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Sri Lanka's health transition: past successes, unfinished business and future challenges

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Foreword

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This issue of the *WHO South-East Asia Journal of Public Health* presents a range of articles on public health in the region but has a particular focus on Sri Lanka. The country's strong performance in the Millennium Developments Goals (MDGs) related to health is well recognized, especially with regard to maternal health and child survival. As with all countries of the region, focus has now moved towards addressing the new opportunities and challenges of the Sustainable Development Goals (SDGs). In many respects, this shift from MDGs to SDGs mirrors the change in the current health priorities in Sri Lanka resulting from demographic and epidemiological transitions. It is thus timely to analyse the situation, to review lessons learnt and to help inform future actions. It was in this spirit that the *WHO South-East Asia Journal of Public Health* invited experts to assess aspects of Sri Lanka's past and future health challenges through a series of articles in this issue of the journal.

With respect to communicable diseases, commitment to the national immunization programme continues to result in high coverage, and several vaccine-preventable diseases are approaching elimination status. In neglected tropical diseases, earlier this year, Sri Lanka and Maldives were the first countries in the World Health Organization (WHO) South-East Asia Region to be declared officially free of lymphatic filariasis. As described in this issue, Sri Lanka has now applied to WHO for certification of malaria elimination, and reaching the target of elimination of rabies by 2020 now lies within grasp. Nevertheless, communicable diseases remain a threat, notably dengue, for which a comprehensive prevention and control programme has been put in place.

The burden on Sri Lanka's health system has shifted from communicable to noncommunicable diseases. As the leading causes of mortality, morbidity and disability, noncommunicable diseases carry serious socioeconomic consequences not only for the country but also for individuals and families. The urgent need to prioritize prevention and control of these diseases and to tackle their social determinants has been recognized in the *National Multisectoral Action Plan for the Prevention and Control of Noncommunicable Diseases 2016–2020*. Healthy Lifestyle Centres were introduced in 2011 as part of health-system strengthening for the early detection and management of noncommunicable diseases and their risk factors. This issue includes an analysis of progress to date with this network of centres.

Universal health coverage is not only a target but also a central tenet of the SDG on health, and thus is fundamental to all aspects of meeting the country's health-development needs. As explored in this issue, although Sri Lanka is well positioned in this area, emerging concerns about service provision and financing will need to be addressed, as will mechanisms to ensure sustainable access to medicines. A notable challenge is the gap between life expectancy and healthy life expectancy. This gap is particularly pertinent, since Sri Lanka is home to one of the fastest-ageing populations in the world. Significant work done to date has resulted in a range of policies and initiatives to meet the health-care and social-care demands resulting from this rapid demographic transition. A healthy, economically active, elderly population will be an asset in a society with a shrinking workforce. Yet, as discussed in this issue, more still needs to be done, perhaps including application of the lessons learnt from past successes in reducing maternal mortality to address community-based care of the elderly.

I hope that all readers will find this issue a useful study of the strategies by which past successes were accomplished in Sri Lanka and how future ambitions in health may be realized.

Dr Poonam Khetrapal Singh
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Editorial

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Reorienting the focus towards the Sustainable Development Goals: challenges and opportunities for Sri Lanka

Sri Lanka is a country experiencing many transitions – sociodemographic, economic and epidemiological – all of which are greatly influencing health development. In the health sector, success in the Millennium Development Goals (MDGs) was focused on certain specific health issues. A year ago, the Sustainable Development Goals (SDGs) were adopted, with an agenda of unprecedented scope and ambition that goes well beyond the MDGs they succeed. Thus Sri Lanka, as with other countries, is also experiencing the transition from MDGs to SDGs.

There are many contributors to the evolving health environment in Sri Lanka. Influencing factors include the changing sociodemography, with an ageing society; altered health behaviours influenced by globalization; open economic policies; increasing purchasing power; changing dietary patterns; and an increase in people's expectations of health-care services. The country's early response to these changes was reflected in amendments to the stewardship of health organization, with the establishment of directorates for elderly care and for noncommunicable diseases within the Ministry of Health, Nutrition and Indigenous Medicine.

Sri Lanka was on track to achieve most of the health-related MDG indicators long before the target date for accomplishment. Key results were in reduction in child mortality, improved maternal health, maintenance of a low prevalence of HIV and the elimination of malaria.[1] Notably, the health-care-delivery system performed particularly well in response to the challenges in maternal and child health that prevailed several decades ago, and this was reflected in the achievements of the MDGs. The system now needs to be reviewed for its capacity to meet new challenges, mindful that improving maternal health and child survival remain within the SDG targets as part of the "unfinished MDG agenda".

Nutritional status is a key contributor to overall health for sustainable development. For Sri Lanka, the specific nutrition challenge of the MDG indicator on the prevalence of underweight children aged less than 5 years was not sufficiently met. National programmes have been instituted to address iron status and iodine deficiency and need further review. Several interventions are also ongoing to monitor body mass index through existing maternal and child health programmes, school health programmes, adolescent health programmes and the Healthy Lifestyle Centres.

The country is noted for its high enrolment in the education system without gender disparity. Sri Lanka can further benefit from the opportunities provided by this key social determinant to influence positive behaviours for health. Female empowerment is considered a key contributor to improvements in maternal and child health. In Sri Lanka, this link is reflected in the declining level of teenage pregnancies at the subnational level.[1] However, although Sri Lanka is considered to have high health-system performance among its regional counterparts, it has to be cognisant of obvious disparities in the unmet need for family planning and knowledge gaps around HIV among young people. Such issues can be tackled through well-targeted national school-education programmes. The school system can also be harnessed to promote positive attitudes to health, modify risk behaviours for chronic noncommunicable diseases and create healthy environments.

The MDGs were seen to be less powerful in creating these multisectoral linkages that are now being considered in the agenda for sustainable development. Opportunities exist for Sri Lanka, not only through high-school enrolment, but also through its existing national programme for school health.[2] This programme largely focuses on school medical inspection, and national programmes that encourage participation of the school community in adopting positive health attitudes and behaviours should be built into the school curriculum for development of life-skills.[3]

The sociodemography and economy of Sri Lanka largely benefited from the success in controlling malaria. Today, Sri Lanka has reached elimination status with no indigenous cases reported since 2012. The challenge now lies in migration and exogenous cases.[4]

Lessons learnt from the monitoring of MDGs indicate that multisectoral linkages need specific focus. Progress on the MDG indicators was largely monitored via sectoral reporting. Since Sri Lanka was seen to be achieving some important targets early, the initial target-setting to some extent affected enthusiasm for tracking activities; thus rigorous monitoring was not regarded as a priority. The SDGs[5] give each country the opportunity to set its own national targets, which should enable capture of the multisectoral inputs required to achieve positive health outcomes. A key challenge is therefore the formulation of systems for monitoring and evaluation that encourage multisector analysis. While the MDGs were selective and did

not address the total health-development needs for the country, the SDGs are seen to be more accommodative and give the opportunity to construct indicators tailored to the local context of health and social determinants. Sri Lanka is currently preparing its National Health Performance Framework, which identifies national needs for assessment of health performance and includes health-related indicators that are relevant to the SDGs.

Sri Lanka has been noted for having an efficient health-care model that delivers good health outcomes at low cost.[6] The government continues its commitment to provide free health care to all its citizens, with high utilization of health care through government health facilities. National heath accounts reveal that out-of-pocket expenditure on health is around 40% of the country's total health expenditure. The government is of the view that the current health burden is contributing to household-level out-of-pocket expenditure and health financing needs to address this challenge to sustain a free health system.

Universal health coverage is a key strategy for accomplishment of Goal 3 of the SDGs, "Ensure healthy lives and promote well-being for all, at all ages".[5] Sri Lanka is revisiting its position on universal health coverage, which has shown commendable achievements in the past for maternal and child health care and communicable diseases. The system of health-care delivery places emphasis on preventive aspects, through a community health-service structure where medical officers, together with field health staff, are accountable for the achievement of community health care for a defined population within geographical boundaries. Similarly, primary-level curative care is available through the 965 institutions where medical officers provide care. Specialized institutions available throughout the country support the primary care system. A public health-care institution that provides free health care is available to every citizen within a 3 km radius.[7] Sri Lanka plans to make further improvements in primary care access through the large network of curative care facilities, by reorienting and reorganizing its health services, with the aim of providing greater access to care needs relevant to the changing health burden in the country. A more family-centred, personalized and continuing-care model, with optimum use of primary and specialized care, is planned for the future, and it is expected that this will ensure the health contribution to sustainable development.

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Maintaining momentum in Sri Lanka to ensure that malaria is gone – but not forgotten

Sri Lanka's control of malaria is a public health success story but continued efforts are needed to ensure these gains are not lost: *Chathuri Dissanayake* reports

Beruwala, Sri Lanka – When a member of the Beruwala gem merchants' community starts to run a fever, one of the first calls made is to the Anti Malaria Campaign headquarters in Colombo. These merchants, who constantly travel between Madagascar and Sri Lanka to trade, are now aware that they face a high risk of contracting malaria.

"We always ask the doctors at the hospital to test for malaria if we run a fever", says Mohamed Shiraz Nabhan, a gem merchant in Beruwala. "We first got to know about malaria when we started going to Madagascar in 2008 to buy rubies from the new gem mine there", he explains. "We had earlier heard about the fever, but since it was not common in these parts we knew nothing about it."

> **"It is important to follow up [these cases], as the country is now in the elimination phase"**
> *Dr Kamini Mendis*

It was only when a gem merchant developed an unusual fever during a business trip to malaria-endemic Madagascar that the community became aware that their regular business trips were putting them at risk. As a result, Nabhan often takes the initiative to coordinate with the Anti Malaria Campaign headquarters in Colombo if a community member is suspected of having malaria. The malaria programme, which is run by the Sri Lanka Ministry of Health, Nutrition and Indigenous Medicine, conducts extensive monitoring activities once a case is reported.

