	16	19	41	39	7
No. of full-time equivalent staff in health ministry for tobacco control <sup>25</sup>	14	6	12	3	10	41	20
National funding for noncommunicable diseases prevention, promotion, screening, treatment, surveillance, monitoring and evaluation, palliative care and research <sup>a</sup>	Yes	Yes, except research budget	Yes	Yes	Yes	Yes	Yes
Sources of funding for noncommunicable diseases and their risk factors <sup>a</sup>	Government budget and donors	Government budget, donors and social protection schemes	Government budget and health insurance	Government budget and health insurance	Government budget and donors	Government budget, health insurance and Thai Health Promotion Foundation	Government budget, health insurance, donors and earmarked tobacco tax
Government expenditure on tobacco control (year), US\$ <sup>25</sup>	23 000 (2014)	22 200 (2008)	882 414 (2008)	21 739 (2007)	462 235 (2016)	892 359 (2015)	12 000 000 (2016)

US\$: United States dollar.

<sup>a</sup> Personal communication with health ministries.

to establish procedures for disclosing interactions between governments and the industry.

Industry interference with government policies is further highlighted by Thailand's experience in introducing an excise tax on beverages containing sugar in 2017,<sup>42</sup> where the government faced resistance by the Thai Beverage Industry Association that challenged the links between obesity and drinking soda.<sup>43</sup>

To address the commercial determinants of noncommunicable diseases and policy interference by industries, countries require improved governance, political leadership and a whole-of-government approach to making legislative decisions on taxation and strengthening regulatory capacities.

### Monitoring and evaluation gaps

The existing systems for surveillance of health risks, including the prevalence of smoking, alcohol per capita consumption, daily salt intake and levels of physical inactivity, need strengthening, standardization and integration for comprehensive noncommunicable diseases policies to be formulated. Integrated household surveys such as the *STEPwise approach to surveillance*<sup>44</sup> or equivalent should cover all noncommunicable diseases risks in one survey.

The lack of global standardized detail reporting on alcohol control hampers countries from monitoring and advancing the alcohol control agenda; for example, monitoring tax

rates against the preferred level of tax rate, similar to the FCTC MPOWER report.<sup>18</sup> Estimations of daily salt intake requires laboratory testing to quantify 24-hour urinary sodium excretion,<sup>45</sup> and only a few countries worldwide conduct such surveys.<sup>46,47</sup> The burdensome 24-hour collection of urine can be replaced by urine spot testing,<sup>48</sup> which is more practical and less costly. Salt intake using spot urine samples can provide countries with a good indication of mean population salt intake.<sup>49</sup> The level of daily salt intake is a powerful message for policy advocacy in educating the public and benchmarking with international peers. Monitoring measures for unhealthy diet reduction need to be more comprehensive. Such monitoring needs to cover people's consumption of trans-fat and sugar-sweetened beverages; policy interventions such as introduction of sugar-sweetened beverages taxes and bans on trans-fat in food; and the food industries' responses and adherence to policy.

Learning from the FCTC global tobacco epidemic report,<sup>18</sup> the WHO and international partners should develop a standardized, comprehensive monitoring tool on alcohol, salt, unhealthy food, physical activity and primary healthcare readiness to provide noncommunicable diseases services. The indicators in the country capacity survey<sup>24</sup> are inadequate to drive health-systems responses to noncommunicable diseases.

### Conclusion

Our survey identified more challenges than achievements in these seven Asian countries, although some progress has been made since implementing their national action plans on noncommunicable diseases control. Key underlying barriers for insufficient progress of noncommunicable disease policy are the lack of institutional capacities of noncommunicable disease units in managing action across different sectors; inadequate investment on primary prevention; and inadequate health-systems responses on clinical management. The multifactorial nature of noncommunicable disease requires coordinated health action across sectors within and outside the health system, including tax policies, health policies, food policies, transport and urban design. To overcome implementation gaps, governments need to improve the coordination of noncommunicable diseases units with other sectors, invest more in effective interventions such as the WHO recommended best buys, and improve monitoring and evaluation capacities. ■

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## 摘要

**不丹、菲律宾、柬埔寨、斯里兰卡、泰国、印度尼西亚、越南的非传染性疾病国家行动计划的实施**  
截至 2016 年，世界卫生组织 (WHO) 成员国均已根据《预防和控制非传染性疾病全球行动计划 (2013-2020)》开展并实施了非传染性疾病国家行动计划。2018 年，我们评估了亚洲七国预防和控制非传染性疾病的“最合算措施”以及其它推荐干预措施的实施情况。这七个分别是：不丹、菲律宾、柬埔寨、斯里兰卡、泰国、印度尼西亚、和越南。我们从一系列已发表的报告和卫生部门直接收集数据。调查涵盖了减少烟草使用、减少有害使用酒精、减少身体不足活动、减少高盐摄入等干预措施，同时还有卫生系统反应，我们由此确定实施的差距，并提出解决方案。2018 年，各国在此方面的进展并不均衡。干预措施的实施存在差

距的主要原因包括资金不足；机构能力有限（尽管指派了非传染性疾病部门）；卫生系统内外不同部门的行动不足；以及缺乏制定政策的标准化监测和评估机制。为了解决实施差距，政府应更多地采取有效的干预措施，例如世界卫生组织预防和控制非传染性疾病的“最合算措施”以及其它推荐干预措施，从而改善不同部门的行动力，提高监测、评估和研究的能力。根据《烟草控制框架公约》，世卫组织及其国际合作伙伴应制定关于酒精、盐和不健康饮食、身体活动不足和卫生系统反应的标准化综合监测工具。

**Résumé****Mise en œuvre de plans d'action nationaux sur les maladies non transmissibles au Bhoutan, au Cambodge, en Indonésie, aux Philippines, au Sri Lanka, en Thaïlande et au Viet Nam**

En 2016, les États membres de l'Organisation mondiale de la Santé (OMS) avaient élaboré et mis en œuvre des plans d'action nationaux sur les maladies non transmissibles conformément au Plan d'action mondial pour la lutte contre les maladies non transmissibles (2013–2020). En 2018, nous avons évalué l'état de l'application des interventions les plus avantageuses recommandées en matière de maladies non transmissibles dans sept pays asiatiques: le Bhoutan, le Cambodge, l'Indonésie, les Philippines, le Sri Lanka, la Thaïlande et le Viet Nam. Nous avons recueilli des données à partir de toute une série de rapports publiés et directement auprès des ministères de la Santé. Nous avons inclus les interventions qui concernaient la consommation de tabac et d'alcool, une activité physique inadéquate et une consommation de sel élevée, ainsi que les réponses des systèmes de santé, et nous avons identifié les lacunes et proposé des solutions. En 2018, les progrès étaient variables

selon les pays. Les lacunes étaient largement dues à un financement inadéquat; des capacités institutionnelles limitées (malgré des unités dédiées aux maladies non transmissibles); une action inadéquate dans les différents secteurs au sein et en dehors du système de santé; et l'absence de mécanismes de suivi et d'évaluation standardisés pour orienter les politiques. Afin de combler ces lacunes, les gouvernements doivent investir davantage dans des interventions efficaces telles que les interventions les plus avantageuses recommandées par l'OMS, améliorer l'action dans les différents secteurs, et renforcer les capacités en matière de suivi et d'évaluation, mais aussi de recherche. En s'inspirant de la Convention-cadre pour la lutte antitabac, l'OMS et ses partenaires internationaux devraient élaborer un outil de suivi complet et standardisé sur la consommation d'alcool, de sel et d'aliments malsains, l'activité physique et la réponse des systèmes de santé.

**ملخص**

**تنفيذ خطط عمل وطنية بشأن الأمراض غير المعدية، إندونيسيا والفلبين وبوتان وتايلندا وسري لانكا وفييت نام وكمبوديا** عدم كفاية التمويل؛ والقدرات المؤسسية المحدودة (على الرغم من الوحدات المخصصة للأمراض غير السارية)؛ وعدم كفاية العمل عبر القطاعات المختلفة داخل وخارج النظام الصحي؛ وعدم وجود آليات موحدة للرصد والتقييم لتوجيه السياسات. وللحاجة الفجوات على مستوى التنفيذ، تحتاج الحكومات إلى أن تستثمر أكثر في التدخلات الفعالة مثل أفضل التدخلات التي توصي بها منظمة الصحة العالمية، وتحسين العمل عبر مختلف القطاعات، وتعزيز القدرة على الرصد والتقييم في الأبحاث. بناء على الاستفادة المحققة من الاتفاقية الإطارية لمكافحة التبغ، فإنه يجب على كل من منظمة الصحة العالمية والشركاء الدوليين تطوير أداة رصد قياسية وشاملة لكل من الكحول والملح والاستهلاك الغذائي غير الصحي والنشاط البدني واستجابة النظم الصحية.

قامت الدول الأعضاء في منظمة الصحة العالمية (WHO) في عام 2016 بتطوير وتنفيذ خطط عمل وطنية بشأن الأمراض غير المعدية بما يتناسب مع خطة العمل العالمية للوقاية من الأمراض غير المعدية ومكافحتها (2013–2020). في عام 2018، قمنا بتقييم حالة تنفيذ أفضل التدخلات الموصى في الأمراض غير المعدية في سبعة بلدان آسيوية: إندونيسيا والفلبين وبوتان وتايلندا وسري لانكا وفييت نام وكمبوديا. قمنا بجمع بيانات من مجموعة من التقارير المنشورة، كما جمعنا البيانات مباشرة من وزارات الصحة. وقمنا بتضمين التدخلات التي تناولت استخدام التبغ والكحول، والنشاط البدني غير الكافي والاستهلاك المرتفع من الملح، وكذلك استجابات الأنظمة الصحية، وحددنا الفجوات والحلول المقترنة. وفي عام 2018، كان التقدم متفاوتاً بين البلدان. وكانت الفجوات في مستوى التنفيذ ترجع إلى حد كبير إلى

**Résumé****Осуществление национальных планов действий в отношении неинфекционных заболеваний в Бутане, Вьетнаме, Индонезии, Камбодже, Таиланде, на Филиппинах и в Шри-Ланке**

К 2016 году страны-члены Всемирной организации здравоохранения (ВОЗ) разработали и осуществили национальные планы действий в отношении неинфекционных заболеваний в соответствии с Мировым планом действий по предотвращению и контролю распространения неинфекционных заболеваний (2013–2020 гг.). В 2018 году была проведена оценка состояния рекомендуемых и наиболее популярных мер борьбы с неинфекциоными заболеваниями в семи странах Азии: в Бутане, Вьетнаме, Индонезии, Камбодже, Таиланде, на Филиппинах и в Шри-Ланке. Были собраны данные ряда опубликованных отчетов, а также получены сведения непосредственно из министерств здравоохранения. Авторы включили в обзор действия в отношении употребления табака и алкоголя, борьбы с недостаточной физической активностью и высоким потреблением соли, а также оценили реакцию систем здравоохранения, выявили недостатки системы действий и предложили способы их устранения. По состоянию на 2018 год страны демонстрировали неравномерный прогресс. Основные недостатки предпринятых

действий были связаны с недостаточным финансированием, ограниченными институциональными возможностями (несмотря на наличие специально созданных отделов по борьбе с неинфекциоными заболеваниями), недостаточностью действий в разных секторах внутри системы здравоохранения и вне ее, а также с нехваткой стандартизованных механизмов мониторинга и оценки для информирования лиц, принимающих стратегические решения. Для ликвидации отставания правительства должны больше инвестировать в эффективные меры борьбы, которые рекомендованы ВОЗ как наиболее популярные, улучшать взаимодействие секторов и расширять возможности исследований, мониторинга и оценки. Опираясь на опыт Рамочной конвенции по борьбе против табака, ВОЗ и ее международные партнеры должны разработать стандартизованный всеобъемлющий метод мониторинга потребления алкоголя, соли и вредных продуктов питания, а также оценки физической активности и реакции системы здравоохранения.

## Resumen

### Aplicación de planes de acción nacionales sobre las enfermedades no contagiosas, Bhután, Camboya, Filipinas, Indonesia, Sri Lanka, Tailandia y Vietnam

Para 2016, los Estados miembros de la Organización Mundial de la Salud (OMS) habían elaborado y aplicado planes de acción nacionales sobre las enfermedades no contagiosas de acuerdo con el Plan de acción mundial para la prevención y el control de las enfermedades no transmisibles (2013-2020). En 2018, se evaluó el estado de implementación de las intervenciones recomendadas en siete países asiáticos en materia de enfermedades no contagiosas: Bhután, Camboya, Filipinas, Indonesia, Sri Lanka, Tailandia y Vietnam. Se recopilaron datos de una serie de informes publicados y directamente de los ministerios de salud. Se incluyeron intervenciones que abordaron el uso del tabaco y el alcohol, la actividad física inadecuada y la ingesta elevada de sal, así como las respuestas de los sistemas de salud, se identificaron las deficiencias y se propusieron soluciones. En 2018, el progreso fue desigual entre los países. Las deficiencias en la aplicación se debieron en gran medida a la

falta de financiación, a la limitada capacidad institucional (a pesar de las dependencias designadas para las enfermedades no contagiosas), a la inadecuación de las medidas adoptadas en los diferentes sectores dentro y fuera del sistema de salud y a la falta de mecanismos normalizados de supervisión y evaluación que sirvieran de base a las políticas. Para subsanar las deficiencias en materia de aplicación, los gobiernos deben invertir más en intervenciones eficaces, como las recomendadas por la OMS, mejorar las medidas adoptadas en los distintos sectores y aumentar la capacidad de seguimiento y evaluación y de investigación. A partir de las enseñanzas del Convenio Marco para el Control del Tabaco, la OMS y los asociados internacionales deberían elaborar un instrumento de seguimiento normalizado y completo para el consumo de alcohol, sal y alimentos no saludables, la actividad física y la respuesta de los sistemas de salud.

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# Integrating noncommunicable disease services into primary health care, Botswana

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**Abstract** Despite the rising burden of noncommunicable diseases, access to quality decentralized noncommunicable disease services remain limited in many low- and middle-income countries. Here we describe the strategies we employed to drive the process from adaptation to national endorsement and implementation of the *2016 Botswana primary healthcare guidelines for adults*. The strategies included detailed multilevel assessment with broad stakeholder inputs and in-depth analysis of local data; leveraging academic partnerships; facilitating development of supporting policy instruments; and embedding noncommunicable disease guidelines within broader primary health-care guidelines in keeping with the health ministry strategic direction. At facility level, strategies included developing a multimethod training programme for health-care providers, leveraging on the experience of provision of human immunodeficiency virus care and engaging health-care implementers early in the process. Through the strategies employed, the country's first national primary health-care guidelines were endorsed in 2016 and a phased three-year implementation started in August 2017. In addition, provision of primary health-care delivery of noncommunicable disease services was included in the country's 11th national development plan (2017–2023). During the guideline development process, we learnt that strong interdisciplinary skills in communication, organization, coalition building and systems thinking, and technical grasp of best-practices in low- and middle-income countries were important. Furthermore, misaligned agendas of stakeholders, exaggerated by a siloed approach to guideline development, underestimation of the importance of having policy instruments in place and coordination of the processes initially being led outside the health ministry caused delays. Our experience is relevant to other countries interested in developing and implementing guidelines for evidence-based noncommunicable disease services.

Abstracts in **عربي**, **中文**, **Français**, **Русский** and **Español** at the end of each article.

## Introduction

Noncommunicable diseases cause 41 million deaths each year and accounts for an estimated 71% of all deaths globally.<sup>1</sup> Of the deaths caused by noncommunicable diseases, 32 million occurred in low- and middle-income countries.<sup>1</sup> In sub-Saharan Africa in 2015, 34% of all deaths (3.1 million/9.2 million) were due to noncommunicable diseases.<sup>2</sup> Due to increasing life expectancy, rapid demographic transition and additional risk introduced by human immunodeficiency virus (HIV), the World Health Organization (WHO) estimates that the African Region will experience steep rises in noncommunicable disease incidence and related mortality over the next decade.<sup>3</sup>

However, services to prevent and control noncommunicable diseases in the Region are largely inaccessible or lacking in quality, particularly for poor people and rural residents.<sup>4,5</sup> There is global consensus that using the primary health-care system, which provides a decentralized and integrated platform of care, is important in addressing noncommunicable diseases.<sup>6–9</sup> WHO's Package of Essential Noncommunicable Disease Interventions (WHO PEN) for primary health care in low-resource settings<sup>10</sup> provides evidence-based clinical guidelines

to improve access and quality of noncommunicable disease services delivered at primary health-care facilities while bolstering the universal health coverage agenda.<sup>2</sup> Some countries in sub-Saharan Africa have adapted the WHO package to the local context, however few have endorsed them and only two countries, Benin and Togo, have done a national implementation.<sup>2</sup> However, published experiences from the translation of evidence-based guidelines to routine practice in resource-constrained settings are scarce.<sup>11</sup> Thus, sharing experiences on implementation of evidence-based guidelines for the delivery of noncommunicable disease services at primary health-care level in such settings is important. Here we describe the strategies employed to drive the process from adaptation to national endorsement of such guidelines and the plan for effective implementation and sustainment of the *2016 Botswana primary healthcare guidelines for adults*.

## Local setting

The burden of noncommunicable diseases in Botswana, a middle-income country in southern Africa, reflects that of other countries in the Region. In 2014, an estimated 37%

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Table 1. Prevalence of noncommunicable disease risk factors among adults aged 15–69 years, Botswana, 2014

Risk factor	All (n = 4074)		Male (n = 1321)		Female (n = 2753)	
	No. <sup>a</sup>	Weighted % (95% CI)	No. <sup>a</sup>	Weighted % (95% CI)	No. <sup>a</sup>	Weighted % (95% CI)
% of people who currently smoke tobacco	4066	18.3 (15.9–20.7)	1316	31.4 (27.5–35.3)	2750	4.9 (3.5–6.2)
% of people with insufficient fruit or vegetable consumption <sup>b</sup>	3651	94.8 (93.4–96.1)	1161	95.8 (93.9–97.6)	2490	93.8 (92.2–95.4)
% of people with insufficient physical activity <sup>c</sup>	3671	20.1 (17.4–22.7)	1182	14.3 (11.3–17.3)	2489	25.9 (22.7–29.2)
% of people who are overweight or obese <sup>d</sup>	3906	30.6 (28.5–32.7)	1299	19.8 (17.0–22.6)	2607	42.3 (39.5–45.0)
% of people with hypertension <sup>e</sup>	4056	29.4 (27.3–31.6)	1314	30.4 (27.2–33.7)	2742	28.4 (25.9–30.8)
% of people with elevated fasting glucose level or currently on treatment for diabetes <sup>f</sup>	3481	4.5 (3.3–5.7)	1115	3.3 (2.2–4.9)	2366	4.8 (3.6–6.1)
% of people who are aged 40–69 years and have a 10-year CVD risk of ≥ 30% or an existing CVD <sup>g</sup>	3468	9.7 (6.9–12.6)	1113	9.3 (5.2–13.5)	2355	10.1 (6.7–13.4)

CI: confidence interval; CVD: cardiovascular disease.

<sup>a</sup> Denominator of proportion is reported.

<sup>b</sup> More than five servings of fruit and/or vegetables on average per day.

<sup>c</sup> Less than 150 minutes of moderate-intensity activity per week.

<sup>d</sup> Definitions of overweight and obesity are a body mass index of ≥ 25.0 kg/m<sup>2</sup> and ≥ 30.0 kg/m<sup>2</sup>, respectively.

<sup>e</sup> People with systolic blood pressure ≥ 140 and/or diastolic blood pressure ≥ 90 mmHg or currently on hypertensive medication.

<sup>f</sup> Elevated glucose level is defined as a concentration of ≥ 7.0 mmol/L in venous blood.

<sup>g</sup> A 10-year CVD risk of ≥ 30% is defined according to age, sex, blood pressure, smoking status (smoker defined as current smokers or those who quit smoking less than 1 year before the assessment), total cholesterol and diabetes previously diagnosed or a fasting plasma glucose concentration > 7.0 mmol/L.<sup>13</sup>

Data source: Botswana STEPS survey report on non-communicable disease risk factors.<sup>14</sup>

(5920/16000) of deaths in the country were due to noncommunicable diseases.<sup>12</sup> In the same year, a population-based noncommunicable disease risk factors survey conducted among 4074 adults aged 15–69 years showed that an average of 29% (95% confidence interval, CI: 27–32) of participants had hypertension and 18% (95% CI: 16–21) were smoking (Table 1).<sup>15</sup>

Of the 2 million people living in Botswana, about 95% reside within 8 km of a health facility and basic health services are available for free to all citizens.<sup>16</sup> The lowest level facilities, the primary clinics and health posts, are each staffed by one or more general nurses, who have at least a two-year nursing diploma following secondary schooling. Botswana's health-care system shares characteristics with other countries in the Region, including a primary care-based health system structure, shortages in health-care workforce, weak supply chain management and underdeveloped health information systems.<sup>17,18</sup>

Before 2016, there were no national clinical guidelines for noncommunicable diseases. Adults presenting to primary clinics with a major noncommunicable disease, such as diabetes, hypertension, cardiovascular disease, chronic respiratory disease and cancer, were managed and referred inconsistently, depending on an individual providers' training or whether the pro-

vider used international professional guidelines. In 2013, the health ministry, in collaboration with the University of Botswana, initiated the adaptation of the WHO package for Botswana context,<sup>19</sup> leading to the endorsement of the country's first national primary health-care guidelines for adults in November 2016. These guidelines contain standardized algorithms for screening, risk stratification and management of diabetes, hypertension, asthma and screening for, as well as algorithms for broader management of common clinical complaints and preventive care in adults. In addition to evidence-based treatment decision support for health-care providers, the guidelines also emphasize promotion of patient self-management through individual counselling by a nurse and a dietitian, as well as group education, defaulter tracing and strengthening coordination of care.

## Approach

To guide implementation of the guidelines, we selected the conceptual model of evidence-based practice implementation in public service sectors.<sup>20</sup> We chose this multilevel model, among various dissemination-implementation options,<sup>21</sup> because of this model's operational specificity, emphasis on implementation rather than dissemination alone, and relevance to public sector

context. The model considers outer, e.g. legislation, policy, funding, and interorganizational networks, and inner, e.g. leadership, organizational culture, readiness for change and individual adopter attitude, including contextual factors that influence the implementation processes. Below we describe, and Fig. 1 outlines, the strategies and processes we undertook during the implementation, using the models' four phases: exploration, preparation, implementation and sustainment.

### Exploration

To understand the limitations in provision of noncommunicable disease services in the public health-care system, the health ministry's national noncommunicable disease programme, conducted a multilevel situation analysis. The analysis consisted of a policy and literature review, assessment of available national statistical data, key informant interviews as well as stakeholder inputs from consultative forums. The stakeholders were part of a technical working group that met periodically, and included managers of related national programmes, specialist and general clinicians, academics, hospital administrators and representatives from civil society and development partner organizations.

Before 2016, a national policy or strategy on noncommunicable diseases

was lacking. The only national policy instruments related to noncommunicable diseases were the Alcohol Policy, Tobacco Policy, Nutrition Strategy, Essential Health Services Package, and Botswana Public Health Act, and these did not comprehensively address non-communicable diseases. Published local studies on noncommunicable diseases management at primary health-care level were few, and all were descriptive.<sup>22–24</sup> Nonetheless, they indicated gaps in diagnosis, quality of care and control of disease. These findings have been corroborated in analyses conducted following guidelines endorsement (Tapela NM et al., Botswana Health Ministry, unpublished data, 2018; Mosepele M et al., University of Botswana, unpublished data, 2018). For example, analysis of data from the 2014 Botswana STEPS survey on noncommunicable disease risk factors<sup>14</sup> revealed that 637 of the 1725 participants (weighted percentage: 43%)

with elevated blood pressure had not been previously diagnosed with hypertension. Of the 1088 participants with hypertension, 585 (weighted percentage: 53%) had uncontrolled blood pressure (Tapela NM et al., Botswana Health Ministry, unpublished data, 2018). These results are similar to those found in other surveys in the Region,<sup>25</sup> and indicated that improvement of services for detecting people with hypertension and controlling hypertension was needed. For other chronic noncommunicable diseases such as diabetes and asthma, we hypothesized that the percentages of people with diagnosed disease and the disease under control were also low.

To assess capacity of facilities to deliver essential noncommunicable disease services, we used a self-reported survey derived from WHO Service Availability and Readiness Assessment tool.<sup>26</sup> We distributed the survey to all 639 primary health-care clinics and 32

district hospitals. Preliminary analysis of the first 142 surveys returned (representing 136 clinics and six hospitals, spanning 10 districts across the country) revealed that essential medicines, basic equipment and relevant laboratory tests were generally available. Furthermore, opportunities for continuing medical education and professional development across professional levels for noncommunicable diseases were lacking. Only six (7%) of the 84 doctors and 27 (2%) of the 1377 nurses surveyed had received any in-service training for noncommunicable diseases management during the previous two years (Government of Botswana, Ministry of Health and Wellness, personal communication, August 2018).

In addition, we visited six primary clinics and two district hospital clinics in two districts to interview key informants and to directly observe consultations for four noncommunicable dis-

**Fig. 1. Strategies employed in facilitating endorsement and initial implementation of Botswana's national primary care guidelines, 2014–2017**

	Exploration	Preparation	Implementation	Sustainment
Sociopolitical context and funding	<ul style="list-style-type: none"> <li>Review relevant policies and legislation</li> <li>Review current spending on health</li> </ul>	<ul style="list-style-type: none"> <li>Facilitate development of supportive policy instruments</li> </ul>	<ul style="list-style-type: none"> <li>Distribute primary health-care guidelines and supportive policy documents</li> <li>Establish partnerships to support initial training</li> </ul>	<ul style="list-style-type: none"> <li>Cascade related national development plan objectives to district level</li> <li>Fully cost and allocate funding for primary health-care guidelines</li> </ul>
Client and interorganizational networks	<ul style="list-style-type: none"> <li>Hold broad stakeholder consultations</li> </ul>	<ul style="list-style-type: none"> <li>Establish an intersectoral technical working group</li> </ul>	<ul style="list-style-type: none"> <li>Hold annual technical working group briefings</li> <li>Public awareness campaign on available primary health-care services for noncommunicable diseases</li> </ul>	<ul style="list-style-type: none"> <li>Hold annual technical working group briefings</li> <li>Continue public awareness</li> </ul>
Organizational characteristics	<ul style="list-style-type: none"> <li>Conduct analysis of local data</li> <li>Consult related health ministry programme</li> <li>Assess facility readiness and current clinical practice</li> </ul>	<ul style="list-style-type: none"> <li>Review evidence; identify and adapt guidelines that are structural/ideological fit</li> </ul>	<ul style="list-style-type: none"> <li>Delivery standardized multimethod in-service training and coaching</li> </ul>	<ul style="list-style-type: none"> <li>Continue trainings and coaching; issue professional development points</li> </ul>
Leadership	<ul style="list-style-type: none"> <li>Understand health ministry strategic direction under current leadership</li> </ul>	<ul style="list-style-type: none"> <li>Present primary health-care guidelines at health ministry leadership meetings</li> <li>Nationally endorse guidelines</li> </ul>	<ul style="list-style-type: none"> <li>Embed measures in ministerial key performance indicators</li> </ul>	<ul style="list-style-type: none"> <li>Embed measures in ministerial key performance indicators</li> </ul>
Individual adopter characteristics	<ul style="list-style-type: none"> <li>Identify national programme to lead effort</li> </ul>	<ul style="list-style-type: none"> <li>Scout for local master trainers</li> </ul>	<ul style="list-style-type: none"> <li>At district level, designate and train multidisciplinary master trainer teams</li> </ul>	<ul style="list-style-type: none"> <li>Continue engagement and recognition of local champions</li> </ul>
Fidelity monitoring and support	<ul style="list-style-type: none"> <li>No action taken</li> </ul>	<ul style="list-style-type: none"> <li>Develop an implementation plan, including service package and roles of providers and training materials for providers</li> <li>Develop training material</li> </ul>	<ul style="list-style-type: none"> <li>Monitor indicators<sup>a</sup> and provide feedback to facilities on performance data</li> </ul>	<ul style="list-style-type: none"> <li>Explore the collection of clinical outcome data using an electronic health information system</li> </ul>

<sup>a</sup> Indicators are based on RE-AIM framework, which assesses five domains: reach; efficacy; adoption; implementation and maintenance<sup>28</sup>. Note: We used the conceptual model for evidence-based practice in public service sectors<sup>20</sup> to guide the implementation process.

eases: cardiovascular diseases; diabetes; chronic respiratory disease and cancers (Tshisimogo G et al., Botswana Health Ministry, unpublished data, 2018). A general physician knowledgeable in primary health-care guidelines observed the consultations and employed a purposive sampling of about 20 consecutive consultations at each facility. **Table 2** illustrates findings from observations made for 82 follow-up visits for individuals with hypertension, carried out by 11 health-care providers. Of these consultations, 59 (72%) involved appropriate step up of antihypertensives, that is, initiating new drug or increasing dose for patient reported medication adherence, but still had a blood pressure over 160/100 mmHg. Only 27 (33%) patients received any advice related to healthy diet, physical activity or weight control, and no patients had ever had their body mass index or waist circumference measured at the given facility. These assessments indicated that health-care facilities were generally equipped to provide quality clinical services, but primary health-care providers would need training to effectively implement the guidelines and deliver quality care.