"It is important to follow up [these cases], as the country is now in the elimination phase", explains Dr Kamini Mendis, an independent consultant in malaria and tropical medicine and former coordinator of malaria treatment and malaria elimination at the World Health Organization (WHO) headquarters in Geneva.

After extensive control activities conducted by the Anti Malaria Campaign over several decades, the disease has finally been brought under control in Sri Lanka. The country recorded its last indigenous case of malaria in October 2012 and the Minister of Health, Nutrition and Indigenous Medicine has applied to WHO for certification of malaria elimination. This certification is the official recognition by WHO of a country's malaria-free status.

With indigenous malaria successfully halted, the focus is now on preventing reintroduction of the disease and managing imported cases, says Dr Risintha Premaratne, Director, Research of the Ministry of Health, Nutrition and Indigenous Medicine and the national coordinator for preparation for WHO malaria-free certification.

HISTORY OF MALARIA IN SRI LANKA

Indigenous medical records indicate that Sri Lanka's experience with malaria spans many centuries; indeed, it is believed that malaria was the "pestilence" that devastated the then-capital Anuradhapura in 300 CE. The biggest recorded outbreak of malaria was in 1934–1935, with an estimated nearly 1.5 million patients and 80 000 deaths. As a result of extensive eradication activities, including the introduction of indoor residual spraying, in subsequent decades the country saw a massive reduction in the number of malaria cases, to only 17 documented cases in 1963. However, factors such as reduced surveillance, persistence of undetected malaria transmission, extensive internal population movements and reallocation of funds away from the malaria programme resulted in a resurgence of the disease and a major epidemic during 1967–1968, although this time mortality was very low, as the epidemic was almost exclusively *Plasmodium vivax* malaria and antimalarial drugs were readily available.

Although activities were scaled up and a control programme initiated, thereafter significant numbers of cases were reported annually until 1999, with major epidemics in 1987 and during 1990–1992. The reduction in the number of malaria cases from 2000 onwards, plus the end of the civil conflict in 2009, led to a national programme aimed at elimination of malaria by 2014. Extensive surveillance, prevention and control activities, and decentralization of the implementation of the malaria programme, resulted in elimination being reached 2 years prior to the target, in 2012. This achievement is particularly notable, given the major operational challenges resulting from armed conflict between the Sri Lankan national forces and the separatist Liberation Tigers of the Tamil Eelam (LTTE) since 1983, which only concluded in 2009.

CONFLICT AND MALARIA

"The last outbreak of malaria [in Southern Province] was recorded in Katagamuwa army camp in 2009, and we managed to contain it within the camp", recalls Hambantota Regional Malaria Coordinator, Lalanithika Peiris. Hambantota district, a coastal district in Sri Lanka's dry zone, was one of the districts that were worst affected by malaria in the 1990s, recording epidemic levels. "It was difficult for us to carry out control activities, and we realized indoor residual spraying – a standard method used in malaria control – is not effective in controlling the outbreak in the camp, as soldiers spent most nights deployed in the Yala jungle, where they are exposed to the mosquitoes", she explains.

To address this issue, the malaria-control team conducted a larvicide programme along a 35-km stretch of the Kumbukkan Oya river, which was identified as a the main mosquito breeding site. This proved to be an arduous task, says Peiris. The malaria-control officers could not go into the jungle area alone, and covering 35 km within the 2-week time period for the larviciding to be effective was impossible for the small team.

As a solution, Peiris discussed with the area commander and enlisted the support of the army personnel to carry out the activities. "We taught the soldiers to how to carry out larvicide activities, assist in entomological surveillance, treatment methods and [how] to carry out monitoring activities thereafter", she says. In addition, the soldiers who contracted the disease were given leave only after their course of directly observed treatment was completed while in the camp. This proved to be effective, as the outbreak was contained within the camp.

WHO/Amila Gamage

Hambantota Regional Malaria Coordinator, Lalanithika Peiris

"It could have caused a huge outbreak if the infected soldiers were given leave, as the soldiers were from different parts of the country, and the disease could have spread", explained Chandradasa Weerasooriya, public health inspector, who worked as a field assistant in the team that responded to the outbreak.

Prior to the last recorded indigenous case in 2012, the majority of malaria cases occurred among military personnel stationed in the malaria-prone northern and eastern parts of the country. This led to a strong involvement of the Ministry of Defence in malaria-control activities. The cooperation of the security forces was also needed, to conduct malaria-control activities in the conflict-affected areas of Sri Lanka prior to 2009.

During the conflict, outbreaks occurring in LTTE-controlled areas were also managed effectively through collaboration. During that time, many international aid and volunteer groups were engaged in relief activities in the areas controlled by the LTTE, for example, Kilinochchi district in northern Sri Lanka. "The government used to send us supplies for spraying and other control activities, and we would coordinate with the group in control in the area to carry out the activities. We were never prevented from doing our job", recalls Saminathan Thushyanthan, who worked as a volunteer for Médecins Sans Frontières in 2006. He is now employed as a public health laborarory technician in the Kilinochchi Regional Office of the Anti Malaria Campaign .

Similarly, during the Janatha Vimukthi Peramuna insurrection during the late 1980s and 1990s, the members of the anti-malaria team were never hindered from carrying out their duties. "We had a team of young men carrying out entomological surveillance activities in Hambantota – the heart of [the] insurgency campaign during the time; still not a single member of the team was ever obstructed from doing their work", recalls Mendis, who ran a 24-hour malaria clinic in the region at that time. "The importance of our work was acknowledged by all parties", she explains. This acceptance led to the success of the malaria-control efforts, she notes.

CURRENT STATUS AND NEW PRIORITIES

With the country now in the elimination phase, a significant threat to these efforts is the risk of resurgence resulting from imported cases. The Anti Malaria Campaign now places great emphasis on monitoring and surveillance activities to prevent reintroduction and has identified different at-risk groups. One such at-risk group is people who frequently travel between malaria-endemic countries and Sri Lanka, such as the gem traders in Beruwala. Other travellers visiting the country from malaria-endemic countries also pose a serious threat. The Anti Malaria Campaign has now refocused, to ensure that areas that record a high number of tourists are also covered in their surveillance activities.

Several countries in south Asia are also at the near-elimination stage, and would benefit from an information-sharing

network, Premaratne says. For example, Sri Lanka receives a lot of visitors from India, travelling through both regular and irregular channels. "If we know in which areas malaria is prevalent in India and we are able to identify travel trends, then we would be in a better position to carry out surveillance and control activities", he notes, adding that this calls for more collaboration between countries to manage anti-malaria activities effectively.

Another at-risk group is returning refugees, who were in refugee camps, mainly in India, many of whom have been exposed to malaria in India. To address the issue, compulsory testing has been made a part of their reintegration programme, explains Dr M Mahendran, the Regional Malaria Officer (RMO) in Vavuniya, a district in northern Sri Lanka, where large numbers of returnee refugees reside.

WHO/Amila Gamage

Public health inspector, Chandradasa Weerasooriya

"A record is maintained on the malaria testing of each returnee, where officers carry out the test at four different time points to ensure there is no infection", Mahendran explains. "The government reintegration assistance is not released if the form is not complete. This ensures that testing is done." The returnees are also given information about the risks and prevention methods, by the malaria officers who conduct the tests. Added to this mix are the refugees that come from other countries. On several occasions, the Anti Malaria Campaign has collaborated with the Sri Lanka Navy to treat refugees stranded in boats off the Sri Lankan coast.

The Anti Malaria Campaign carries out extensive follow-up activities when an imported case is reported, to eliminate any possibility of reintroduction. For example, in 2013, two children from a community of asylum seekers from Pakistan, living in a traditionally malaria non-endemic area in the Western Province, were diagnosed with malaria. The Anti Malaria Campaign coordinated active surveillance, which allowed detection and treatment of a cluster of malaria cases in this particular community.

The Anti Malaria Campaign continues to conduct door-to-door testing in formerly endemic areas of the country, where the risk of resurgence remains high, owing to the presence of relatively high numbers of the mosquito vectors and other factors favouring malaria transmission. These activities mirror those done during epidemic periods and include rigorous monitoring and frequent blood testing. Mobile clinics equipped to test, diagnose and treat patients are also used. When needed, these can also be deployed immediately to the relevant area when an imported case is reported.

ENSURING MALARIA DOES NOT BECOME A "FORGOTTEN" DISEASE

Despite these efforts, Premaratne harbours a deep concern that malaria is becoming a "forgotten" disease in Sri Lanka. In many parts of the country, including districts in the dry zone where the disease was formerly endemic, the younger generation is not familiar with the disease, and is not aware of the threats, he notes. This lack of awareness also extends to Sri Lanka's health-care workers. Since the indigenous burden of malaria is zero, when a patient presents with fever, malaria is not high on the list of differential diagnoses. If a health professional overlooks the possibility of malaria infection, thereby delaying diagnosis, the life of the patient is put at danger and the country risks a reintroduction. To mitigate this possibility, the Anti Malaria Campaign now carries out awareness programmes for both private health-care professionals and those practising in the state hospital system.

Last, but not least, is the serious worry for the Anti Malaria Campaign of running out of funding for the essential surveillance activities. "I fear that this may be the beginning of the end. Once malaria-free status certification is obtained from WHO, we may not get funds from the Global Fund to Fight AIDS, Tuberculosis and Malaria, and the government may also cut down on funds as there are other disease-control activities that need attention as well", Mendis highlights.

Regional teams of the Anti Malaria Campaign already carry out control activities for dengue, another mosquito-borne disease, which is now a leading public health problem in the country. Mendis fears that resources may be reallocated to focus more on such control activities, pushing the activities of the Anti Malaria Campaign behind, which could result in a situation similar to the 1969 resurgence.