## Preparation

To identify options for evidence-based care delivery models in rural or resource-limited settings, we did a web-based literature review by primarily searching PubMed and HINARI, using the search terms “quality improvement” or “guideline implementation”; and “primary care” or “chronic diseases” or “noncommunicable diseases” “health-care services” or “care”; and “rural” or “resource-limited” or “sub-Saharan Africa”. To select the model that best fitted the context of Botswana’s health system, we considered the alignment with existing national policies and guidelines. We also considered the ongoing transition of the health ministry, which started in 2015, which is a strategic paradigm shift from curative-focused approaches and disease-specific programmes to an emphasis on prevention, early diagnosis and integrated treatment. To gain insights on current practice and potential structural constraints, we held a series of meetings with clinical experts, the Health Ministry Permanent Secretary, managers for HIV, tuberculosis, primary health care and maternal health programmes and clinical services department, and se-

**Table 2. Observed quality of follow up care for hypertensive patients, Botswana, 2015**

Service component	No. of patients (%) <i>n</i> =82
<b>Patient characteristic</b>	
With comorbid diabetes	16 (20)
With other noncommunicable disease comorbidities	9 (11)
<b>Assessment</b>	
Asked about symptoms	78 (95)
Asked about hospitalization interval	1 (1)
Measured blood pressure	82 (100)
Used correct blood pressure measurement technique	66 (80)
Measured weight	24 (29)
Measured height	0 (0)
Measured waist circumference	0 (0)
Performed foot exam	11 (13)
<b>Treatment and monitoring</b>	
Asked about medication adherence	47 (57)
Appropriately increased antihypertensive medication	59 (72)
Ordered appropriate laboratory tests	22 (27)
Scheduled appropriate follow-up	65 (79)
<b>Education and advise</b>	
Provided education on disease danger signs	4 (5)
Advised about physical activity	14 (17)
Advised about healthy diet	36 (44)
Advised about alcohol consumption	4 (5)
Advised about tobacco use	2 (2)
Provided any advice on lifestyle modification	27 (33)

lected clinicians and management staff in district health teams. Based on the findings from the literature review, the key informants deemed the integrated models, such as Wagner’s Chronic Care Model (CCM),<sup>27</sup> most favourable for the health-care system context. Therefore, the national noncommunicable diseases programme believed that the available WHO package,<sup>10</sup> underpinned by this Chronic care model, to be the most fitting.

Details of the process of adapting the WHO package to the Botswana context have been previously described.<sup>19</sup> Briefly, algorithms for screening, risk stratification and/or management of diabetes, hypertension, asthma, breast and cervical cancer were embedded within algorithms for broader management of common clinical complaints in adults (**Table 3**). The national formulary, which comprises a list of essential medicines covered by the government budget and free to patients, was revised to include relevant medicines from the WHO essential medicine list.

The endorsement, effective implementation and impact of the guidelines would depend on a supportive policy

environment. Therefore, starting in mid-2015 and concluding in late 2017, development of a multisectoral strategy for the prevention and control of noncommunicable diseases 2017–2022 was accelerated to provide a national roadmap for noncommunicable disease interventions both within and outside the health sector. During the same period, planning for Botswana’s 11th national development plan, for the period 2017–2023, was underway. The health ministry, an actor in this national planning process, identified this timing as opportune. The consultative platforms were leveraged by the health ministry to sensitize stakeholders across sectors, and foster intersectoral action and long-term resource allocation to reduce mortality and morbidity of noncommunicable diseases.

Once we anticipated endorsement of the guidelines, we developed a guidelines implementation plan and training programme for health-care providers with support of a public-private partnership (**Box 1**). Training materials that were developed were non-proprietary, facilitated by private sector funding and use of readily avail-

Table 3. **Outline of the essential noncommunicable disease package included in the 2016 Botswana's primary health-care guidelines for adults**

Service components <sup>a</sup>	Service task examples	Provider of service
<b>Patient</b>		
Education and self-management support	Advise individuals or groups on lifestyle modification, smoking cessation, by employing the five A's: ask; advise; assess; assist; and arrange	Nurse at primary clinic or dietitian <sup>b</sup>
Screening and risk stratification for people older than 40 years	Ask about lifestyle risk factors, including tobacco; harmful alcohol use; diet and physical activity; family history; past medical history; and symptoms related to diabetes, hypertension, heart disease and chronic respiratory disease	Nurse at primary clinic
	Assess age, sex, HIV status, BMI or waist circumference, blood pressure, fasting or random glucose level and total cholesterol level for patients with more than two other risk factors	Nurse at primary clinic
Screening women for cervical and breast cancer	Do pap smear or VIA for females aged 30–49 years and physical breast exam for females aged 40–69 years	Nurse or midwife at primary clinic, VIA performed at district hospital by nurse or midwife
Triage and emergent referral	Assess the criteria for emergent status, such as systolic blood pressure above 200, unstable angina, acute stroke or diabetic ketoacidosis	Nurse at primary clinic, in consultation with nurse <sup>b</sup> or doctor <sup>b</sup>
Risk-based treatment	For patients with hypertension: initiate antihypertensive if blood pressure is persistently above 140/90; For confirmed diabetes: prescribe metformin and an ACE-inhibitor Assess 10-year CVD risk <sup>c</sup> For patients with a CVD risk of 10–20%, suggest lifestyle modifications For patients with a CVD risk of 20–30%, suggest lifestyle modifications and prescribe statins For patients with a CVD risk above 30%, suggest lifestyle modifications and prescribe statins and aspirin Refer patients who have uncontrolled disease despite primary clinic management (e.g. blood pressure > 140/90 despite three antihypertensive medications) to district hospital	Nurse at primary clinic, with initial review by rotating doctor <sup>d</sup> Nurse at primary clinic Nurse at primary clinic Nurse at primary clinic, with initial review by rotating doctor <sup>d</sup> Nurse at primary clinic, with initial review by rotating doctor <sup>d</sup> Nurse at primary clinic
<b>Organizational</b>		
Delivery system design	Trace missed visits and conduct home visits Provide care coordination support for patients requiring care across facility levels	Nurse at primary clinic, supported by community nurse or social worker <sup>b</sup> Community nurse <sup>b</sup>
<b>Professional</b>		
Decision support	Train and coach nurses at primary clinics	Master trainer team

ACE: angiotensin-converting-enzyme; BMI: body mass index; CVD: cardiovascular disease; HIV: human immunodeficiency virus; VIA: visual inspection with acetic acid.

<sup>a</sup> Service components supported by systematic monitoring and evaluation of care, provider training and mentorship, availability of essential medicines and diagnostics.

<sup>b</sup> Members of the multidisciplinary master trainer team.

<sup>c</sup> CVD risk is assessed according to age, sex, blood pressure, smoking status (smoker defined as current smokers or those who quit smoking less than 1 year before the assessment), total cholesterol level and diabetes.

<sup>d</sup> General practitioner seeing patients at district hospital or conducting outreach visits to primary clinics.

able software. We used the RE-AIM framework<sup>28</sup> and additionally WHO HEARTS technical tool<sup>29</sup> and Partners In Health Guide to Chronic care integration of endemic noncommunicable diseases,<sup>30</sup> to define a standardized set of performance indicators (Table 4). The national noncommunicable disease programme revised paper-based and basic electronic reporting to include these indicators. Facility staff members reported on these indicators

monthly to the district health management teams and national noncommunicable disease programme, using routine district health management reporting practice. On a quarterly basis, the national noncommunicable disease programme compiled and provided feedback of reports data to facilities. A subset of these indicators has been included in key performance targets for the health ministry and in the 11th national development plan.

## Implementation

The health ministry planned that the implementation should be done in three phases, by scaling up noncommunicable disease services in 8–10 districts during each phase. The first phase began in August 2017 and involved eight districts where an international nongovernmental organization had established multidisciplinary diabetes clinics at district hospitals in 2012.

Within each district, the health leadership assigned health-care providers to a district-based multidisciplinary team of master trainers. To obtain the ideal mix of skills in the team, the leadership consulted with district-based health-care providers and the noncommunicable disease programme. Each team consisted of one doctor, one clinical nurse, one dietitian and one community nurse or social worker. The team participated in an intensive five-day multimethod training programme (Box 1). Thus far, 32 master trainers covering eight districts have been trained and are currently providing training and case-management coaching for providers at primary health-care facilities throughout their given district. Implementation at an additional nine districts began in May 2018 and implementation in the remaining 10 districts is planned to start in 2019. The aim is achieving national roll-out by August 2020.

### Sustainment

To foster a sustained system change, much was done and planned in advance. For example, inclusion of guidelines indicators both in the ministerial key performance targets and in the national development plan will support high-level policy prioritization and collective programme accountability. To ensure long-term support and institutionalization of guideline-compliant care, we engaged health-care providers and district health managers early on as part of the preparation process. Additionally, training local master trainers in parallel with development of non-proprietary training material will enable future trainings that do not rely upon external resources. To incentivizing participation by nurses, the guidelines training is accredited for nursing clinical professional development points.

### Lessons learnt

By using and strengthening the country's primary health-care platform, we have accomplished a positive step towards decentralizing quality health-care services for noncommunicable diseases. Botswana is well placed to demonstrate quality and sustained services because of these guidelines and the political support of the national development plan objectives and accessibility of health-care services.

#### Box 1. Curriculum development for multimethod training on primary care-based management of noncommunicable diseases, Botswana

A multidisciplinary team of clinical experts, many of whom had been involved in the primary health-care guidelines adaptation process, developed the curriculum. Funding and technical support of the curriculum development and training material design, the health ministry established a public–private partnership. The curriculum consists of three modules: (i) risk assessment, diagnosis and treatment; (ii) health education and counselling; and (iii) principles of systems and quality improvement generalizable to chronic conditions, such as longitudinal documentation, missed visit tracing and responding to medicine stock outs.

The curriculum for master trainers included a fourth module on how to be a trainer, encompassing principles in adult learning, mentorship and team-based work. Trainings were intended for maximum 30 participants, with trainer:trainee ratio of 1:10 at most. Training employed several pedagogical methods, including participatory didactic sessions, focus group discussions, practical skills training (such as diabetic foot exam) and role-plays for communication and counselling.

Training of master trainers was five days long and included one clinical nurse (in the first phase of implementation, the nurse was from a comprehensive diabetes clinic), one community nurse or social worker, one medical officer and one dietitian from each district. Subsequently, these master trainer teams would lead three-day general trainings in their respective districts (for a minimum of two primary care providers per facility trained in each district) and offer long-term phone-based and site-visit mentorship to health providers at primary clinics.

To evaluate the training, a team from the health ministry's national noncommunicable disease programme performed surveys before and after training, assessing the participants' knowledge, skills and confidence in managing conditions. In addition, observation of trainee performance in role plays gave the trainees immediate feedback and if needed, the trainers provided additional practice.

Many of the strategies we employed took into consideration contextual factors (Table 5). For example, emphasizing the potential threat of noncommunicable diseases reversing health gains made by combatting the HIV epidemic facilitated prioritization of noncommunicable diseases during the exploration phase. The health ministry addressed limited expertise in analysing local data and identifying research evidence, a reality in many health ministries in low- and middle-income countries,<sup>31</sup> by collaborating with academia. This collaboration enabled in-depth analysis of local data and synthesis of published literature. Instead of a more rigorous and resource-intensive assessment of service provision, we distributed self-reported surveys to facilities and visited purposefully selected facilities. These surveys were administered by University of Botswana research fellows affiliated with the national noncommunicable disease programme. Analysis of local data clarified local gaps as well as helped engaging policy decision-makers, who were sceptical that international averaged figures reflected local context. More analyses of these data, including further disaggregation by social determinants of health, should be emphasized to better inform policy and practice.

The preparation phase, leading up to endorsement of the guidelines, was a lengthy, iterative process and subject to

many delays. In retrospect, delays were due to a combination of inner and outer contextual factors, including misaligned agendas of stakeholders exaggerated by conventional siloed and disease-specific approach to guidelines, underestimation of the importance of having policy instruments in place and coordination of the processes initially being led outside the health ministry. Development of Botswana's noncommunicable disease strategy was an enabling and necessary policy step towards guidelines endorsement. The two-year process of developing the noncommunicable disease strategy provided intersectoral stakeholder engagement that was instrumental for the prominent inclusion of mortality reduction of noncommunicable diseases in the national development plan. The process also helped to bring together individuals across the health ministry's programmes and sectors, who were relevant to adaptation of the guidelines.

During the preparation phase, the national noncommunicable disease programme needed to coordinate diverse stakeholders, consider efficacy of guidelines and other factors in decision-making, such as strategic alignment, equity and the health ministry capacity of additional health services. The programme also needed to handle multiple nonlinear processes, such as development of policy instruments. The health ministry has had an inadequate capacity

Table 4. Key noncommunicable disease performance indicators for Botswana's national primary health-care guidelines implementation

District-level indicator by implementation outcome <sup>a</sup>	Target
<b>Adoption</b>	
% of facilities with ≥ 2 providers trained	> 90%
<b>Maintenance</b>	
% of facilities with ≥ 2 consecutive monthly reports submitted to district monitoring and evaluation team	> 90%
<b>Reach</b>	
% increase in individuals enrolled in care, compared with baseline <sup>b</sup>	> 10%
Coverage of blood pressure screening among residents older than 40 years	> 10%
Coverage of cervical cancer screening among female residents aged 30–49 years	> 10%
Coverage of screening for breast cancer by physical exam, among female residents aged 40–69 years	> 10%
<b>Implementation</b>	
% of new visits by patients aged 40 years or older where CVD risk is assessed and documented <sup>c</sup>	> 90%
% of new visits where patients with 10-year CVD risk above 30% is started on statin	> 90%
% all visits where patients with blood pressure above 160/100 antihypertensives are increased	> 90%
<b>Efficacy of service provision</b>	
% people with hypertension with most recent blood pressure < 140/90 mmHg (among enrolled patients with a visit during the previous month)	> 60% <sup>d</sup>
Mean change in systolic blood pressure over the past 12 months for people with hypertension	-5mmHg <sup>d</sup>
% of people with diabetes with most recent glucose or HbA1c level < 8 mmol/L and above 6.5 mmol/L (among enrolled diabetics with a visit during the previous month)	> 60% <sup>d</sup>
% patients enrolled in care <sup>b</sup> with at least one visit in addition to intake visit (retention)	> 90%

BMI: body mass index; CVD: cardiovascular disease; HbA1c: glycated haemoglobin.

<sup>a</sup> Indicators are based on RE-AIM framework, which assesses five domains: reach; efficacy; adoption; implementation and maintenance;<sup>28</sup> WHO HEARTS technical tool<sup>29</sup> and Partners In Health Guide to Chronic care integration of endemic noncommunicable diseases.<sup>30</sup>

<sup>b</sup> Patients enrolled in care at baseline are individuals who had at least one visit during the 12 months period before guidelines implementation, were not known to have died or relocated and who meet any of the following criteria: known hypertension or diabetes, older than 40 years, or a 10-year CVD risk above 10%. New patients are those with same clinical criteria as above, enrolled in care during the 12 months following guidelines implementation within the given district

<sup>c</sup> CVD risk assessment deemed completed if the provider had checked and documented: age, sex, blood pressure, blood glucose level, BMI or waist circumference, tobacco use and human immunodeficiency virus status.

<sup>d</sup> The target consists of two categories: (i) new diagnosis, patients diagnosed within the past 12 months; and (ii) knowing diagnosis, patients diagnosed over 12 months before end of reporting period.

Notes: Targets to be achieved within 12 months of guidelines implementation start. Facilities submit reports monthly including patient-level data, data are then aggregated across districts and nationally reviewed on quarterly and annual basis. Data will be augmented by periodic purposive audits.

for health-care stewardship in general,<sup>32</sup> and this shortcoming was also seen in the guidelines development process. We found that strong interdisciplinary skills in communication, organization, coalition building and systems thinking, as well as a technical grasp of best-practices in low- and middle-income countries, were particularly important. In Botswana, and in many low- and middle-income countries, these skills should be

emphasized and developed as a strategy for improving clinical service delivery.

With regards to implementation, strategies employed were informed by published literature on effective guideline implementation and quality improvement.<sup>11,33–35</sup> Limited clinical knowledge and confidence in non-communicable diseases management by health-care providers have been described in other low- and middle-

income countries.<sup>9</sup> We addressed these issues by developing a multimethod training coupled with a mentorship programme. Phased implementation leveraged the experience of existing district hospitals with multidisciplinary diabetes teams. These teams, while focused on a single disease and based at district hospitals, had experience managing patients with chronic conditions. They were therefore well placed to serve as mentors and receive patients with complex issues, such as multimorbidity or needing special care, referred from primary clinics. Train-the-trainers model mirrored that of Botswana's successful national HIV training programme.<sup>36</sup> The potential synergies of applying relevant HIV experience and resources to noncommunicable diseases decentralization have been described,<sup>37–39</sup> and incorporating this approach should be suitable in other African countries.

We had to assess and address health-care workforce limitations. While there were some concerns that primary health-care guidelines would introduce additional unbearable workload, facility readiness assessments revealed that most primary clinics generally completed patient consultations by 2 pm. To further facilitate the work of the providers, we also employed task-shifting. The introduction of master trainer positions, which included 50% routine clinical practice and 50% training and mentorship of primary-care clinicians and nurses, required additional sensitization of facility leadership, such as meetings and workload negotiations. These positions were modelled after the existing tuberculosis and HIV nurse coordinator position and provide an example that facilitated the master trainer positions' acceptability among health-care providers and administrators.

## Challenges

While political commitment exists, disbursement of funds has been delayed due to complex bureaucratic procedures involved in budget allocation. This delay has resulted in a decreased implementation pace and failure to execute a national communication campaign to raise public awareness on services made available or improved by the primary health-care guidelines. Both epidemiological surveillance and monitoring of health services are necessary to assess the near and long-term impact of these guidelines,

Table 5. Key strategies employed in response to contextual factors during adoption and initial implementation of Botswana primary health-care guidelines

Key implementation strategies by implementation phase <sup>a</sup>	Contextual factors
<b>Exploration</b>	
Multilevel assessment to understand sociopolitical landscape, funding, current clinical practice and strategic priorities. Used broad stakeholder inputs; review of policies, legislation, programme reports, local data analysis, and operational research	Concerns that noncommunicable diseases might reverse health gains made when combatting HIV. <sup>b</sup> Existing national noncommunicable disease programme to spearhead effort <sup>b</sup>
Assessed facility capacity and readiness to deliver quality services at primary health-care level. Used purposive sampling and local university trainees to general local data at lower cost	Constrained resources for rigorous facility and provider and/or client assessment
In-depth analysis of local data, leveraged partnerships with academic institutions	Limited research evidence interpretation and analytical expertise within the health ministry; data available from the 2014 noncommunicable disease risk factors survey <sup>b</sup>
<b>Preparation</b>	
Selected and adapted guidelines that fit model of care aligned with health ministry structure and strategic direction. Embedded noncommunicable diseases within primary health-care guidelines, aligning with the health ministry strategic direction and emphasizing integrated primary health-care services for individuals with multiple risk factors and morbidities	Key policy instruments did not exist before 2016; the global advocacy for UHC; the health ministry's primary care-oriented strategic direction <sup>b</sup>
Engaged future on-the-ground adopters early on, starting with guidelines adaptation, to ensure context appropriate guidelines and facilitate ownership and sustainment	Before these guidelines, the experience and focus of health-care providers was predominantly HIV-focused, thus challenging adoption
Set up a broad technical working group and leveraged intersectoral forums to advocate for national prioritization of noncommunicable diseases and enable development of supportive policy instruments, such as a noncommunicable disease strategic plan, national essential medicines list and a national development plan	Tradition of siloed, disease and/or programme-focused approach to guidelines development
Achieved strong and streamlined stakeholder coordination to minimize fatigue and redundancy, through multiple nonlinear related processes <sup>c</sup>	The small pool of local technical experts presenting risk of meeting fatigue
<b>Implementation</b>	
Started implementation in districts with some experience in multidisciplinary chronic disease management	Hospital-based multidisciplinary diabetes clinics established in 2012 in eight districts <sup>b</sup>
Coupled standardized in-serve training programme with long-term mentorship to support continued change in practice	Positive and recent experience with HIV training programme, using master trainers <sup>b</sup>
Monitored standardized performance indicators, <sup>d</sup> which include process measures to signal early on delayed progress and suggest solutions to address delays	No existing routine reporting of noncommunicable diseases care; cumbersome paper-based reporting
Established public-private partnership to provide technical expertise and expediently obtain funding for initial training	Absence of global funding mechanism for noncommunicable diseases; slow government budget allocation processes
<b>Sustainment</b>	
Included noncommunicable diseases mortality reduction priority and strategies in the next national development plan. Selected indicators included in health ministry's key performance indicators	10th National Development Plan ending in 2016 <sup>b</sup>
Developed experienced local master trainers and non-proprietary training material to allow for future trainings without need for external resources	Recent and positive experience with national HIV training programme <sup>b</sup>
Going forward, will explore future electronic monitoring of primary health-care indicators, and regular feedback to providers, which will be critical to ensuring continued high-quality surveillance data	Existing patient-level electronic health information primarily for HIV, tuberculosis and child health

HIV: human immunodeficiency virus; UHC: universal health coverage.

<sup>a</sup> We used a multilevel model that divides the implementation process into four phases: exploration, preparation, implementation and sustainment.<sup>20</sup><sup>b</sup> Enabling contextual factors.<sup>c</sup> Nonlinear related processes were noncommunicable disease strategy development, review of essential medicines list, development of primary care guidelines<sup>d</sup> We defined the indicators according to the RE-AIM framework.<sup>28</sup>

however national surveys can be costly and paper-based monitoring unwieldy. Advocacy is ongoing for more resource-efficient surveillance, by including key noncommunicable disease indicators in large better-resourced national surveys, such as the HIV and population surveys,

and consolidating related surveys, such as the noncommunicable disease risk factors and tobacco surveys. Collaborative pilot projects are exploring feasible options for monitoring quality of care using electronic patient-level integrated health information platforms.<sup>40</sup> Finally,

evidence-based guidelines need to be reviewed periodically to ensure alignment with evolving evidence. While HIV guidelines have been updated every two years in Botswana, regular review of other guidelines has been less successful, and a review of the primary

health-care guidelines would need to be actively promoted.

## Conclusion

By sharing our experience in adapting, endorsing and implementing evidence-based guidelines for noncommunicable diseases, we hope to help other countries planning to implement health services for noncommunicable diseases. We anticipate that lessons learnt will be relevant to stakeholders of national health programmes. The lessons may provide a road map and implementation insights that inform introduction of a WHO package specifically, or of other clinical guidelines that improve services delivered at primary health-care facilities in similar settings. ■

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## ملخص

**دمج خدمات الأمراض غير المعدية في الرعاية الصحية الأولية، بوتسوانا**

الصحية الأولية الوطنية في الدولة في عام 2016، وبدأ التنفيذ الم relu لمدة ثلاثة سنوات في أغسطس/آب 2017. وبالإضافة إلى ذلك، فإن تقديم الرعاية الصحية الأولية لخدمات الأمراض غير المعدية قد تم إدراجه في خطة التنمية الوطنية رقم 11 للدولة (2017 إلى 2023). خلال عملية تطوير الإرشادات، أدركنا أهمية المهارات القوية متعددة التخصصات في مجال الاتصالات، والتنظيم، وبناء التحالفات، والتفكير في النظم، والفهم التقني لأفضل الممارسات في الدول منخفضة الدخل ومتوسطة الدخل. وعلاوة على ذلك، فإن الأجندة غير المنسقة للجهات المعنية، والتي يُبالغ فيها نتيجة الأسلوب المنعزل لتطوير الإرشادات، والتقليل من أهمية وجود أدوات لسياسة قيد التنفيذ، وتنسيق العمليات التي تتم بشكل مبدئي خارج وزارة الصحة، قد تسبّب ذلك كله في حدوث تأخيرات. تناسب خبرتنا الدول الأخرى المهتمة بتطوير وتنفيذ الإرشادات الخاصة بخدمات الأمراض غير المعدية القائمة على الأدلة.

على الرغم من ارتفاع عبء الأمراض غير المعدية، إلا أن الحصول على الخدمات اللامركزية ذات الجودة العالية للأمراض المعدية ظل محدوداً في العديد من الدول منخفضة الدخل ومتوسطة الدخل. نحن هنا نصف الاستراتيجيات التي استعنا بها لدفع العملية من مرحلة التكيف إلى مرحلة التأييد الوطني وتنفيذ إرشادات الرعاية الصحية الأولية للبالغين في بوتسوانا لعام 2016. وشملت الاستراتيجيات تقييم مفصل متعدد المستويات بمدخلات واسعة من الجهات المعنية وتحليل متعمق للبيانات المحلية؛ والاستفادة من الشراكات الأكادémie؛ وتسهيل تطوير أدوات دعم السياسات؛ ودمج إرشادات الأمراض غير المعدية في إطار إرشادات الرعاية الصحية الأولية الأوسع نطاقاً مع موافقة التوجّه الاستراتيجي لوزارة الصحة. وعلى مستوى المرافق، شملت الاستراتيجيات وضع برنامج تدريبي متعدد المنهج لمقدمي الرعاية الصحية، والاستفادة من تجربة توفير الرعاية لغير وساق المخاعة البشرية، وإشراك منفذى الرعاية الصحية في مرحلة مبكرة من العملية. ومن خلال الاستراتيجيات المتبعة، تم اعتماد أول إرشادات للرعاية

## 摘要

### 博茨瓦纳将非传染性疾病服务纳入初级卫生保健

由于非传染性疾病负担的日益加重，诸多低收入和中等收入国家获得优质、分散式的非传染性疾病服务的途径仍然有限。本文中，我们描述了所采用的策略，该策略推动《2016 年博茨瓦纳成人初级卫生保健指南》从适应实际情况到获得国家认可和实施的过程。这些策略包括了纳入广泛利益相关者的意见和对当地数据深入分析基础上的多层次详尽评估；利用学术合作伙伴关系；促进支持性政策工具的制定；将非传染性疾病指南纳入更广泛的初级卫生保健指南，并与卫生部的战略方向保持一致。在医疗机构层面，策略涵盖了为医疗护理提供人员制定的一种多方法培训计划、利用人体免疫缺陷病毒护理提供的经验以及在早期过程中聘请医护人员。通过采用此类策略，该国

首个国家初级卫生保健指南于 2016 年获得批准，并于 2017 年 8 月开始分阶段进行三年实施计划。此外，该国第 11 个国家发展计划 (2017-2023) 还涵盖了提供非传染性疾病服务的初级卫生保健服务。在指南制定过程中，我们了解到，在沟通、组织、联盟建设和系统思考，以及对低收入和中等收入国家的最佳实践掌握技术等方面强大的跨学科技能至关重要。此外，利益相关者的议程方向偏离、指南制定的孤立方法过于夸大、制定政策工具的重要性被低估以及最初卫生部以外领导协调流程造成了延误。我们的经验关乎其他有兴趣制定并实施循证非传染性疾病服务指南的国家。

## Résumé

### **Botswana - Intégration des services de prévention et de prise en charge des maladies non transmissibles dans les soins de santé primaires**

Malgré la charge de morbidité croissante des maladies non transmissibles, l'accès à des services décentralisés de qualité pour lutter contre ces maladies reste limité dans de nombreux pays à revenu faible ou intermédiaire. Dans cet article, nous décrivons les stratégies qui ont été employées pour mener les étapes d'adaptation, de validation et de mise en œuvre à l'échelle nationale des *Lignes directrices 2016 du Botswana sur les soins de santé primaires pour l'adulte*. Ces stratégies ont inclus: une évaluation multiniveau détaillée avec une large implication des parties prenantes et une analyse approfondie des données locales; le recours à des partenariats universitaires; la promotion de l'élaboration d'instruments politiques propices; l'intégration de lignes directrices portant spécifiquement sur les maladies non transmissibles dans les lignes directrices générales sur les soins primaires, en écho à l'orientation stratégique du ministère de la Santé. Au niveau des établissements de santé, les stratégies ont inclus: la création d'un programme de formation multiméthode à destination des prestataires de soins; l'exploitation de l'expérience acquise dans la prise en charge du virus de l'immunodéficience humaine et l'implication des prestataires de soins très tôt dans le processus. Grâce aux stratégies employées, les premières lignes directrices nationales sur les soins de santé primaires

ont été validées en 2016, et une étape de mise en œuvre graduelle, sur trois ans, a commencé en août 2017. De plus, la prestation de soins de santé primaires contre les maladies non transmissibles a été incluse dans le 11<sup>e</sup> plan national de développement du pays (2017-2023). Pendant la phase d'élaboration des lignes directrices, nous avons constaté toute l'importance, dans les pays à revenu faible et intermédiaire, de pouvoir compter sur de solides compétences interdisciplinaires en matière de communication, d'organisation, de création de coalitions et de réflexion systémique et d'obtenir une bonne compréhension technique des meilleures pratiques. Nous avons par ailleurs observé des retards provoqués par des problèmes d'incompatibilité d'agendas entre les différentes parties prenantes, exagérés par des approches cloisonnées lors de la phase d'élaboration des lignes directrices, par la sous-estimation de l'importance d'avoir des outils politiques déjà en place et par des difficultés de coordination des processus initialement pilotés hors du ministère de la Santé. Notre expérience peut être utile pour d'autres pays qui souhaiteraient élaborer et mettre en œuvre des lignes directrices pour des services de soins contre les maladies non transmissibles fondés sur des données probantes.