However, the Director-General of Health Services in the Ministry of Health, Nutrition and Indigenous Medicine, Dr Palitha Mahipala, assures that such cut-backs will not happen. According to him, the Ministry of Health, Nutrition and Indigenous Medicine already funds 60% of the Anti Malaria Campaign programme, and plans to fulfil all funding requirements in the future. ■

Perspective

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Universal health coverage and the health Sustainable Development Goal: achievements and challenges for Sri Lanka

Amala de Silva[1], Thushara Ranasinghe[2], Palitha Abeykoon[3]

ABSTRACT

With state-funded health care that is free at the point of delivery, a sound primary health-care policy and widespread health-care services, Sri Lanka seems a good example of universal health coverage. Yet, health transition and disparities in provision and financing threaten this situation. Sri Lanka did well on the Millennium Development Goal health indicators, but the Sustainable Development Goal (SDG) for health has a wider purview, which is to "ensure healthy lives and promote well-being for all at all ages". The gender gap in life expectancy and the gap between life expectancy and healthy life expectancy make achievement of the health SDG more challenging. Although women and children do well overall, the comparative health disadvantage for men in Sri Lanka is a cause for concern. From a financing perspective, high out-of-pocket expenditure and high utilization of the private sector, even by those in the lowest income quintile, are concerns, as is the emerging "third tier", where some individuals accessing state health care that is free at the point of delivery actually bear some of the costs of drugs, investigations and surgery. This cost sharing is resulting in catastrophic health expenditure for individuals, and delays in and non-compliance with treatment. These concerns about provision and financing must be addressed, as health transition will intensify the morbidity burden and loss of well-being, and could derail plans to achieve the health SDG.

Key words: gender gap, healthy life expectancy, out of pocket, Sri Lanka, Sustainable Development Goals, universal health coverage

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BACKGROUND

As Sri Lanka grapples with demographic and epidemiological transition and tight budgetary constraints, it is essential for policy-makers to evaluate the achievements and challenges in attaining universal health coverage (UHC) and the Sustainable Development Goal (SDG) for health.[1] UHC is defined by the World Health Organization (WHO) as ensuring that "all people can use the promotive, preventive, curative, rehabilitative and palliative health services they need, of sufficient quality to be effective, while also ensuring that the use of these services does not expose the user to financial hardship".[2]

The SDGs were adopted by the United Nations General Assembly in September 2015.[3] Of the 17 goals, Goal 3 is to "ensure healthy lives and promote well-being for all, at all ages". Overall, Sri Lanka achieved good outcomes on Millennium Development Goal (MDG) health indicators but failed to reduce malnutrition significantly.[4] The wider purview of the SDGs, covering all ages, all health conditions and all determinants of health, will make them more challenging for Sri Lanka to reach. Achievement of UHC is not only an SDG target in itself but also underpins success in meeting the other SDG health targets. As the SDG declaration says, "To promote physical health and well-being, and to extend life expectancy for all, we must achieve universal health coverage".[3] This paper assesses progress towards, and potential threats to, attaining UHC and the SDG for health in Sri Lanka.[1]

SRI LANKA TODAY

The Sri Lankan health system has been recognized internationally since the 1970s as a highly successful low-cost model. This achievement was built on the foundations of a health-care system that has been free at the point of delivery since 1951; a sound primary health-care approach since the mid-1920s (significantly in advance of the *Declaration of Alma-Ata* in 1978);[5] establishment of close-to-client primary health-care services as a consequence of universal adult franchise since 1931; and high female literacy. Although Sri Lanka is therefore well positioned to achieve UHC, current

demographic, epidemiological and economic transitions are challenges to ensuring universal and equitable health financing and care provision.

Sri Lanka is a lower-middle-income country, and has excellent life expectancy and indicators for neonatal, infant, under-five and maternal mortality.[6] Data from the *World Health Statistics 2015* include average indicators for countries by income group and allow comparison of Sri Lankan data with the averages for upper-middle and high-income countries (see Table 1).[6] Sri Lankan indicators are better than those of the average upper-middle-income country category (World Bank classification of gross national income [GNI] per capita of more than US$ 1045 but less than US$ 12 736, with the upper and lower cut-off value, respectively, being US$ 4125)[7] and close to those of the high-income country category (GNI per capita of US$ 12 736 or more), while being classified as a lower-middle-income country with a per capita gross domestic product (GDP) of US$ 3912 in 2015.[8] Sri Lanka also performs better than the average for female life expectancy for an upper-middle-income country, and equally well for male life expectancy but less well with respect to healthy life expectancy (see Table 1).[6] The gap between life expectancy and healthy life expectancy is greater in Sri Lanka than in the upper-middle- and high-income countries, reflecting the country's relatively high burden of disease (see Table 1).

Women and children do well

Improving maternal health and child survival remain within the SDG targets as part of the "unfinished MDG agenda". *World Health Statistics 2016* reports the maternal mortality ratio as 30 per 100 000 live births for Sri Lanka in 2015 (with the 2030 SDG global goal as 70 per 100 000).[9] In addition, 93% of pregnant women have four or more visits for antenatal care and 99% of births are attended by skilled health personnel. Institutional deliveries make up 99.9% of the total number reported.[10] The proportion of married or in-union women of reproductive age using modern family-planning methods is 69.4%, while the rate of adolescent births (per 1000 women aged 15–19 years) was 20.3 in Sri Lanka, compared with an overall average of 33.9 for the WHO South-East Asia Region.[9]

Sri Lanka's neonatal and infant mortality rates for 2015 are 5.4 and 9.8 per 1000 live births – well below the new SDG health targets of 12/1000 and 25/1000, respectively.[9] Two recent developments should further improve neonatal mortality rates: first, a recommendation that first births should occur at base- or higher-level hospitals; and second, the fact that, following a successful pilot introducing vehicles and staff equipped to transfer preterm and critically ill neonates to a neonatal intensive-care unit at Lady Ridgeway Hospital for Children, Colombo, the service is being rolled out nationally.[11]

Disparities in health between men and women

To explore the male factors in Sri Lanka that are relevant to UHC, it is useful to compare with Canada, a high-income country with good health performance and social health insurance. Life expectancy in Sri Lanka compares relatively well with that for Canada: 80 years and 84 years respectively for women, and 72 years and 78 years respectively for men.[6] The gender gap in Sri Lanka is greater than for Canada, reflecting a greater health disadvantage for men in Sri Lanka. From the WHO estimates of disability-adjusted life-years (DALYs) for 2012,[12] the DALYs per 100 000 can be calculated as 34 389 and 26 416 for Sri Lankan and Canadian men, respectively. The equivalent data for women are very similar: 23 967 for Sri

Table 1. Key indicators for Millennium Development Goals and Sustainable Development Goals for Sri Lanka[1] versus upper-middle-income and high-income country estimates as reported in *World Health Statistics 2015*[6]

Indicator	Sri Lanka	Upper-middle-income country average	High-income country average
Life expectancy at birth, years			
Male	72	72	76
Female	78	76	82
Both sexes	75	74	79
Healthy life expectancy at birth (both sexes), years	65	66	70
Mortality rate per 1000 live births			
Neonatal	5.9	9.7	3.5
Infant	8.2	15.6	5.3
Under 5 years	9.6	19.6	6.3
Maternal mortality ratio (per 100 000 live births)	29	57	17

Source: World Health Statistics 2015.[6] Data are for 2013. (*World Health Statistics* 2016 does not report these statistics by income-group.)

Lanka and 23 934 for Canada. Although there are biological and behavioural health differences for the sexes, preventive and curative health-care provision may also differ, such that male health needs are insufficiently addressed. Addressing this concern will be key to achieving UHC and this is discussed later in this paper.

When the data are disaggregated by disease types, as expected, the figure for Sri Lanka is much higher in the category of communicable diseases and maternal, perinatal and nutritional disorders, at 4128 DALYs per 100 000 in Sri Lanka compared with 1341 DALYs per 100 000 in Canada.[12] The male and female DALYs per 100 000 in this category are 4625 and 3652 for Sri Lanka and 1390 and 1292 for Canada. The SDG health targets also include noncommunicable diseases and injuries. For noncommunicable diseases, the burden is very similar for both countries (20 635 per 100 000 for Sri Lanka and 21 775 per 100 000 for Canada). However, in Sri Lanka, 56% of the total DALY burden of noncommunicable disease is in the age group 0–59 years, compared with 46% in Canada (higher percentage in Sri Lanka for all but the 70 years and older category).[12] This finding could reflect earlier onset of noncommunicable diseases and greater severity. This is probably a result of delays in diagnosis.[13]

Sri Lanka's burden of disease from injuries is 4303 DALYs per 100 000, double that of Canada. The difference between sexes is striking in Sri Lanka: the DALY burden for injuries in males is triple that for females.[12] Road traffic mortality is also extremely high in Sri Lanka: 17.4 per 100 000 population, compared with 6.0 per 100 000 in Canada.[9]

ACHIEVING UNIVERSAL HEALTH COVERAGE

UHC is considered the core of the overall SDG health goal. It is concerned with coverage of the population by quality essential health services, along with financial protection, with a focus on equity. A UHC monitoring framework developed by WHO and the World Bank uses two indicators: a coverage index for essential health services, disaggregated where possible by key stratifiers, and a measure of lack of financial protection.[9,14] The coverage index has four groups of tracer indicators: reproductive, maternal, newborn and child health; infectious diseases; noncommunicable diseases; and service capacity and access.

Service provision

As already described, Sri Lanka scores well on the indicators for reproductive, maternal, newborn and child health.[9,10] With respect to service provision for infectious disease, indicators are good overall. Estimated DALYs for lower respiratory tract infections are relatively low at 21.8 and 4.5 per 1000 population, for the age groups 0–4 years and 5–14 years respectively.[11] However, no data exist in relation to health-seeking behaviour for child pneumonia – the single largest infectious cause of death in children worldwide. The incidence of tuberculosis is 65 per 100 000 and the prevalence of HIV is low (<0.1 per 1000 uninfected population),[9] but Sri Lanka scores poorly for antiretroviral treatment for HIV, with only 18% coverage among people living with HIV.[6] Following implementation of intensive control measures, Sri Lanka has not had a local (i.e. non-imported) case of malaria since 2012.[15] Improved water and sanitation sources are used by 96% and 95% of the population, respectively.[9]

Sri Lanka fares less well in terms of provision of services to prevent noncommunicable disease. For example, screening for cervical cancer using the Papanicolaou smear test was initiated at community level in 1996, via "well woman clinics". However, there have been many deficiencies in the programme and high rates of hospital admission for advanced stages of cervical malignancies persist.[16] The age-standardized prevalence of tobacco smoking among persons aged 15 years and older was 28.4% for males and 0.4% for females in 2015.[9] A worrying trend, however, is the prevalence of current tobacco use among adolescents aged 13–15 years, which is 15.7% for males and 5.4% for females.[6] In 2011, the Ministry of Health addressed the lack of a structured screening service for noncommunicable diseases, with the introduction of Healthy Lifestyle Centres.[17] In the same year, the Ministry of Health also recognized that the existing structure for curative health-care service needed to transition from episodic patient management to a continuing-care model that is more appropriate for noncommunicable diseases. Following pilots, a new organizational structure "the shared care cluster system" has been proposed, to accommodate the additional burden of noncommunicable diseases. Services will be grouped around a hospital providing specialist care at the apex, with primary-care curative institutions at divisional and primary levels.[18]

The state provides a free medical health-care facility within 4.8 km of every household and a health-care facility can be found, on average, not further than 1.4 km from any home.[10] Universal adult franchise in 1931 resulted in a demand for hospitals close to communities, with rapid growth of a widespread network of government hospitals. The emergence of the private health-care system since 1977 widened the options for access to basic hospital services. The density of doctors, nurses and midwives per 10 000 population was 30.5 in 2012. Although this is above the minimum density threshold set by the 2006 *World Health Report* of 22.8 skilled health professionals/10 000 people to provide the most basic health coverage,[19] it is relatively low, particularly with regard to the increased need for nursing staff in response to health transition.[20] The provincial maldistribution is also striking and needs to be rectified through systematic human-resource planning and training programmes.[21]

A nationwide survey of the availability of 100 essential medicines found that in government hospitals in three of Sri Lanka's 25 districts, the availability of 12 essential drugs for noncommunicable diseases was only 75% (personal communication, unpublished data). The mean availability of the 100 medicines was 73.2% in the government sector, while in the private sector it was 81.3%. A situational analysis of medicines' supply, selection, use, regulation and policy in Sri Lanka, conducted by the WHO Regional Office for South-East Asia and the Ministry of Health in 2015, found that the availability of essential drugs was over 90% in teaching

hospitals but was 72–79% in lower-level facilities,[22] while a World Bank study found that only 57.5% of primary health-care institutions had a one-month buffer stock of 16 selected drugs for noncommunicable diseases.[23]

Equity of access by income quintile

Is access to health facilities equitable across the income distribution? Sri Lanka's Department of Census and Statistics publishes Household Income and Expenditure Survey (HIES) reports periodically. Analysis of the most recent data available, from HIES 2012/2013, suggests that there are minimal disparities in proximity to services among income quintiles (see Fig. 1).[24] However, the pattern of care differs among quintiles, with the highest-income quintile using a higher proportion of private care. Notably, the use of private care is also significant in the lower-income quintiles; as discussed below, this is probably partly a result of non-availability of public services outside standard working hours. Further, analysis of data from the HIES 2012/2013 shows that private outpatient care is more widely spread geographically than state-sector outpatient facilities.[24] These private outpatient locations include a range of facilities, from home-based makeshift clinics run by individuals to more established group practices and hospitals. They could involve full-time or part-time private practitioners, or government doctors working in their off-duty hours.

Equity of access by gender

Could the health disadvantage for men in Sri Lanka be partly attributed to differences in utilization of health services? The constraint faced by men is that most state outpatient and clinic services are provided on weekday mornings and afternoons. The lack of an appointment system in most hospitals adds to this problem, causing queuing and long waiting times for consultations, diagnostic services and dispensing of drugs.

Labour-force participation rates of men and women in Sri Lanka were 74.6% and 34.7% respectively in 2014.[25] Of the employed men, 62.4% work in the informal sector. Accessing government-sector outpatient and clinic services often involves sacrificing daily wages. This acts as a deterrent to men seeking government health care, resulting in aggravation of the severity of illness and delayed care.[13]

HEALTH-FINANCING BURDEN

The outstanding-health financing features in Sri Lanka are the heavy reliance on the private sector, involving out-of-pocket expenditure (43.9% of total health expenditure was private health expenditure in 2014, despite a system of health provision that is free at the point of delivery),[26] and the predominance of out-of-pocket payments, which formed 95.8% of private health

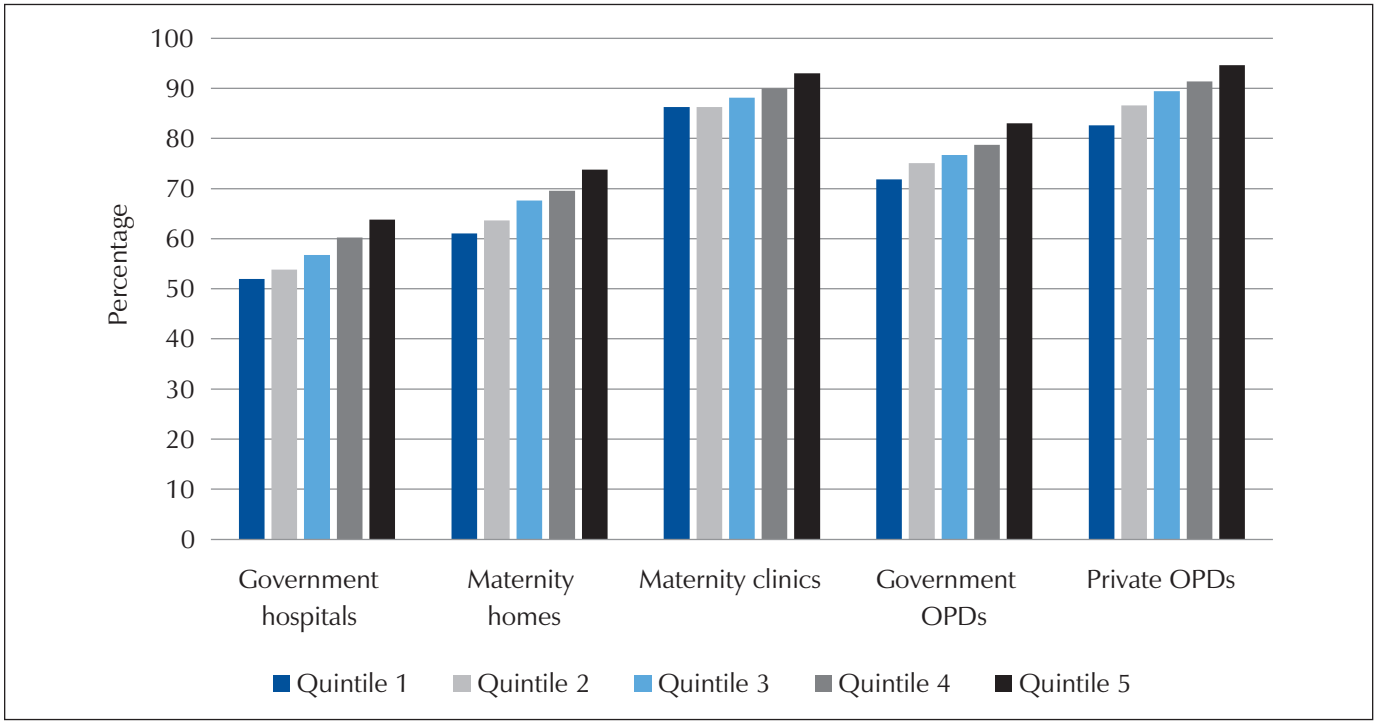

Fig. 1. Proximity of health facilities by type and income quintile

OPD: outpatient department.
Quintile 1 = lowest income, quintile 5 = highest income.
Maternity homes involve deliveries and inpatient care; maternity clinics only provide outpatient encounters during pregnancy; private OPD refers to consultation with specialists or general practitioners at private hospitals.
Source: Based on data from the Department of Census and Statistics Household Income and Expenditure Survey 2012/2013.[24]

expenditure in 2014.[26] This high dependence on out-of-pocket payments results in households lacking financial protection, making them susceptible to impoverishment and catastrophic health expenditure.[27]

Private-sector utilization

From the pre-independence era (before the 1950s), Sri Lanka has had a strong state sector (first tier),[28] with only a minuscule private sector. The liberalization of the economy in 1977 resulted in specialists and medical officers being given the right to undertake private practice outside their working hours. This led to rapid development of the private health-care system (the second tier involving dual affiliation of state-sector health personnel) in the country.[29] This included large private hospitals, small outpatient clinics, laboratories, imaging centres and pharmacies. It provided patients with greater choice, though the two-tier system led to inequities in services and outcomes.[30] The high level of utilization of this second tier, even by those in the lowest two income quintiles, is evident in Fig. 2.[24,30]

"Push" and "pull" factors determine the choice of treatment source. Long outpatient waiting time, long delays in accessing inpatient care/surgery, drug shortages, and lack of laboratory and scanning facilities are pushing households to utilize private care. Among the pull factors, a major determinant is the time involved in accessing care. Most private health-care provision occurs outside normal working hours, not necessitating a loss of earnings to patients and caregivers. Other pull factors include the ability to gain "specialist" care and individual choice of a specific health-care provider.