## Резюме

### **Включение медицинской помощи в связи с неинфекционными заболеваниями в комплекс услуг первичного медико-санитарного обслуживания в Ботсване**

Несмотря на растущее бремя неинфекционных заболеваний, доступ к качественному децентрализованному медицинскому обслуживанию в связи с этими заболеваниями в странах с низким и средним уровнем дохода остается ограниченным. В статье описаны стратегии по содействию данному процессу, начиная с адаптации и заканчивая принятием и внедрением на национальном уровне рекомендаций по первичному медико-санитарному обслуживанию взрослого населения в Ботсване на 2016 год. Стратегии включали: подробную многоуровневую оценку с привлечением широкого спектра партнеров и с глубоким анализом местных данных, обеспечение академического сотрудничества, содействие разработке сопутствующих стратегий и правил, внедрение рекомендаций относительно неинфекционных заболеваний в общие рекомендательные документы в сфере первичного медико-санитарного обслуживания с соблюдением основных направлений развития, принятых Министерством здравоохранения страны. На уровне учреждений здравоохранения стратегии включали в себя: разработку многосторонней программы обучения сотрудников системы здравоохранения, эффективное использование опыта, накопленного в ходе выполнения программ по лечению вируса иммунодефицита человека, и привлечение непосредственно занятого оказанием помощи медперсонала на самых ранних этапах. Благодаря этим стратегиям первые национальные рекомендации по первичному медико-санитарному обслуживанию были одобрены в 2016 году, а в августе 2017 года был запущен процесс

их поэтапного внедрения в течение трехлетнего периода. Кроме того, оказание первичного медико-санитарного обслуживания применительно к неинфекционным заболеваниям было включено в 11-й национальный план развития (2017–2023 гг.). Процесс разработки рекомендаций продемонстрировал важность вовлечения многопрофильных специалистов в процессы обмена информацией, организации, создания коалиций и системного мышления, а также необходимость практического овладения передовым опытом в странах с низким и средним уровнем дохода. Кроме того, несогласованность интересов партнеров, усугубленная обособленным подходом к разработке рекомендаций, недостаточное понимание важности разработки стратегических планов и координации процессов, которые сначала не подчинялись Министерству здравоохранения, привели к задержкам. Полученный опыт важен для других стран, заинтересованных в разработке и внедрении рекомендаций по медико-санитарному обслуживанию неинфекционных заболеваний, основанному на принципах доказательной медицины.

## Resumen

### Integración de los servicios de enfermedades no transmisibles en la atención primaria de salud, Botswana

A pesar de la creciente carga de las enfermedades no transmisibles, el acceso a servicios de calidad descentralizados para estas enfermedades sigue siendo limitado en muchos países de bajos y medianos ingresos. A continuación, describimos las estrategias que empleamos para impulsar el proceso desde la adaptación a la aprobación nacional y la implementación de las directrices de atención primaria de la salud para adultos de Botswana de 2016. Las estrategias incluían una evaluación detallada a varios niveles con amplias aportaciones de las partes interesadas y un análisis a fondo de los datos locales; el aprovechamiento de las asociaciones académicas; la facilidad para elaborar instrumentos normativos de apoyo; la incorporación de directrices sobre las enfermedades no transmisibles en las directrices más amplias sobre la atención primaria de la salud, de conformidad con la dirección estratégica del Ministerio de Salud. A nivel de los centros de salud, las estrategias incluían la elaboración de un programa de capacitación multimétodo para los proveedores de servicios de salud, el aprovechamiento de la experiencia en la prestación de servicios de atención del virus de la inmunodeficiencia humana y la participación de los encargados de la ejecución de los servicios de salud en las primeras

etapas del proceso. Gracias a las estrategias empleadas, en 2016 se aprobaron las primeras directrices nacionales de atención primaria de la salud del país y en agosto de 2017 se inició una aplicación por etapas de tres años. Además, la prestación de servicios de atención primaria de la salud para las enfermedades no transmisibles se incluyó en el 11º plan nacional de desarrollo del país (2017-2023). Durante el proceso de desarrollo de las directrices, aprendimos que eran importantes las buenas habilidades interdisciplinarias en comunicación, organización, formación de coaliciones y pensamiento sistémico, así como la comprensión técnica de las mejores prácticas en los países de ingresos bajos y medios. Por otra parte, las agendas desalineadas de las partes interesadas, exageradas por el enfoque aislado del desarrollo de las directrices, la subestimación de la importancia de contar con instrumentos de política y la coordinación de los procesos que inicialmente se llevaban a cabo fuera del ministerio de salud causaron retrasos. Nuestra experiencia es relevante para otros países interesados en desarrollar e implementar directrices para servicios de enfermedades no transmisibles basados en la evidencia.

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## Development of a sweetened beverage tax, Philippines

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**Problem** Both sugar-sweetened beverage consumption and the incidence of obesity have increased in the Philippines in recent years.

**Approach** A proposal to tax sugar-sweetened beverages was introduced in the House of Representatives and merged into a proposed comprehensive Tax Reform for Acceleration and Inclusion (TRAIN) Bill to increase the likelihood of acceptance. The health department and finance department recommended a policy that would maximize benefits to both public health and government revenue. To advance discussions, the health department expanded the health argument to include the country's poor performance in oral health. The approved TRAIN Law adopted the term sweetened beverage to emphasize that the tax covers both sugar and non-sugar sweetened beverages. The tax rate was set to 6.00 Philippine pesos (0.111 United States dollars) per litre of sweetened beverages. The sugar industry successfully lobbied for higher tax rates on beverages containing high-fructose corn syrup, resulting in a differential rate of 12.00 Philippine pesos per litre.

**Local setting** Despite a 12% value-added tax on sugar-sweetened beverages, sales had been sustained by enhanced marketing and product variants being offered in small portions.

**Relevant changes** One month after implementation of the tax in 1 January 2018, prices of taxable sweetened beverages had increased by 16.6 to 20.6% and sales in *sari-sari* (convenience) stores had declined 8.7%.

**Lessons learnt** The tax benefited from high-level government commitment and support, keeping policy simple reduced opportunities for tax avoidance and evasion, and taking both health and non-health considerations into account were helpful in arguing for the tax.

Abstracts in *عربي*, *中文*, *Français*, *Русский* and *Español* at the end of each article.

### Introduction

Sugar-sweetened beverages are more strongly associated with high energy intake and weight gain than any other form of processed food.<sup>1</sup> In the Philippines, both the proportion of the population that consumes these beverages and per capita consumption increase with age (Pulse Asia Research Inc., unpublished report, 2017). Moreover, the fraction of daily sugar intake that comes from sugar-sweetened beverages increased 44% in 10 years: in 2005, Filipinos consumed 14.9 g of sugar per capita per day from sugar-sweetened beverages alone; in 2015, it was 21.4 g (M Abrigo and K Francisco, Philippine Institute for Development Studies, unpublished report, 2018).

Obesity prevalence in the Philippines have remained low relative to other countries in the Association of South-East Asian Nations (ASEAN).<sup>2</sup> Nevertheless, a growing proportion of Filipinos of all ages are overweight or obese, which is likely to substantially increase the number of productive years lost due to poor health.<sup>3</sup> Cross-country comparisons among ASEAN member states indicate that the loss of productive years due to obesity is greatest in the Philippines.<sup>4</sup> The annual cost of obesity-related productivity loss in the country has been estimated to 567 million United States dollars.<sup>2</sup>

### Local setting

Before 1 January 2018, no specific tax applied to sugar-sweetened beverages in the Philippines, although they were subject to a general 12% value-added tax. Beverage manufacturers sustained sales by enhanced marketing and offering products in small portion, this lowered the unit price of sugar-sweetened beverages (Organic Intelligence Consulting Inc., unpublished report, 2017) and increased the likelihood of

frequent consumption.<sup>5</sup> When the World Health Organization recommended taxes on sugar-sweetened beverages to address childhood obesity in 2016,<sup>6</sup> the Philippines was presented with the opportunity to enact another landmark piece of health legislation to follow the 2012 Sin Tax Reform Law on Tobacco and Alcohol.<sup>7</sup> A proposal to tax sugar-sweetened beverages was filed by a first-term lawmaker in the House of Representatives (House Bill 3365) during the 16<sup>th</sup> Congress (from 2013 to 2016).<sup>8</sup> When this was not successful, she refilled it (House Bill 292) during the 17<sup>th</sup> Congress (from 2016 to 2019) and then secured the support of the health department and the finance department. This partnership between executive and legislative branches of the government culminated in the Philippines, becoming the third ASEAN member state after Brunei Darussalam and Thailand to impose taxes on sugar-sweetened beverages.

### Legislative approach

As the sugar-sweetened beverage tax was a health-related tax, the health department and finance department collaborated on recommending a tax policy that would maximize benefits to both public health and government revenue and that considered reviews of the best available evidence, including in-house evidence from both agencies. In particular, the policy focused on firstly modifying health risks by introducing taxes that increased the price of sugar-sweetened beverages sufficiently to deter purchases and that could be applied to a wide range of products, thereby discouraging unhealthy substitution. Secondly the policy also focused on securing revenues by using a unitary tax scheme (i.e. applying a single tax rate) and volumetric tax collection (i.e. basing tax on the volume of sugar per litre of beverage), both of which simplify tax administration

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**Box 1. Legislative steps towards a sweetened beverage tax, the Philippines, 2017****House Bill 292 (standalone sugar-sweetened beverage tax bill), included in the TRAIN Bill 26 April 2017**

Definition: sugar-sweetened beverages were defined as non-alcoholic beverages that contain caloric sweeteners or added sugar or artificial or non-caloric sweeteners in the form of a liquid, syrup, concentrate or solid mixture that is added to water or other liquids to make a drink.

Taxable products: (i) soft drinks and carbonated drinks; (ii) fruit drinks and punches; (iii) sports drinks; (iv) sweetened tea and coffee drinks; (v) energy drinks; and (vi) all non-alcoholic beverages that are ready to drink or in powder form and contain added natural or artificial sugar.

Exemptions: (i) 100% natural fruit juices without added sugar or caloric sweeteners; (ii) 100% natural vegetable juices without added sugar or caloric sweeteners; (iii) yogurt and fruit-flavoured yogurt beverages; (iv) meal-replacement beverages (e.g. medical food), weight-loss products, any liquid or powder drink or product for oral nutritional therapy; and (v) all milk products.

Tax rate: 10.00 Philippine pesos<sup>b</sup> per litre with a 4% increment each year to adjust for inflation.

**House Bill 5636 (House version of the TRAIN Bill) passed 31 May 2017**

Definition: sugar-sweetened beverages were defined as non-alcoholic beverages of any constitution (i.e. liquid, powder or concentrate) that are prepackaged and sealed in accordance with Philippine Food and Drug Administration standards and that contain sugar added by the manufacturers.

Taxable products: (i) sweetened juice drinks; (ii) sweetened tea and coffee; and (iii) other beverages (including all carbonated beverages) with added sugar or caloric or non-caloric sweeteners, flavoured water, energy drinks, sports drinks, powdered drinks not classified as milk, juice, tea or coffee, cereal and grain beverages, and other non-alcoholic beverages that contain added sugar.

Exemptions: (i) plain milk and milk drink products without added sugar; (ii) all milk drink products, infant formula and milk alternatives (e.g. soy milk and almond milk), including flavoured milk, such as chocolate milk; (iii) 100% natural fruit juices without added sugar or caloric sweeteners; (iv) 100% natural vegetable juices without added sugar or caloric sweeteners; (v) meal-replacement and medically indicated beverages; (vi) ground coffee; and (vii) unsweetened tea.

Tax rate: 10.00 Philippine pesos<sup>b</sup> per litre for beverages containing locally sourced sweeteners and 20.00 Philippine pesos<sup>b</sup> per litre for beverages containing imported sweeteners.

**Senate Bill 1592 (Senate version of the TRAIN Bill) passed 27 November 2017**

Definition: sweetened beverages were defined as non-alcoholic beverages of any constitution (i.e. liquid, powder or concentrate) that are prepackaged and sealed in accordance with Philippine Food and Drug Administration standards and that contain caloric or non-caloric sweeteners or both added by the manufacturers.

Taxable products: (i) sweetened juice drinks; (ii) sweetened tea; (iii) all carbonated beverages; (iv) flavoured water; (v) energy and sports drinks; (vi) powdered drinks not classified as milk, juice, tea or coffee; (vii) cereal and grain beverages; and (viii) other non-alcoholic beverages that contain added sugar.

Exemptions: (i) plain milk, infant formula milk and growing-up milk; (ii) powdered milk, ready-to-drink milk, flavoured milk and fermented milk; (iii) 100% natural fruit juices without added sugar or caloric sweeteners; (iv) 100% natural vegetable juices without added sugar or caloric sweeteners; (v) meal-replacement and medically indicated beverages; (vi) ground coffee, instant soluble coffee and prepackaged powdered coffee products, with or without added sugar; (vii) unsweetened tea; and (viii) beverages sweetened with coconut sap or stevia glycosides.