Private health care is widespread, mainly as a result of medical officers and specialists undertaking private practice in off-duty hours, and is mainly financed through out-of-pocket spending. This is a major determinant of the high cost of health care in the country. Dual affiliation is also argued to create inefficiencies in the state sector, and is one of the major deterrents to implementing noncommunicable disease clinics and outpatient services in state hospitals in the evening.

Emergence of the third tier

The discussion regarding the health-financing burden on households is made more complex by the emergence of what is termed the "third tier" in Sri Lanka. In this paper, the third tier is defined broadly as payment to a private party for obtaining goods or services, as part of accessing state-sector services. There are two types. In the first, payments are made for medicines or laboratory services that should be covered as part of the service that is provided free at the point of delivery. In the second, costs are borne for goods and services that are needed to complement the free service but are not currently covered by state funding. Examples include purchase of intraocular lenses for cataract surgery, pins for bone-fracture repair, coronary stents, additional scans and blood tests, and higher-quality drugs. A 2012 study done under the Social Determinants of Health project found that, in state facilities, cardiac troponin assays were performed on more than 75% of

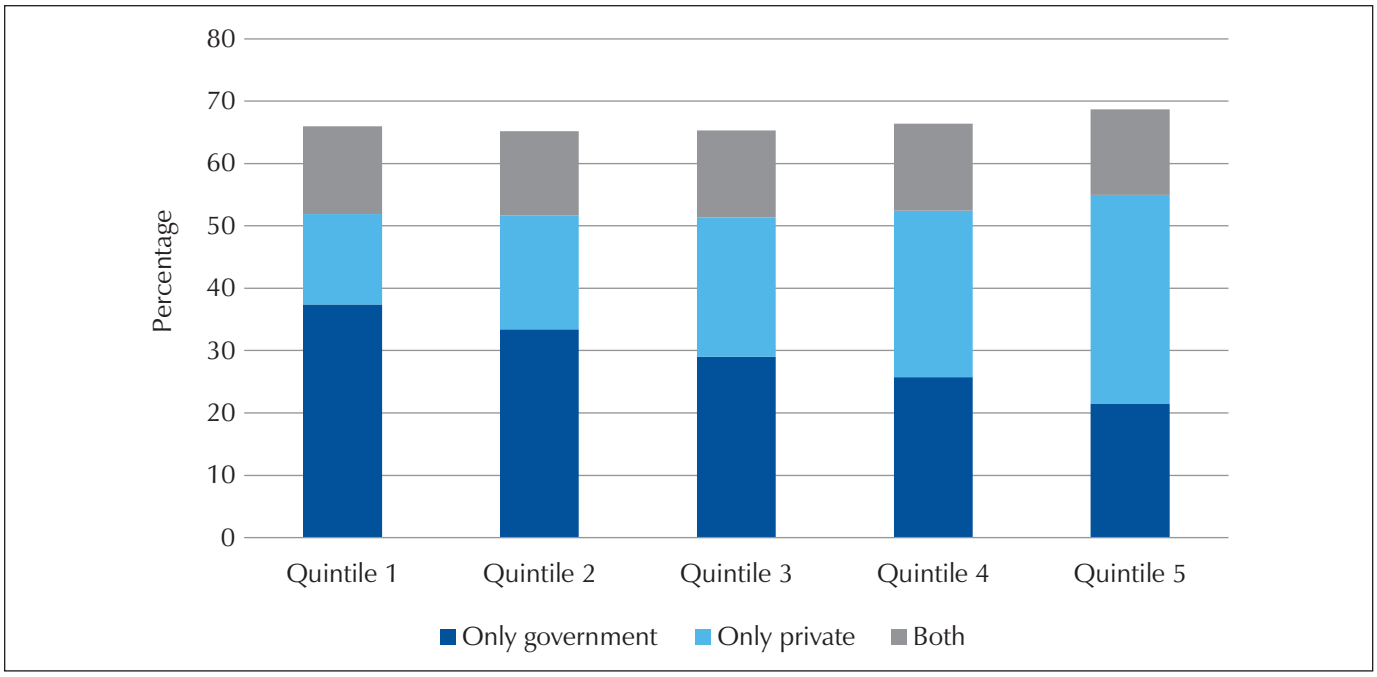

Fig. 2. Utilization of outpatient care by quintile and source of care

Quintile 1 = lowest income, quintile 5 = highest income.
Note: Columns do not add up to 100% as some patients access non-allopathic services.
Source: Based on data from the Department of Census and Statistics Household Income and Expenditure Survey 2012/2013.[24]

patients with suspected myocardial infarction, despite these investigations not being available in the state sector, and that percutaneous transluminal coronary angioplasty was only done for the 4% of patients with ischaemic heart disease who could bear the cost (personal communication).

This tier is likely to still be small in economic terms and patient numbers. No systematic studies have yet been undertaken of this phenomenon, but it is significant[31] and likely to expand further, given the state budgetary challenges in tandem with the expansion of health-care needs engendered by the health transition. This trend goes against the objective of UHC. It is adding an economic burden to households accessing what is considered to be "health care free at the point of delivery". From a national perspective, it is an erosion of the policy of successive governments of "health care free at the point of delivery". The fact that this expenditure is neither systematic nor fully predictable makes it sometimes catastrophic at household level. There are many instances when drug scarcities in the state sector force even poor households to purchase drugs from the private sector.[32] In the case of noncommunicable diseases, this leads to poor compliance. In sudden medical emergencies, such as heart attacks or fractures, finding the money rapidly is an additional burden and leads to borrowing at high interest rates, selling of assets or selecting a suboptimal treatment option.

POLICY CONCERNS

The first challenge to policy-makers in addressing the SDG for health at country level is likely to be the setting of national targets, based on data on the burden of disease, disaggregated by sex, age and disease, given the gender disparities. Sri Lanka needs to set health-indicator targets in line with those of high-income countries (for example, a country like Canada selected on the basis of population size, health performance and use of social health insurance as the financing mechanism;[33] alternatives being Australia and the Netherlands) rather than being complacent about overshooting those of upper-middle-income countries.

UHC involves the whole range of health-care services. Enhancing UHC from a promotive health-care perspective could involve more interministerial coordination of activities beyond the Ministry of Health. The main challenges faced by Sri Lanka, such as eradicating communicable diseases, preventing premature mortality from noncommunicable diseases, and reducing road traffic accidents and substance abuse, which are all included as SDG health indicators, need multisectoral interventions. A national body that provides strategic direction and links all state-sector organizations, like the National Health Council that operated effectively in the 1970s in Sri Lanka, could be a step in the right direction to achievement of the SDG for health. Since better health is both the result of, and a prerequisite for, achievement of a number of SDGs, such interministry collaboration is essential.

Prevention of noncommunicable diseases, with health promotion that targets working men in particular, would seem to be crucial. If this population is not strategically targeted, there will be an economic impact in the long run, with an increase in premature mortality and morbidity of the skilled workforce. Gaining the leadership of employers in the process, and targeting men through the media, is vital.

The state health-care system handles both curative and rehabilitative care, mainly in hospital settings. Rehabilitative domiciliary care is poor, owing to the absence of adequate health cadres such as physiotherapists, speech and language therapists and occupational therapists in the state-sector hospitals. People with disabilities, including children with developmental problems and delays, are also adversely affected. There is limited provision of such services in the urban setting, mainly by the private sector, leading to geographic and economic inequities. Given the large population of elderly, and those afflicted by acute noncommunicable diseases, provision of domiciliary care backed by community nursing, and setting up hospices for palliative care would reduce the economic burden on households.

Finally, is the third tier a cause for concern at national level? Health-sector reforms have often stressed the need for public–private partnerships. It could be argued that shifting a part of health-care costs onto households is in line with such a policy. It could also be argued that, given rising health-care costs and severe budgetary constraints, a comprehensive health service that is free of charge at the point of delivery is no longer viable for the country. Both these arguments are rational. However, if the third tier is inevitable, then it should be better planned and managed, to differentiate between the poor and non-poor, and to determine what services are essential. Safety nets should be available to ensure financing of emergency care. If this issue is not addressed seriously, then the drive for UHC and the SDG for health will both be derailed.

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Perspective

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Healthy Lifestyle Centres: a service for screening noncommunicable diseases through primary health-care institutions in Sri Lanka

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ABSTRACT

The Ministry of Health in Sri Lanka initiated the Healthy Lifestyle Centres (HLCs) in 2011, to address the lack of a structured noncommunicable disease (NCD) screening service through the lowest level of primary health-care institutions. The main service objective of the HLCs is to reduce the risk of NCDs of 40–65 year olds by detecting risk factors early and improving access to specialized care for those with a higher risk of cardiovascular disease (CVD). The screened clients are managed at HLCs, based on the total-risk approach to assess their 10-year CVD risk, using the World Health Organization/International Society of Hypertension risk-prediction chart. Those with a 10-year CVD risk of more than 30% are referred to the specialized medical clinics, while others are managed with lifestyle modification and are requested to visit the HLC for rescreening, based on the levels of CVD risk and intermediate risk factors. Identified challenges to date include: underutilization of services, especially by men; weak staff adherence to protocols; lack of integration into pre-existing NCD-screening services; non-inclusion of screening for all the major NCDs; and human resources. The government plans to address these challenges as a priority, within the context of the *National multisectoral action plan for the prevention and control of NCDs in Sri Lanka 2016–2020*. Key interventions include: extended opening hours for HLCs, outreach activities in workplaces, and integration with "well woman clinics". Costs related to actions have been realistically estimated. Some actions have already been initiated, while others are being designed with identified funds.

Key words: cardiovascular disease, noncommunicable diseases, primary health care, screening, Sri Lanka

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BACKGROUND

The major noncommunicable diseases (NCDs), such as cardiovascular disease (CVD), cancer, chronic respiratory disease and diabetes, are the dominant health challenge of the 21st century and accounted for an estimated 63% of the global death toll in 2014. More than three quarters of these deaths occur in low- and middle-income countries.[1]

At present, NCDs are the leading causes of mortality, morbidity and disability in Sri Lanka. The government hospital data for 2012 show that approximately 65% of all deaths that year were due to NCDs.[2] The probability of dying between the ages of 30 and 70 years from the four main NCDs (CVD, cancer, chronic respiratory disease and diabetes) was 18%.[1]

SERVICES FOR NONCOMMUNICABLE DISEASES IN SRI LANKA

Sri Lanka offers free preventive, curative and rehabilitative health-care services through its public sector. The public health sector is organized in two streams: preventive services focusing mainly on promotive and preventive health, and curative services, which mainly focus on outpatient and inpatient care. The preventive health services are provided through 338 health units, known as medical officer of health (MOH) areas. The services are delivered by a team of field officers and led by a medical officer.

Curative institutions comprise an extensive network of institutions ranging from primary health-care (PHC)

institutions, namely primary medical care institutions (primary medical care units [PMCUs]) and divisional hospitals, to secondary and tertiary care institutions, with the National Hospital at the apex.

Responding to the increasing burden of chronic NCDs, in 1996, the preventive health services introduced screening for selected NCDs, exclusively for women, with the establishment of the "well woman clinics". These provide screening services for hypertension, diabetes mellitus and cancers of the breast and cervix, for women aged over 35 years. Utilization of these clinic services has been low, with some improvement over the past two decades.[3]

NCD care, provided through the curative-care service sector until 2010, was largely focused on managing patients diagnosed with NCDs at specialist clinics, as long-term outpatients and as inpatients in secondary- or tertiary-care institutions. The role of the PHC institutions was minimal, though some offered clinics to follow up long-term outpatients. However, as these institutions often lack the NCD medications and facilities to perform the necessary investigations, patients often bypassed these follow-up care services in PHC and used secondary and tertiary facilities. Although opportunistic screening by the medical officers of high-risk patients reporting to the institutions for other illnesses was encouraged, implementation of such screening was very low.

Acknowledging that prevention and control of NCDs is a priority in the country, the Government of Sri Lanka formulated the *National policy and strategic framework for prevention and control of chronic noncommunicable diseases* in 2010.[4] Guided by the World Health Organization (WHO) strategic framework of the *2008–2013 Action plan for the global strategy for the prevention and control of noncommunicable diseases*,[5] the objective of the Sri Lankan NCD policy is to reduce premature mortality due to chronic NCDs, through the expansion of evidence-based curative services and individual and community-wide health-promotion measures for the reduction of risk factors. The strategic framework includes nine strategies; one of these is implementing a cost-effective NCD screening programme at community level, with special emphasis on CVD.[4]

Guided by the worldwide evidence that implementation of universal, financially and physically accessible, high-quality clinical interventions to enhance early detection and treatment of NCDs through PHC is effective in reducing some NCD risk factors and preventing advanced-stage disease and complications at relatively low cost,[6,7] the Ministry of Health in Sri Lanka initiated the Healthy Lifestyle Centres (HLCs) in 2011, to address the lack of an NCD screening service provided through PHC institutions in Sri Lanka.

MODELS THAT CONTRIBUTED TO THE DEVELOPMENT OF THE HEALTHY LIFESTYLE CENTRES

For designing the HLCs, the Ministry of Health drew evidence from three pilot projects that had been conducted in Sri Lanka. The three models were the WHO *Package of essential noncommunicable (PEN) disease interventions for primary health care in low-resource settings* (WHO-PEN);[6] the NCD Prevention Project (NPP), piloted by the Japan International Cooperation Agency (JICA) (NPP-JICA);[8] and the community-based health-promotion component of the National Initiative to Reinforce and Organize General Diabetes Care in Sri Lanka (NIROGI Lanka) of the Sri Lanka Medical Association.[9]

The WHO-PEN is a set of interventions that defines the minimum standards to strengthen national capacity to integrate and scale up care of heart disease, stroke, CVD risk, diabetes, cancer, asthma and chronic obstructive pulmonary disease in primary health care in low-resource settings.[6] The core interventional activities of the WHO-PEN pilot project included protocols for screening and management of NCD, tools to predict the risk of CVD, essential medicines, essential technologies, standards and indicators to measure the progress of implementation, and the impact of the project and the information system on the services.[6] The basic details of the pilot project of the WHO-PEN in Sri Lanka and the key features relevant to the development of the HLC model are indicated in Table 1.

The *Project on health promotion and preventive care measures of chronic NCDs*, commonly identified as the NPP-JICA, was developed, tested and evaluated in two districts in Sri Lanka in 2008–2013.[8] The project comprised four models, namely a model for screening for major NCDs, a health-guidance model to guide people on healthy lifestyles, a model for health promotion to enable people to take control over and improve their health, and a social marketing model to disseminate information to prevent NCDs and enable individuals to gain access to services.[8] In the pilot project, the model for screening for major NCDs included testing the feasibility of different check-up models and a cost analysis.[8] Piloting allowed development of a final health check-up model, which has been included in NPP guidelines. The basic details of the pilot project of the NPP-JICA in Sri Lanka, and the key features relevant to the development of the HLC model, are indicated in Table 1.

The NIROGI Lanka project of the Sri Lanka Medical Association, supported by the World Diabetes Foundation, is an island-wide project comprising three components. The main component was a pilot on the feasibility of recruiting and training diabetes nurse educators, and strengthening primary health-care services to improve knowledge, skills and attitudes in the area of control and prevention of diabetes in Sri Lanka. One of the components, piloted in one MOH area in the district of Colombo, was on empowering communities from work, school and community groups through the activities that encourage community and family participation through a health-promotional approach.[9] Approaches used by the NIROGI Lanka project to address the risk behaviours of communities and families were incorporated into the HLC model (see Table 1).

Table 1. Key features of pilot projects on screening and managing noncommunicable diseases through primary health care conducted in Sri Lanka in relation to the Healthy Lifestyle Centres model

Pilot model	WHO-PEN[6]	NPP-JICA[8]	Sri Lanka Medical Association – NIROGI Lanka[9]
Dates of pilot	2009–2011	2008–2013	2009–2015
Location of pilot	1 district	2 districts	1 district
Number of facilities	3 MOH area	3 MOH areas	1 MOH area
Key features relevant to development of the HLC model	WHO/ISH chart for CVD risk prediction[10] Guideline for management of NCDs in primary health care, developed by the Ministry of Health, based on a total-risk approach, is being used to manage persons screened at HLCs[11] List of essential medicines proposed is being adapted and made available at primary health-care institutions to manage the screened persons being referred	Health check-up model used to recruit clients for the HLCs Health-guidance model is being used in managing the persons screened at HLCs Information system (registrant and returnees) is being used to document services provided at HLCs Health-education material developed in the social marketing model is being used in health-promotional education at HLCs	Approaches used to address the risk behaviours of communities and families

CVD: cardiovascular disease; HLC: Healthy Lifestyle Centre; ISH: International Society of Hypertension; MOH: medical officer of health; NCD: noncommunicable disease; NIROGI Lanka: National Initiative to Reinforce and Organize General Diabetes Care in Sri Lanka;[9] NPP-JICA: Noncommunicable disease Prevention Project, piloted by the Japan International Cooperation Agency;[8] WHO: World Health Organization; WHO-PEN: WHO *Package of essential noncommunicable (PEN) disease interventions for primary health care in low-resource settings*.[6]

HEALTHY LIFESTYLE CENTRES: THE SCREENING SERVICE FOR NONCOMMUNICABLE DISEASES THROUGH PRIMARY HEALTH-CARE INSTITUTIONS IN SRI LANKA

Establishment of HLCs by the Ministry of Health as an NCD screening service provided through PHC institutions dates back to 2011.[12] This initiative is in alignment with one of the strategies in the NCD policy of Sri Lanka on establishing cost-effective screening programmes for NCDs in Sri Lanka.[4] In accordance with the strategy, the focus of HLCs was proactive identification of both behavioural and intermediate risk factors, with a view to preventing the end-point of CVD, rather than treating patients. The main service objective of the HLCs is to reduce the risk of NCDs by detecting risk factors early and improving access to specialized care for those with NCDs.

PMCUs were the PHC institutions identified as the settings for the HLCs. The PHC institutions were expected to conduct HLCs on at least one weekday, from 08:00 to 12:00, with participation of a minimum of 20 clients. The population targeted for screening were individuals aged 40–65 years who were previously undiagnosed with major NCDs, which is nearly 25% of the total Sri Lankan population.[13] The PMCUs in Sri Lanka are the lowest level of curative institutions offering only outpatient services. They are staffed in most places with one medical officer and one health assistant and/or a dispenser. Supervision and coordination of the activities of HLCs at each district was assigned to a new cadre of medical officers, called medical officers (NCD) (MO(NCD)s), who are the coordinators for NCD-related activities at the district level.

The HLC model that is in place encourages the targeted population to use the HLC services through self-referral. Other methods used to enrol the targeted population are displaying banners and posters, referring from outpatient departments and giving health talks in the health institutions.

Activities at Healthy Lifestyle Centres

To ensure uniformity, services to be offered to the targeted population at HLCs are specified as protocols.