Tax rate: 4.50 Philippine pesos<sup>b</sup> per litre for beverages sweetened with a caloric or non-caloric sweetener (except high-fructose corn syrup) and 9.00 Philippine pesos<sup>b</sup> per litre for beverages sweetened with high-fructose corn syrup.

**Republic Act 10963 Section 47 (TRAIN Law) signed into law 19 December 2017**

Definition: sweetened beverages were defined as non-alcoholic beverages of any constitution (i.e. liquid, powder or concentrate) that are prepackaged and sealed in accordance with Philippine Food and Drug Administration standards and that contain caloric or non-caloric sweeteners or both added by the manufacturers.

Taxable products: (i) sweetened juice drinks; (ii) sweetened tea; (iii) all carbonated beverages; (iv) flavoured water; (v) energy and sports drinks; (vi) powdered drinks not classified as milk, juice, tea or coffee; (v) cereal and grain beverages; and (vi) other non-alcoholic beverages that contain added sugar.

Exemptions: (i) all milk products, including plain milk, infant formula milk, follow-on milk, growing-up milk, powdered milk, ready-to-drink milk, flavoured milk, fermented milk, soy milk and flavoured soy milk; (ii) 100% natural fruit juices without added sugar or caloric sweeteners; (iii) 100% natural vegetable juices without added sugar or caloric sweeteners; (iv) meal-replacement and medically indicated beverages; and (v) ground coffee, instant soluble coffee and prepackaged powdered coffee products; and (vi) beverages sweetened with coconut sap or stevia glycosides.

Tax rate: 6.00 Philippine pesos<sup>a</sup> per litre for beverages sweetened with caloric or non-caloric sweeteners (except high-fructose corn syrup) and 12.00 Philippine pesos<sup>a</sup> per litre for beverages sweetened with high-fructose corn syrup.

TRAIN: Tax Reform for Acceleration and Inclusion.

<sup>a</sup> In 2017, 1 Philippine peso was equivalent to 0.0185 United States dollars.

Note: In the Philippines, fiscal policies requiring legislation follow a sequential process in Congress: (i) tax proposals should pass the House of Representatives before the Senate initiates discussions on their counterpart bill; (ii) differences between versions of the bill passed by the House of Representatives and the Senate are reconciled during a Bicameral Conference; and (iii) both chambers of Congress then ratify the reconciled version, which is sent to the Office of the President to be signed.

and minimize opportunities for avoidance and evasion. Box 1 summarizes the legislation's development.

The sugar-sweetened beverage tax was framed as a preventive health measure that addressed features of the food market associated with increased rates

of obesity and diabetes. The acceptance of the tax was hampered by: (i) limited interest in tackling obesity and diabetes; (ii) the claim that sugar-sweetened beverages help poor people satisfy their dietary needs;<sup>9</sup> (iii) the misconception that the positive health effects of the

tax would favour richer households with more flexible spending power; and (iv) the strongly held belief that under-nutrition is the real problem despite evidence of the country's double burden of malnutrition (i.e. the coexistence of under-nutrition and diet-related non-

#### Box 2. Summary of main lessons learnt

- Visible, high-level, government commitment and support were vital for establishing the sweetened beverage tax.
- A simple and clear policy reduced opportunities for tax avoidance and evasion and helped avoid biased interpretations of the legislation that could weaken the tax base.
- Both health and non-health considerations were helpful to take into account in developing comprehensive and compelling arguments for the tax.

communicable diseases).<sup>3</sup> To increase the likelihood that the tax proposal would be passed, it was incorporated into the government's proposed comprehensive Tax Reform for Acceleration and Inclusion (TRAIN) Bill. Certification of the TRAIN Bill as urgent by the Philippine president was instrumental in ensuring the sugar-sweetened beverage tax entered into law.<sup>10</sup>

To advance discussions, the health argument was expanded to include the country's poor performance in oral health. Although prolonged sugar exposure has been strongly associated with dental caries, this association has not often been used to support sugar-sweetened beverage tax policies. Dental caries are common in the Philippines, with a national prevalence of 88%.<sup>11</sup> Moreover, untreated dental caries among Filipino children have been linked to being underweight,<sup>12</sup> and data from the education department indicate that toothache is a principal cause of school absenteeism. This argument contributed to a compelling narrative that helped anchor the sugar-sweetened beverage tax policy within the TRAIN Bill; namely the tax proposal supported human capital development and ongoing universal health-care reforms.

After advancing through both chambers of Congress, the Bicameral Conference Committee reconciled differences between the sweetened beverages tax proposals incorporated in House Bill 5636 and Senate Bill 1592. The TRAIN Law signed by the president adopted most provisions in the Senate version (Box 1), including use of the term "sweetened beverages" to emphasize that the tax covers both sugar and non-sugar sweetened beverages. Successful lobbying by the sugar industry resulted in the decisions: (i) to impose a high differential tax rate on drinks containing high-fructose corn syrup; and (ii) to subject artificially sweetened beverages to an excise tax. The local sugar industry,

which had been disadvantaged by an influx of high-fructose corn syrup into the country, expressed concern that food manufacturers would shift to artificial sweeteners should artificially sweetened beverages be exempted from excise tax. The tax on artificially sweetened beverages was also supported by medical societies as a way of reducing consumption of all types of sweetened beverage.

The final tax rate was set to 6.00 Philippine pesos (equivalent to 0.111 United States dollars in 2017) per litre for beverages sweetened with caloric or non-caloric sweeteners, except for beverages sweetened with high-fructose corn syrup with a tax of 12.00 Philippine pesos per litre (Box 1).

#### Impact of the tax

A month after the sweetened beverage tax was implemented on 1 January 2018, market surveillance indicated that the average price of taxable sweetened beverages in *sari-sari* stores (i.e. neighbourhood convenience stores) had increased by 20.6% and average prices in supermarkets had increased by 16.6%.<sup>13</sup> Among taxable product categories, carbonated non-alcoholic drinks experienced the highest average price hike, at 21.0%. *Sari-sari* stores experienced the greatest decline in sales, which averaged 8.7% over the month.<sup>14</sup> Given that the tax has just recently been implemented, it is too soon to evaluate its impact on risks to population health. A monitoring programme is planned to investigate changes in consumers' purchasing and consumption behaviour and the food industry's response. The health department has allocated research funds to start monitoring in 2019.

Implementation of the sweetened beverage tax also catalysed substantial policy changes in the food system. The resulting Implementing Rules and Guidelines meant that prepacked concentrates sold to food retailers for

dispensing were also subject to excise tax. As a result, the unlimited beverage refills offered in some food outlets have been discontinued. In addition, the president issued a directive to put health warning labels on sweetened beverages to help consumers make an informed choice.<sup>15</sup> This provided an opportunity to finally regulate front-of-pack labels and to counter misleading brand messages from manufacturers.

#### Lessons learnt

The main lessons learnt in establishing the sweetened beverage tax are summarized in Box 2. First, the tax greatly benefited from visible, high-level, sustained commitment from both legislative and executive branches of government, which counterbalanced opposition led by the beverage industries. In addition, the soft power represented by the presence of former health ministers, incumbent cabinet officials, development partners and legislators at public hearings enhanced the political desirability of the reform. Experience in the Philippines demonstrates that taxes relevant to health do not have to be framed or designed as exclusively health or revenue measures. Moreover, reduced consumption and higher revenues can be sustained over the long term by ensuring taxes are simple to implement administratively. Policies should also be kept simple to avoid loopholes that could provide opportunities for tax avoidance and evasion or for biased interpretations of the legislation that could weaken the tax base. Although obesity is the dominant health rationale globally for imposing sugar-sweetened beverage taxes, the lack of political interest in addressing obesity in the Philippines meant that progress depended on framing the threat to health differently. Taking both health and non-health considerations into account could therefore be valuable when developing comprehensive, highly nuanced and compelling arguments about the societal cost of poor health over the long term.

This paper describes strategies used in the Philippines that could help other countries develop fiscal interventions to address market failures influencing health. These interventions should balance health and fiscal objectives. Four other ASEAN member states are already planning to implement sugar-

sweetened beverage taxes: (i) Indonesia and Singapore are exploring appropriate policy designs; and (ii) Malaysia and Viet Nam are finalizing proposals for submission to lawmakers. Although a sugar-sweetened beverage tax will not reverse the burden of malnutrition and noncommunicable diseases by itself, it could trigger a domino effect in the food system that will modify health risk factors. Such a tax could be a tangible first step towards re-engineering an obesogenic environment by denormalizing the consumption of sugar-sweetened beverages in the mind of the public. ■

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**Competing interests:** None declared.

## ملخص

### تطوير ضريبة المشروبات المحلاة، الفلبين

المشكلة ازداد كل من استهلاك المشروبات المحلاة بالسكر ومعدل السمنة في الفلبين في السنوات الأخيرة.

الأسلوب تم تقديم اقتراح لفرض ضريبة على المشروبات المحلاة بالسكر في مجلس النواب ودمجها في مشروع قانون الإصلاح الضريبي الشامل للتعجيل والإدماج (TRAIN)، وذلك بهدف زيادة احتلالات القبول. وأوصت كل من وزارة الصحة ووزارة المالية بسياسة من شأنها تعظيم الفوائد بالنسبة للصحة العامة والإيرادات الحكومية. ولدفع التقدم في المناقشات، قامت وزارة الصحة بتوسيع حجم النقاش الصحي ليشمل الأداء المترهل للدولة في مجال صحة الفم. اعتمد قانون TRAIN الذي نال الموافقة على مصطلح المشروبات المحلاة للتأكيد على أن الضريبة تغطي كلاً من المشروبات المحلاة أو غير المحلاة بالسكر. تم ضبط معدل الضريبة على 6.00 بيزو فلبيني (0.111 دولار أمريكي) لكل لتر من المشروبات المحلاة. مارس قطاع صناعة السكر ضغوطاً ناجحة من أجل رفع معدلات الضريبة على المشروبات

التي تحتوي على شراب الذرة بنسبة عالية من الفركتوز، مما أدى إلى معدل تفاضلي قدره 12.00 بيزو فلبيني لكل لتر.

الموقع المحلي على الرغم من فرض ضريبة للقيمة المضافة بنسبة 12٪ على المشروبات المحلاة بالسكر، إلا أن المبيعات قد ازدادت من خلال التسويق المحسّن ومتغيرات المنتج الذي يتم تقديمها في أحجام صغيرة.

التغيرات ذات الصلة بعد شهر واحد من تطبيق الضريبة في 1 يناير/كانون ثاني 2018، كانت أسعار المشروبات المحلاة الخاضعة للضريبة قد ارتفعت بنسبة 16.6 إلى 20.6٪، وأنخفضت المبيعات في متاجر ساري-ساري ( محلات البقالة الصغيرة) بنسبة 8.7٪. الدروس المستفادة استفادت الضريبة من الالتزام والدعم رفيع المستوى من الحكومة، كما أن السياسة السيطرة المستخدمة أدت إلى الحد من فرص التهرب من الضريبة وتجنبها، كذلك فإن وضع الاعتبارات الصحية وغير الصحية في الحساب كان مفيداً في الترويج للضريبة.

## 摘要

### 菲律宾含糖饮料税的发展

**问题** 近年来，菲律宾含糖饮料的销量和肥胖率均有增长。

**方法** 众议院提出了对含糖饮料征税的提案，并将之纳入提议的全面的《税制改革加速包容法案 (TRAIN)》中，以提高其被接受的可能性。卫生部门和财政部门提出一项政策，旨在最大限度地提高公共卫生和政府收入的效益。为了推进讨论，卫生部门拓展了健康论点，将该国口腔卫生状况不佳的情况纳入讨论。获批的 TRAIN 采用“含糖饮料”这一术语，强调了此项税收包括含糖饮料和无糖甜味饮料。含糖饮料的税率为每升 6.00 菲律宾比索 (0.111 美元)。对于含有高果糖

玉米糖浆的饮料，制糖业成功游说对其征收更高的含糖税，即税率达到每升 12.00 菲律宾比索。

**当地状况** 尽管对含糖饮料征收了 12% 的增值税，但得益于市场营销和少量的产品变型，其销量仍得以维持。

**相关变化** 自 2018 年 1 月 1 日起实施该税法一个月后，需缴税的含糖饮料价格上升了 16.6% 至 20.6% 而 sari-sari (便利店) 的销量降低了 8.7%。

**经验教训** 该税法得益于政府高层的承诺和支持，简单明晰的政策规定降低了避税、逃税的机会，并将有利于税收讨论的健康和非健康因素均纳入考量。

## Résumé

### Mise en place d'une taxe sur les boissons sucrées aux Philippines

**Problème** Au cours des dernières années, les Philippines ont enregistré une augmentation de la consommation de boissons sucrées avec du sucre et de l'incidence de l'obésité.

**Approche** Une proposition de taxe sur les boissons sucrées avec du sucre a été présentée à la Chambre des représentants et a engendré un projet de loi détaillé appelé « Tax Reform for Acceleration and Inclusion »

(TRAIN) destiné à accroître la probabilité d'acceptation. Le ministère de la Santé et le ministère des Finances ont recommandé l'adoption d'une politique qui présenterait des avantages en matière de santé publique, mais aussi pour les recettes de l'État. Afin de faire avancer les discussions, le ministère de la Santé a élargi le débat sur la santé de façon à inclure les mauvais résultats du pays en matière de santé bucco-dentaire. La loi TRAIN utilise l'expression « boisson sucrée » pour souligner le fait que la taxe s'applique à la fois aux boissons sucrées avec du sucre et aux boissons sucrées avec d'autres substances. Le taux de la taxe a été fixé à 6,00 pesos philippins (0,111 dollar des États-Unis) par litre de boisson sucrée. L'industrie du sucre a plaidé avec succès pour l'application d'un taux plus important aux boissons contenant du sirop de maïs à haute teneur en fructose, ce qui a donné lieu à un taux différencié de 12,00 pesos philippins par litre.

## Резюме

### Разработка начисления налога на сладкие напитки, Филиппины

**Проблема** В последние годы на Филиппинах увеличилось потребление сахаросодержащих напитков, а также количество людей, страдающих ожирением.