Screening for NCDs and risk factors

All users are issued a personal health record, specially designed for the HLC, which includes provision to record all the findings of the screening assessment and some educational messages on NCDs and risk factors. The screening services offered for intermediate risk factors for NCDs at HLCs investigate for fasting capillary blood glucose, blood pressure and body mass index. In addition, at the screening session, questions are also asked about behavioural risk factors such as smoking, alcohol consumption, unhealthy diet and physical inactivity. Facilities to test total cholesterol are not available in the HLCs at present.

Management of screened patients

The management of screened patients is prescribed in the publication of the Ministry of Health, *Guideline for management of NCDs in primary health care (total risk assessment approach)*.[11] All the screened clients are managed at HLCs, based on the total-risk approach assessing the 10-year CVD risk using the WHO/International Society of Hypertension (ISH) chart[10] adapted for Sri Lanka. Total cholesterol is one item on which information is required for this assessment and, as the facility to investigate total cholesterol is not available at HLCs at present, a proxy value of 5 mmol/L is used for clients.

At present, those with a 10-year CVD risk higher than 30% are referred to the specialized medical clinics conducted at the same PMCU or another institution, for further management. Given that the availability of medicine and technologies is vital to ensure a quality screening programme that provides the necessary interventions, a list of essential NCD drugs to be available at the PMCU has been developed. Furthermore, the Ministry of Health, Nutrition and Indigenous Medicine is taking the necessary steps to monitor and ensure the availability of essential drugs in all PMCUs throughout the year, which is one of the disbursement-linked indicators to measure progress of the health system in Sri Lanka. Those with a 10-year CVD risk below 30% are managed with lifestyle modification and are requested to visit the HLC based on the level of CVD risk and of intermediate risk factors. Group health-education sessions, using brochures, flip charts and videos designed and developed specifically to be used in HLCs, are done by staff trained for the purpose. Staff at HLCs are also encouraged to train the clients who attend the HLCs on physical activity.

Capacity-building of staff and strengthening of other services and resources

In parallel to the establishment of HLCs, island-wide training programmes were conducted in 2011–2012, to train the health-care staff of PHC institutions on following HLC protocols to implement the total-risk approach, recording information on personal medical records, and record keeping and data management. Following the initial training, MO(NCD)s were assigned to conduct in-service training for the relevant staff of HLCs, on an annual basis.

Information management system

The specifically designed paper-based information management system of the HLCs requires service-related data to be collated at each HLC, on a form specifically designed for this purpose, and to be returned to the MO(NCD) on a quarterly basis. The MO(NCD) of each district is required to collate the data and submit them to the NCD unit of the Ministry of Health, Nutrition and Indigenous Medicine.

Monitoring and evaluation of the services

The responsibility for monitoring and evaluation of the functions of the HLCs in the country lies with the Directorate of Noncommunicable Disease of the Ministry of Health, Nutrition and Indigenous Medicine, and regional directors of health services. At present, monitoring and evaluation of the functions of the HLCs is done at quarterly review meetings conducted at both national and district levels by the Directorate of Noncommunicable Disease and regional directors of health services.

TRENDS IN USE OF HEALTHY LIFESTYLE CENTRES

Since the initial directive from the Director-General of Health Services to initiate at least two clinics per MOH area incrementally in 2011,[12] the number of HLCs in the country has significantly increased (see Table 2). In addition, two of the disbursement-linked indicators for the Second Health Sector Development Project of the World Bank, initiated in 2013, are (i) the percentage of MOH areas with at least two HLCs and (ii) the percentage of persons aged over 40 years screened for selected NCDs at HLCs; this initiative has contributed immensely to expansion of the number and services of HLCs in the country.[14]

Table 2. The number and services of Healthy Lifestyle Centres in Sri Lanka, 2011–2016

	2011	2012	2013	2014	2015	2016 (first quarter)
Total number of HLCs	126	420	672	760	814	826
% of MOH areas in a district with two or more HLCs[a]	—	—	56.0 (187/334)	69.5 (235/338)	77.8 (263/338)	79.6 (269/338)
Cumulative % of the target population (aged 40–65 years) screened[b]	2.5	3.8	12.7	19.9	23.1	25.5
Ratio of men:women screened[a]	—	—	2.6:7.3	2.9:7.1	2.8:7.2	2.9:7.1

HLC: Healthy Lifestyle Centre; MOH: medical officer of health.

[a]Data not available for 2011 and 2012.

[b]Target population is nearly 25% of the country population.

Although the proportion of the targeted population screened in the country has increased almost tenfold from 2011 to 2016 (see Table 2), participation by men remains low, with no improvement. Table 3 presents an analysis of the routine data from the HLCs on the percentage of the targeted population in Sri Lanka found, over the period 2013–2015, to have behavioural or intermediate risk factors. This provides grounds for evaluating the HLC service in terms of its objective of detecting those with risk factors.

National data on the proportion of adults known to have specific NCDs or NCD-related risk conditions/behaviours, gathered through surveillance data in the country, can be considered as a benchmark to evaluate the success of the HLC services in terms of capturing the targeted population. However, direct comparison cannot be performed, as the WHO STEPwise approach to Surveillance (STEPS) survey studies adults aged 19–65 years, which includes people who are younger than the population targeted for HLCs.[15] The most recent island-wide STEPs survey for NCD risk factors conducted in Sri Lanka in 2007 was done in a representative sample of 12 500 adults aged 19–65 years.[16] If the HLC services were successful, one would expect that the proportion of the target population screened for behavioural and intermediate risk factors would reach the corresponding proportions from the STEPs surveys of 2007.

Comparison reveals that the proportion in the STEPs survey with high blood pressure (16.1%, 1883/11 710) and obesity (4.7%, 564/11 888) was lower than the proportion detected in the HLC population screened. Some other available indicators, namely the proportions of current tobacco smokers (15%, 1858/12 401) and current drinkers (13.5%, 1661/12 346) in the 2007 STEPs survey, were much higher than the proportions among those screened at HLCs. However, the low proportions of men using the clinics (see Table 3) will have contributed to the picture of the risk factors for alcohol consumption and smoking.

Furthermore, routine data from HLCs facilitates identification of districts or provinces that need to be focused for attention in prevention and control of NCDs. For example, the most recent data indicate that the districts of Nuwaraeliya and Killinochchi have particularly high prevalences of risk factors and behaviours among those screened at HLCs and so they will receive more targeted interventions.

CHALLENGES TO ACHIEVING THE OBJECTIVES OF THE HEALTHY LIFESTYLE CENTRE MODEL

A range of monitoring and evaluation activities – including critical review of the analysis of routine data of HLCs, facility and client surveys, field supervision visits, and regular review meetings of HLC staff and MO(NCDs) – have resulted in identification of the following challenges to achieving the objectives of the present model of HLCs.

First, underutilization of the HLC services by the target population is a key challenge. The HLC services not being "well known" to the public, and the attitude of being "healthy and not requiring screening tests" among those who have been educated on the service, have been cited as the reasons. This underutilization is especially prevalent among men and has been attributed to men being mostly employed and at work during the HLC clinic sessions, which are confined to weekdays between 08:00 and 12:00.

Table 3. Numbers and proportions of targeted population screened in Sri Lanka with behavioural or intermediate risk factors, 2013–2015

Behavioural or intermediate risk factor	Number (%) of screened population with risk factor		
	2013[a]	2014[b]	2015[c]
Fasting blood glucose >126 mg/dL	37 980 (11.58)	48 853 (12.75)	41 372 (10.57)
Raised blood pressure (systolic ≥140 mmHg and/or diastolic ≥90 mmHg)	69 400 (21.16)	91805 (23.96)	89 862 (22.97)
Overweight (BMI ≥25 kg/m^2)	90 686 (27.65)	100 618 (26.26)	99 873 (25.53)
Obese (BMI ≥30 kg/m^2)	29 255 (8.92)	29 043 (7.58)	32 300 (8.26)
Current tobacco smoker	18 170 (5.54)	25 557 (6.67)	26 826 (6.86)
Current drinker	40 604 (12.38)	28 775 (7.51)	29 836 (7.63)
Smokeless tobacco user	21 089 (6.43)	53 604 (13.99)	53 651 (13.71)
With 10-year CVD risk ≥30%	1 836 (0.56)	1 724 (0.45)	2 268 (0.58)

BMI: body mass index; CVD: cardiovascular disease.

[a]88 554 men screened; 239 425 women screened; total population screened: 327 979.

[b]110 469 men screened; 272 692 women screened; total population screened: 383 161.

[c]108 399 men screened; 282 861 women screened; total population screened: 391 260 (weighted data).

Second, there are weaknesses in the services provided at HLCs. For example, practical sessions on lifestyle-changing interventions are currently inadequate and limited to health-education sessions, although a few HLCs conduct regular physical exercise sessions for registrants. In addition, surveys and field-supervision sessions have indicated that adherence to the HLC protocols by the HLC service providers is variable. Non-use of the total-risk approach for CVD in managing the screened persons is the most common variation that has been highlighted. Services for screening of breast cancer and cervical cancer are still delivered through "well woman clinics" and at present have not been linked to HLC services. In addition, although the design of HLCs includes screening for chronic respiratory diseases using peak-flow meters, this is not being done at present. The reasons cited by staff range from technical difficulties in getting the personnel to perform the test to non-availability of disposable mouth pieces.

The third key challenge is lack of a registrant follow-up system and insufficient human resources. There is no system to track the clients who do not return for HLC screening following their initial screening. The lack of a back-referral system precludes an ability of HLCs to monitor whether clients identified as at high CVD risk have gone on to access the services to which they were referred. PMCUs, where the HLCs are mainly based, function with limited health staff of all categories. No additional staff have been provided to the institutions to conduct the HLC clinics.

Finally, an absence of grass-roots-level fieldworkers dedicated to NCD-related work in the country has limited the capacity of the health system to encourage the targeted population to use the HLCs and to follow up the HLC users in the community to continue lifestyle-promotional activities.