**Подход** В Палату представителей было внесено предложение о введении налога на сахаросодержащие напитки, которое было добавлено в законопроект о налоговой реформе (Tax Reform for Acceleration and Inclusion, TRAIN), чтобы увеличить вероятность принятия этого закона. Департаменты здравоохранения и финансовых рекомендовали подход, который бы максимально увеличивал пользу как для общественного здравоохранения, так и для государственных доходов. В ходе дальнейших обсуждений департамент здравоохранения расширил свои аргументы, включив в них плохие показатели состояния здоровья полости рта в среднем по стране. В принятом законе TRAIN используется термин «сладкий напиток», чтобы подчеркнуть, что налог распространяется на все сладкие напитки как с содержанием сахара, так и с его заменителями. Налоговая ставка была установлена в размере 6,00 филиппинского песо (0,111 доллара США) на литр сладкого напитка. Сахарная промышленность успешно

**Environnement local** Malgré une taxe sur la valeur ajoutée de 12% sur les boissons sucrées avec du sucre, les ventes se sont maintenues grâce à un marketing renforcé et à des variantes de produits proposés en petites portions.

**Changements significatifs** Un mois après l'instauration de la taxe le 1er janvier 2018, les prix des boissons sucrées imposables avaient augmenté de 16,6 à 20,6% et les ventes dans les magasins *sari-sari* (de proximité) avaient diminué de 8,7%.

**Leçons tirées** La taxe a bénéficié d'un engagement et d'un soutien de haut niveau de la part du gouvernement; le fait que la politique soit simple a réduit les possibilités d'évasion et de fraude fiscales et la prise en compte de considérations aussi bien sanitaires que non sanitaires a été utile dans l'argumentaire en faveur de la taxe.

## Resumen

### Desarrollo de un impuesto sobre las bebidas endulzadas, Filipinas

**Problema** Tanto el consumo de bebidas azucaradas como la incidencia de la obesidad han aumentado en Filipinas en los últimos años.

**Enfoque** Se presentó una propuesta de aplicar un impuesto a las bebidas azucaradas en la Cámara de Representantes y se fusionó en una propuesta de Reforma Tributaria integral para el Proyecto de Ley de Aceleración e Inclusión (TRAIN, por sus siglas en inglés) para aumentar la probabilidad de aceptación. El departamento de salud y el departamento financiero recomendaron una política que maximice los beneficios tanto para la salud pública como para los ingresos del gobierno. Para avanzar en las discusiones, el departamento de salud amplió el argumento de la salud para incluir el pobre desempeño del país en salud bucal. La Ley TRAIN aprobada adoptó el término «bebidas endulzadas» para enfatizar que el impuesto cubre tanto las bebidas endulzadas con y sin azúcar. El impuesto se fijó en 6,00 pesos filipinos (0,111 dólares estadounidenses) por litro de bebidas endulzadas. La industria azucarera presionó con éxito para que se aplicaran tasas impositivas más altas a las bebidas que contienen jarabe de maíz con

un alto contenido de fructosa, lo que resultó en una tasa diferencial de 12,00 pesos filipinos por litro.

**Marco regional** A pesar de un impuesto al valor añadido del 12 % sobre las bebidas azucaradas, las ventas se habían mantenido gracias a la mejora de la comercialización y a las variantes de productos que se ofrecían en pequeñas porciones.

**Cambios importantes** Un mes después de la implementación del impuesto, el 1 de enero de 2018, los precios de las bebidas endulzadas imponibles habían aumentado entre un 16,6 y un 20,6 % y las ventas en las tiendas *sari-sari* (supermercados) habían disminuido un 8,7 %.

**Lecciones aprendidas** El impuesto se benefició del compromiso y el apoyo de alto nivel del gobierno, que mantuvo la política simple, lo que redujo las oportunidades de evasión y elusión de impuestos, y tuvo en cuenta tanto las consideraciones de salud como las no relacionadas con la misma, lo que fue de gran ayuda para argumentar a favor del impuesto.

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## Climate change, air pollution and noncommunicable diseases

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The World Health Organization (WHO) has identified climate change as one of the greatest health threats of the 21st century, and air pollution as the single largest environmental health risk.<sup>1</sup> At the same time, noncommunicable diseases constitute the largest and fastest growing global health burden, with treatment costs placing a massive strain on government and individual resources.

The scaling up of international commitment on noncommunicable diseases over the past decade had initially focused on four risk factors: tobacco use, the harmful use of alcohol, unhealthy diet and physical inactivity. Exposure to each of these risks has a strong element of personal choice, with the responsibility often placed on individual rather than on broader societal responses. However, these risks are also strongly affected by social determinants, including commodity prices, production methods, marketing and social norms, and in the case of activity levels, the physical environment. A range of other risk factors for noncommunicable diseases are even more strongly linked to environmental exposures – and to climate change.

Therefore, together, climate change, air pollution and noncommunicable diseases represent one of the most serious threats to global health. Many of the same development patterns that lead to high reliance on fossil fuels, as well as policies and technological choices that are driving climate change (such as polluting transport and energy choices) are also worsening air pollution and other environmental exposures. These exposures have a direct and strong influence on the prevalence of noncommunicable diseases. The most obvious is air pollution. Indoor and outdoor air pollution is responsible for an estimated 7 million deaths a year<sup>2</sup> and comes second to tobacco as a risk factor for noncommunicable diseases. Air pollution has therefore been identified as the fifth major risk factor in the latest political declaration of the United Nations Gen-

eral Assembly on the prevention and control of noncommunicable diseases.

The effects of air pollution on health show that noncommunicable diseases are not exclusively due to lifestyle or personal choices, as is commonly perceived. Recommendations to stay indoors, avoid walking along particularly polluted streets or to wear facemasks during episodes of high exposure to air pollution illustrate the inadequacy of individual responses to a broad and serious problem.

The ultimate causes of air pollution, and therefore of a large proportion of the noncommunicable disease burden, are the energy sources that currently drive our transport, electricity generation, industry and food production systems.

The connection between the sources of local air pollution and the emissions that drive climate change is very clear. Estimations show that approximately 25% of urban ambient air pollution from fine particulate matter ( $PM_{2.5}$ ) is contributed by traffic, 15% by industrial activities including electricity generation, 20% by domestic fuel burning (with a remaining 22% from unspecified sources of human origin and 18% from natural sources).<sup>3</sup> Exposure to indoor air pollution is mostly due to the use of solid fuels for cooking in low-income households.<sup>4</sup> Such exposure causes almost 4 million deaths a year, of which almost 3 million are due to noncommunicable diseases such as lung cancer, chronic obstructive pulmonary disease, ischaemic heart disease and stroke.

For comparison, the International Panel on Climate Change estimates that global greenhouse gas emissions are caused by transport (14%), energy; including generation of electricity and heat (35%), industry (21%), buildings (6%) and agriculture and land use change (24%).<sup>5</sup> The sources of climate change and air pollution, and therefore a large part of the noncommunicable disease burden, are broadly the same: polluting energy systems.

Some of the same pollutants contribute both to climate change and local ambient and household air pollution. Black carbon, produced by inefficient combustion in sources such as cookstoves and diesel engines, is the second greatest contributor to global warming after carbon dioxide.<sup>5</sup> Black carbon is also a significant contributor (between 5% and 15%) of urban exposure to  $PM_{2.5}$ . The second largest contributor to global warming is methane, which reacts with other pollutants to form ozone and is responsible for 230 000 chronic respiratory disease deaths globally each year.<sup>6</sup> Both of these pollutants are short-lived in the atmosphere, meaning that targeting them for removal would have immediate beneficial effects on both climate change and noncommunicable diseases, such as stroke and deaths from cardiovascular disease. A set of 16 practical interventions, from replacing polluting cookstoves with cleaner household energy solutions, to replacing the most polluting diesel fuels and engines with less polluting ones, would prevent approximately 0.5°C of global warming, and save some 2.5 million lives a year by 2050.<sup>7</sup>

Other opportunities are available: improving energy efficiency and insulation in houses in temperate climates, therefore reducing mortality from respiratory and cardiovascular deaths in winter; transitioning from polluting solid fuels to clean and sustainable energy in low-income households, therefore reducing deaths from indoor air pollution; adopting reliable renewable energy in health-care facilities not connected to electricity grids, therefore allowing refrigeration of medical supplies and lighting for essential services.<sup>8</sup>

In the transport sector, an accelerated transition from diesel and petrol engines to electric powered vehicles would contribute to reducing emissions of local air pollutants and greenhouse gas. Much greater health gains, however, would result from replacing short urban car journeys with walking and cycling,

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due to increases in physical activity. Modelling based on systematic reviews of the health effects of increased active travel indicated that reductions in air pollution due to increased active travel could prevent 21 premature deaths per million population per year in London, and 99 per million population per year in Delhi. The gains of physical activity are expected to be even greater. As one third of adults and four-fifths of adolescents do not reach the activity levels recommended by WHO, it is estimated that the disability-adjusted life years saved from increased physical activity due to active travel policies could be 37 to 74 times higher than those saved from the reductions in air pollution.<sup>9</sup>

1) Similar considerations apply to agriculture and land use, responsible for approximately a quarter of greenhouse gas emissions. More sustainable agricultural production measures, such as reducing open burning of agricultural land, would help mitigate climate change and reduce air pollution in some regions. However, even greater gains may be obtained by reducing human consumption of meat and by reducing food waste. Even though meat and dairy make a relatively small contribution to overall human energy intake, around 60–80% of the greenhouse gas emissions from agriculture come from the livestock sector, which also has a range of additional

environmental impacts, from deforestation to water contamination and degradation of topsoil, which are increasing with the growing demand from emerging economies.<sup>10</sup> Reducing meat intake in high-consuming populations can therefore be expected to significantly reduce environmental impacts. Modeling the effect of potential strategies to meet national commitments to reduce greenhouse gas emissions from the agricultural sector in the United Kingdom of Great Britain and Northern Ireland look promising. For example, reducing livestock production and consumption of red meat, indicated that these strategies could be expected to result in a 15% reduction in disease burden due to reduced consumption of saturated fats and associated heart disease.

Even more wide-ranging effects could be brought about by fiscal policy. Studies by the International Monetary Fund show that the global production and consumption of highly polluting fuels is indirectly subsidized with over 5 trillion United States dollars (US\$) a year, which is more than all governments around the world spend on health care.<sup>11</sup> This de facto subsidy exists because the health and climate damages that they cause are not reflected in fuel prices. Approximately half of these US\$ 5 trillion are from the uncosted health impacts of air pollution, mainly from coal. Increases

ing the price of fuels, consistent with the damage that they cause to health and to the global climate system would remove this unfair advantage. Such increase would be expected to bring about a shift to cleaner energy sources that would reduce air pollution deaths by half, decrease global carbon dioxide emissions by approximately 20%, and generate about US\$ 3 trillion a year in revenue.<sup>12</sup> This revenue could be directed to socially beneficial investments, for example to universal health coverage and education.

Financial reasons should no longer constitute an obstacle to bring about these changes. In many cases, cleaner and greener technologies are now cheaper than polluting alternatives, particularly if the health gains are accounted for. Implementing such alternatives needs political will and a shift in mindsets. Fiscal, energy or transport policies need to consider the externalities on health to become tools that advance overall sustainable development.

Due to of the connections between environmental degradation and the human and financial costs of noncommunicable diseases, the health sector should have a say in related policy debates. ■

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# Systems approaches to global and national physical activity plans

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A key driver for promoting physical activity is reducing the global burden of noncommunicable diseases, particularly cardiovascular disease, cancer and diabetes. These diseases are responsible for more than 41 million deaths annually, of which a third occur before the age of 70 years.<sup>1</sup> Physical activity has multiple positive impacts on noncommunicable diseases such as heart disease, stroke, diabetes, and breast and colon cancer,<sup>2</sup> as well as numerous social and economic benefits including reduced use of fossil fuels, cleaner air and less congested, safer roads. All these effects are closely linked to several sustainable development goals.<sup>3</sup> However, policy actions have been insufficient and uneven, and government strategies to increase physical activity have not consistently increased the proportion of the adult population meeting recommended levels of activity.<sup>4</sup> Without significant scaling of efforts at local, regional, national and international levels, the global targets for physical activity are unlikely to be achieved.

In response to this lack of progress, there has been a growing recognition of the role of systems theory and accompanying tools such as systems mapping in helping to frame responses to complex public health challenges.<sup>5–8</sup> A complex systems model of public health conceptualizes poor health and health inequalities as outcomes of a multitude of interdependent elements within a connected whole. These elements affect each other in sometimes subtle ways, with changes potentially reverberating throughout the system.<sup>5</sup> In public health, systems theory has been used most extensively in work on obesity<sup>9,10</sup> and is being applied to the evaluation of the soft drink industry levy in the United Kingdom of Great Britain and Northern Ireland.<sup>11</sup>

Systems thinking provides a framework to help examine the factors involved in a problem, the relations

between these factors and changes over time; it views actions as integrated across political, social, cultural, economic and scientific domains within a system. A system is more than the sum of its parts, encompassing the interactions between these parts and the actors involved. This approach differs from traditional linear models of cause and effect that underpin much of the existing evidence base and takes account of factors such as adaptation, the ways in which a system responds to interventions within it, and feedback, which drives some of those responses.

System mapping provides a visual depiction of how the different parts of a system relate to one another. One well known example of a system map comes from the 2007 United Kingdom Government Foresight report *Tackling Obesities*, where the complex dynamic influences driving the obesity epidemic were comprehensively mapped for the first time.<sup>9</sup> Similar approaches have been used for issues such as dietary inequalities<sup>8</sup> and tobacco control.<sup>12</sup>

Physical activity promotion in recent years has increasingly adopted socioecological approaches that place the drivers of physical activity in their social and environmental context. A systems approach builds on this contextualization by adding the dynamic connections between the factors that collectively form the system, and considering the ways in which actors interact with them. A systems approach can help make sense of what otherwise might be perceived as diverse and chaotic relations between large numbers of factors and their physical, commercial, sociocultural and political contexts.

There are several potential uses for systems maps, which can provide a nuanced depiction of the multisectoral and complex nature of a problem. Paradoxically, mapping out and exposing a system by disaggregating factors that

have previously been conflated, and illustrating how they interact (or proposing potential mechanisms by which they might), may enhance and simplify understanding of the elements and processes involved. In addition, maps may be used as the basis of systems dynamics and other models to explore causal mechanisms and potential impacts of interventions. Furthermore, mapping can also support the identification of data sources for monitoring and/or evaluation.

The process of collaborating to build a map can contribute to building consensus on the nature of a problem and engagement with potential policy responses required to address it. Bringing together stakeholders involved in tackling a problem can help those actors to identify their part in a system and to appreciate better the roles of others. The process of generating a system map and the insights gained by stakeholders who do so, may be more important than the map itself, which may not have wider generalizability to other contexts.

Maps may also support the identification of important opportunities to exert influence within a system. Different kinds of leverage points for influencing a system have been suggested,<sup>13,14</sup> including: (i) structural factors, such as the presence of walking infrastructure; (ii) feedback mechanisms, such as the social benefits from volunteer-led community-based physical activity programmes such as Parkrun; (iii) system structures, for example the existence of a national coordinating agency for physical activity; (iv) goals, such as a national sports policy that has a stated aim of promoting physical activity across the population, beyond competitive sport; and (v) the overarching paradigms that define a system, for example treating transport policy as a tool for promoting healthy mobility, beyond the usual core focus of moving people and goods.

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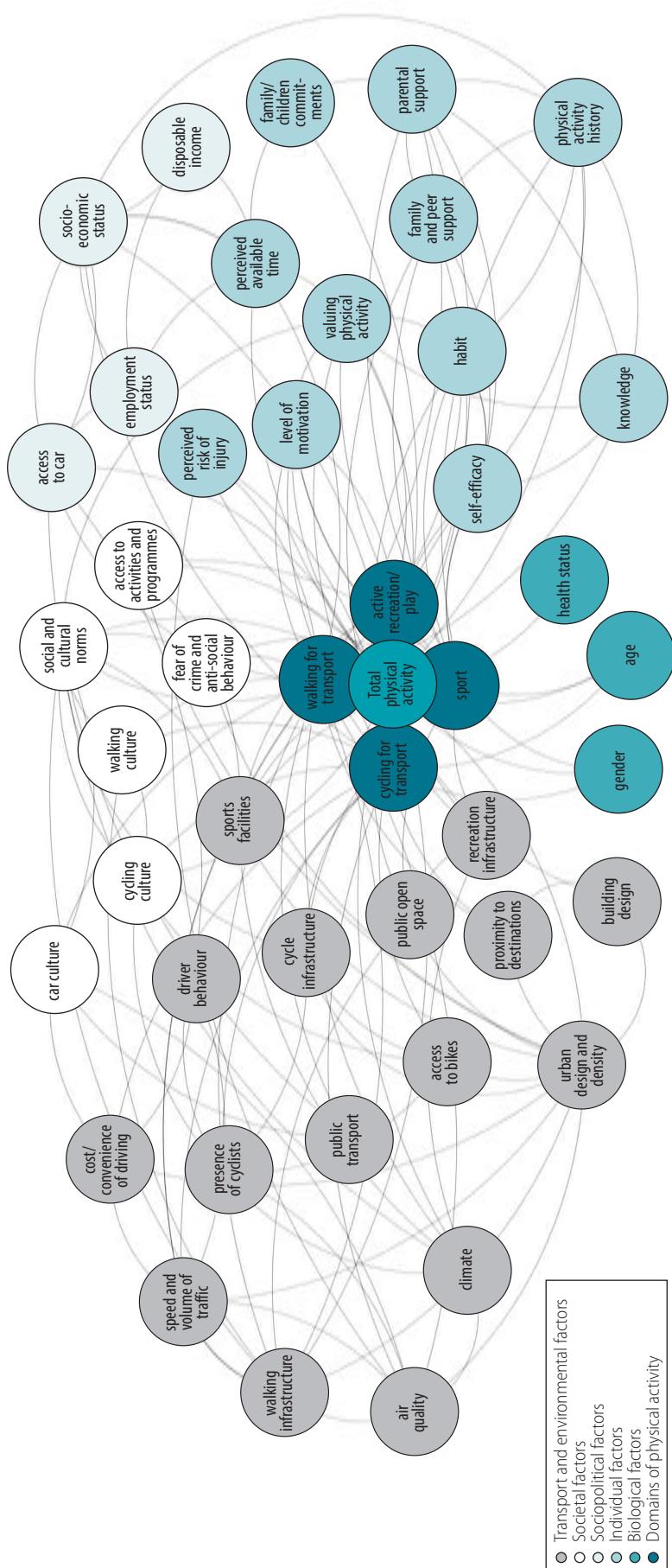
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Fig. 1. An initial physical activity system map



Note: This map provides an illustration of some of the main drivers of physical activity and inactivity, and the relations between them, based on evidence from systematic reviews and expert opinion. The map is a tool to illustrate the breadth of factors driving physical activity, and does not purport to provide a definitive description of all possible ways of conceptualizing the physical activity system.

One example of the use of such a map is seen in the development of a systems framework to support the World Health Organization Global Action Plan on Physical Activity (Fig. 1).<sup>3</sup> The key determinants or correlates of physical activity behaviour from the literature were mapped<sup>15–17</sup> and the draft map was reviewed by a panel of experts representing academia, civil society, medical and allied health sectors, transport and urban design, education and sports sectors and United Nations agencies, and adapted in response to their feedback.

The resulting map provides a visual representation of the multiple factors underpinning physical activity. The map is intended to be used to: support the implementation of the global plan on physical activity through identification of potential mechanisms for influencing the determinants of physical activity; support the identification of data sources for monitoring and evaluation; promote an integrated approach to physical activity policy that emphasizes the cross-sectoral relations involved; and act as the basis of visual tools for communicating the need for wide-ranging actions across multiple sectors and domains to support the promotion of physical activity. The map does not aim to be a formal causal loop diagram with balancing and reinforcing loops, nor does it attempt to quantify the nature of the relations between factors.

An integrated systems map, based on best available scientific evidence, can

capture and illustrate the complex nature of the multiple factors that promote or hinder an outcome such as physical activity. Conceptual models can advance our understanding of the complexity of planning comprehensive and integrated approaches to a public health issue such as physical activity. Conceptual models can also guide both selection and prioritization of actions, and help to coordinate responses to problems.

There are limitations to this kind of tool. These maps are not generally intended to provide robust quantitative descriptions of the nature and magnitude of causal relations; rather, they set out to illustrate the multiple components of a complex system in ways that have relevance for policy-makers and practitioners. There is no definitive standard against which such a map can be assessed, and another group producing a map of the physical activity system might produce different results. To date little empirical evidence exists on the value of these maps, but research to evaluate the impacts of this kind of approach is underway.

A systems map can support the development of policy and action plans to increase physical activity in several ways. Such maps can contribute to communicating the multiple factors and cross-sectoral nature of the influences on physical activity for policy-makers. The maps can illustrate the range of opportunities to implement policy actions across multiple areas to influence

the system; demonstrate the breadth of partnerships needed (including outside the health sector); identify key areas for action that may represent opportunities for significant impacts on policy; support analysis and identification of key areas and priorities for action; support the development of tailored local-level maps that include important contextual factors; help audit existing policy actions or plan new ones; and inform monitoring and evaluation.

A key value of the map is to illustrate the multiple components of an effective response to address physical inactivity in populations. Most importantly, the map shows that the notion of a single approach to increasing physical activity is misguided and inappropriate.

System maps can extend beyond socioecological models and communicate not only the actions required for effective promotion of physical activity, but also the relations between these actions. Emphasizing the interconnectedness of the key drivers of physical inactivity explicitly demonstrates the roles that multiple sectors need to play in our collective response to noncommunicable diseases. ■

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# Finance, data and technology initiatives for noncommunicable disease control

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Initiatives on finance, data and technology could provide new opportunities for the prevention and control of noncommunicable diseases because they offer resources, insights from data and new monitoring means. The World Health Organization's (WHO) independent high-level commission on noncommunicable diseases discusses the potential of these initiatives in the report *Time to deliver*, and suggests incorporating them in the commission's future working agenda.<sup>1</sup>

Potential opportunities and future applications from innovative financing and public-private partnerships, data and digitalization for health have political appeal. However, the public value and relevance of these new opportunities for the prevention and control of noncommunicable diseases require further scrutiny to ensure equity in access and distribution of resources as well as long-term financial sustainability of health systems.

Here I discuss why we should also focus on analysing the risks of finance, data and technology initiatives. Such analysis requires looking into the implications of these initiatives on national policies and determining how they relate to the global norms and policy measures on control of noncommunicable diseases.

## Finance

The increase of noncommunicable diseases, especially in low- and middle-income countries, is placing a financial burden on governments and individuals. Therefore, innovative financing mechanisms for health systems are needed. Innovative financing can be sought through new taxes and levies or more private-sector-driven new financing initiatives, such as advance market commitments, bonds and public-private partnerships. However, in their report *Research and development to meet health*

*needs in developing countries: strengthening global financing and coordination*, the WHO consultative expert working group on financing of research and development took a cautious stance to innovative financing initiatives because of the risks and costs of some of these initiatives.<sup>2</sup> Reliance on private equity investors in global health and health system financing has been questioned on the grounds of similar concerns.<sup>3</sup>

The concerns and risks associated to these initiatives are manifold. Due to the normative role of WHO and public regulatory agencies, public-private partnerships and new models of financing can also result in conflicts of interest. While new partnerships with the private sector are often seen as vital because they could generate new resources, these partnerships are broad and can include charitable foundations, non-profit organizations or transnational industries. New financing models could have unanticipated costs, such as delays in public spending or tying public health spending to a particular treatment or policy choice. New and innovative models also tend to lack evidence on impacts; for example, evidence on social and health impact bonds is limited.

Furthermore, public health budgets are large and may therefore prompt opportunistic business interests from corporations and investors as a new untapped resource. For example, if the World Bank or governments removed financial risk from investors, this could lead to an opportunistic engagement with the health sector, motivated by the low business risk. Another potentially problematic practice is adopting financial arrangements that allow deferred, contractual or conditional payments for health services and/or products. This could undermine legitimate and more sustainable alternative public policy measures, in particular with respect to access to costly new medicines and technologies. Policy-makers and

decision-makers should thus examine innovative financing initiatives both in relation to promised health benefits and to economic risks and risk sharing, public value, accountability, costs and cost-effectiveness.

Private finance initiatives for health have led to increasing costs and concerns over the limited benefits from investment and financial market-driven approaches in public policies by non-governmental and governmental actors. The Eurodad global report and analysis of public-private partnerships criticized the cost of such partnerships.<sup>4</sup> In the United Kingdom of Great Britain and Northern Ireland, the National Auditing Office concluded that private finance procurement results in additional costs compared to publicly financed procurement, the most visible being the higher cost of finance.<sup>5</sup>

When governments seek to limit the costs of novel financial initiatives, contracts or partnerships with private sector and global investors, they may not realize that these initiatives might fall under bilateral trade and investment agreements. International trade and investment agreements safeguard the interests of international investors by ensuring free movement of capital. Investment agreements enable foreign investors to claim for compensation from governments through investment arbitration if governments seek to terminate or amend existing contracts in a way that breaches any of the requirements set within these agreements. These agreements can be important if governments wish to limit profits from publicly financed services. For example, a health insurance company took Slovakia to international arbitration after it sought to limit profits in publicly funded health insurance.<sup>6</sup> Although not many health-related cases have been recorded yet, it is important to note that financing arrangements may be particularly conducive to such claims. According to

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the United Nations Conference on Trade and Development analysis, an increasing number of arbitration cases have dealt with insurances and services.<sup>7</sup>

Global health policy-makers and health ministries need to understand the broader context of finance and interest politics. Potential in using investment decisions more effectively for the control of noncommunicable diseases exists, as shown by experiences from environmental policies and tobacco control.<sup>8</sup> However, choices should be made carefully as corporations also use corporate social responsibility programmes to access and dialogue with politicians to influence policy decisions.<sup>9</sup> Therefore, governments and policy-makers must be aware of the potential conflicts of interests when partnering with the private sector and interest groups, to avoid influence from such partners on regulatory or policy decisions.

International health organizations and health ministries should consider both the potential benefits from engaging with investors and the financial market, as well as broader policy context, conflicts of interests, public value and potential costs for tax payers.

## Data and technology

The potential of data gathering, new technologies and access to a person's health and genetic data for new treatment options is high on the political agenda. However, experiences from the commercial sector suggest that business interests are the main reasons for using data collected on consumers. The case of sale of prescription data in United States of America is one example of the predominance of commercial priorities.<sup>10</sup> Increased access to more consumer and health data as such is unlikely to solve major public health problems. Analysis of large data sets will still require meaningful research questions to bring value to public health. However, access to data

can play an important role in marketing, selection and targeting of consumers. This would allow businesses and insurers to select people in terms of whom to insure, employ or provide services for, and to sell data to other corporations, investors and insurers interested in this data.

New digital technologies, robotics and artificial intelligence are increasingly marketed as tools to reduce the costs of health care, yet evidence on the impacts on costs remains limited. Benefits from new technologies tend to be more limited than what is marketed, and replacing humans by artificial intelligence can also have economic, social and ethical repercussions. A crucial question is how to understand and assess the short- and long-term health impact of new technologies. Companies, clinicians and policy-makers will need a clear framework to differentiate efficacious digital products from commercial opportunism.<sup>11</sup>

While technological advances such as the internet and mobile phones have been crucial for communication, this progress has not necessarily led to fundamental changes in health policy. Politics of hype can distract policy-makers and the public from associated financial vulnerabilities or risks when technologies fail. Innovation is necessary, but over-emphasizing innovation as a market commodity can undermine broader research for health. High expectations in new treatments can also lead to exploiting the patients' hopes, particularly in cases of cancer and rare diseases. New digital solutions, which have an impact on communication with patients, can improve quality of care but are less likely to provide major cost-savings for health systems. The intertwining of business interests and regulation on health is also a concern for the assessment of health technologies, which requires independence from the health-care industries.<sup>12</sup>

## Innovation

Access to data and knowledge can become as important for public health as access to treatment or medicines. The role of governments in regulation, financing and governing in the public interest requires innovation governance. Digitalization and use of data remain shaped by public policies, which govern innovation and how and on what basis innovations are used.<sup>13</sup> If incentives for innovation result in major new monopolies or patenting in new areas, these monopolies could imply substantial costs for the health sector.

Health ministries need to understand the implications of commercial and innovation policies on the sustainability of the financing of health systems. This is particularly important for noncommunicable diseases, since in most countries, such diseases represent a high burden on health systems and health-related spending. Key issues with respect to new technologies have not changed since the 1978 Alma Ata declaration, which placed scientifically sound, socially acceptable and universally accessible methods and technology at the core of primary health care.<sup>14</sup>

While various interest groups tend to seek specific global financing for noncommunicable diseases, the most essential factor to control noncommunicable diseases remains that of sustainable finance and governance of health systems and public policies. Health and broader public policy priorities on how to tackle noncommunicable diseases often conflict with commercial sector or investors' interests. The challenge is about engaging with the private sector, but also about ensuring that global action on noncommunicable diseases is driven by, and accountable to, global and national health policy priorities. ■

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