THE WAY FORWARD IN STRENGTHENING THE HEALTHY LIFESTYLE CENTRES PROGRAMME

To address the challenges, the Government of Sri Lanka recently launched the *National multisectoral action plan for the prevention and control of NCDs in Sri Lanka 2016–2020*;[17] the actions required to respond to the challenges faced by HLCs have been prioritized for the first two years, 2016–2017.[17] The costs related to actions have been realistically estimated. Some actions have already been initiated, while others are being designed with identified funds. The key remedial measures are discussed next.

In order to facilitate screening of the target population and to increase male participation in the screening, plans are under way to extend the routine HLC opening hours of 08:00 to 12:00 until late evenings at 18:00. The additional funds required for payment of extra duty hours to the staff have been accounted for in the costing of the plan. The feasibility of extending the opening hours of HLCs to weekends and public holidays is currently under discussion. Conducting the NCD screening service as an "outreach" screening programme in geographical locations where participation is low, and in workplace settings, has also been initiated.

Ethnographic research is planned, to give a better understanding of human behaviour in relation to undergoing screening tests. It is hoped this will generate evidence on motivating the apparently healthy to undergo screening. Mass-media campaigns have been proven to be effective in making the public aware of the health services in the country, and plans are under way to advertise the services of HLCs through a social marketing campaign.

Measures are also under way to include screening for breast and cervical cancer, which are typically offered at "well woman clinics", in the services of HLCs. Similarly, incorporation of CVD screening into the "well woman clinics" is being considered. Screening for oral cancer by visual inspection, and for asthma using a validated questionnaire, is also going to be incorporated to the services of HLCs.

The following measures are also being implemented to improve utilization of HLC protocols for screening and managing clients:

- use of random blood glucose values instead of fasting blood glucose to calculate total CVD risk and facilitate the assessment of total CVD risk of the many individuals who attend without fasting;
- inclusion of facilities at the HLCs to test for total cholesterol, to allow use of the actual value instead of the arbitrary figure used in current practice, in order to improve the accuracy of assessment of total CVD risk;
- lowering of the threshold at which the treatment of CVD is to be initiated, from 30% to 20% 10-year risk.

The necessary steps have been taken to convert the HLC information system to an electronic system that feeds in data at the district level. This will enable staff to cross-check the data, thereby improving its quality, and will also assist them in identification of service deficiencies.

Finally, discussions have been initiated to develop a separate cadre for a grass-roots-level fieldworker dedicated to NCD-related work in the country, in order to improve the capacity of the health system to encourage the targeted population to use the HLCs, and to follow up the HLC users in the community to encourage them to continue activities that promote a healthy lifestyle.

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Perspective

Meeting the current and future health-care needs of Sri Lanka's ageing population

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ABSTRACT

Sri Lanka is one of the fastest-ageing countries in the world. This rapid demographic transition is expected to result in one quarter of the population being elderly by the year 2041. Profound challenges face the country as a result, especially with respect to planning adequate elderly-oriented services in the social-care and health-care sectors. In response to this need, many initiatives have been put in place to promote and protect the welfare of older people, and these rights have been inscribed in law. Within the health sector, despite the wealth of policies and initiatives in recent years, it is clear that the existing health infrastructure and systems still require strengthening, reorientation and coordination, to meet the needs of the growing population of elderly individuals. Lessons learnt from the successes in reducing the maternal mortality ratio can be applied to strengthening preventive services at the community level, to ensure active healthy ageing in Sri Lanka. Engagement of specialist medical officers of health and general practitioners to provide preventive and curative primary-care services would reduce current pressures on higher-level services. Expansion of dedicated elderly-care wards and units at the tertiary level would restructure care towards changing patient demographics. The key to success in these strategies will be increasing the proportions of the medical, nursing and allied professional cadres who have been trained in geriatric medicine. Such capacity-building in the care of the elderly will allow a move towards provision of multidisciplinary teams that can manage the complex physical, social and psychological needs of the older patient.

Key words: ageing, elderly care, geriatrics, multidisciplinary care, Sri Lanka

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BACKGROUND

Sri Lanka is one of the fastest-ageing countries in the world, with the proportion of the population aged 60 years or older projected to increase from 12.5% currently to 16.7% in 2021.[1] Although this demographic transition is affecting many countries, the speed of change is particularly dramatic for Sri Lanka. An estimated one in four Sri Lankans will be elderly by the year 2041. The trend is, in part, a result of investments in education and health for the past several decades. Low fertility rates and extended life expectancies are expected to continue, putting financial pressure on the working-age population.[1] This is starkly illustrated by the changing dependency ratio in Sri Lanka – i.e. the number of dependent children and elderly individuals per 100 working-age people. There were 55 dependents per 100 working-age people in 2001. This number is expected to rise to 58.3 by 2031 and, following a rapid increase in old-age dependency, is projected to increase significantly after 2041.[1]

As a result, Sri Lanka faces profound economic challenges, for example in provision of pensions. Social structures are also in flux; while the cultural norm has been to care for older relatives within the extended family, factors such as more women working outside the home and migration of working-age adults to urban centres and abroad, are disrupting this traditional support system. Putting robust systems in place to accommodate the greater demands for elderly-oriented social care and health care will be crucial to the country's ability to manage its fast-restructuring population within financial constraints.

The need to respond has been particularly urgent in recent years, owing to Sri Lanka being in a period of "demographic bonus", i.e. where the proportion of the population that is of working age remains significantly larger than that of dependents. This has given Sri Lanka a window of opportunity to align service provision with future needs.[1,2]

SYSTEMS FOR SOCIAL PROTECTION FOR OLDER SRI LANKANS

In the past two decades, many initiatives have been taken to respond to the social needs of the growing population of older people. The *Protection of the Rights of Elders Act* in 2000 led to the establishment of the National Council for Elders, comprising representatives of the ministries of social services, health and finance, as well as experts and voluntary organizations that are engaged in providing services for elderly individuals.[3] Its principal function is the promotion and protection of the welfare and rights of older people. The implementation and funding authority, the National Secretariat for Elders, reports to the National Council for Elders and is situated within the Ministry of Social Empowerment and Welfare. In 2006, the *National Charter for Senior Citizens and National Policy for Senior Citizens Sri Lanka* were adopted.[4] In 2011, amendments were made to the existing Act and the *Protection of Rights of Elders (Amendment) Act* was enacted, which provided more rights to older people.[5]

The National Secretariat for Elders has provided grants to establish elders' committees throughout the country; at the district, divisional and village levels in 2012, there were there were 17 200 and 10 000 committees, respectively.[6] These committees encourage the participation of elderly individuals in decision-making processes at grass-roots level and are a mechanism to ensure that policies and programmes for the elderly are effectively implemented to suit local needs.

The activities of the National Council for Elders include financial assistance for services, including day-care centres, psychological counselling programmes and training for carers of the elderly.[7] Other initiatives include home-care services, provision of assistive devices for elderly individuals with disabilities, financial assistance for those in need, free legal advice service, and support for income-generating activities. The Government of Sri Lanka has taken legal measures against public institutions not providing accessible facilities for disabled persons, including disabled elderly individuals. In addition, any institution providing residential care for elderly people must be registered with the National Secretariat for Elders. Identity cards enable elderly people and their caregivers to receive benefits, such as a discount on the cost of medicines, higher interest rates for fixed-term deposits in banks, and priority in obtaining public and private-sector services.[8]

HEALTH-CARE SERVICES FOR THE ELDERLY POPULATION

The Government of Sri Lanka has committed to the development of a well-structured health system for the elderly population, noting that, "Accessible and affordable health-care provisions will be developed in order to promote healthy lifestyles, nutrition and avoidance of risk factors".[9] Health-care services for the elderly are provided through the standard health system in the country. National-level activities are coordinated by the Youth, Elderly and Disability Unit within the Ministry of Health, Nutrition and Indigenous Medicine. In the past few decades, numerous initiatives have been undertaken to increase the quantity and quality of health care for the elderly at the institutional and community levels.

Current provision: curative care

Curative care for the elderly is delivered through the standard primary-to-tertiary health services. Divisional hospitals provide both inpatient and outpatient care, and primary medical care units provide only outpatient care with non-specialist doctors and allied staff. Although not specifically aimed at elderly patients, specialist health services such as cancer care, eye care, dental care, cardiology, psychiatric care and disability care and rehabilitation mostly treat patients in the older age bracket. Noncommunicable diseases have become one of the leading causes of morbidity, mortality, disability and hospitalization among the elderly population.[10]

Several initiatives are in progress to improve service provision. Elderly-friendly wards in hospitals, and health clinics for the elderly, are planned at the district level in state-sector health institutions. Establishment of a health institution as a centre of excellence for geriatric care in the country is also in progress. Stroke units have been established in many health institutions in the country and the aim is to establish a stroke unit in each district general hospital and a stroke centre in each province.[11]

Current provision: preventive care

Preventive health services are implemented through medical officers of health and their field staff at the district level; additional medical officers focus on mental health and prevention of noncommunicable diseases. The Ministry of Health initiated Healthy Lifestyle Centres in 2011, to address the lack of a structured screening service for noncommunicable disease at the community level. The main objective of Healthy Lifestyle Centres is to reduce the risk of noncommunicable diseases in 40–65 year olds, by detecting risk factors early and improving access to specialized care for those with a higher risk of cardiovascular disease.[12] There are numerous other public health programmes at the community level on prevention of disease and promotion of health for the elderly, such as the national Vision 2020 community programme for eye care and cataract surgery.

The World Health Organization Global Network of Age-friendly Cities and Communities was established to foster the exchange of experience and mutual learning between cities and communities worldwide.[13] In an age-friendly city, policies, services, settings and structures support and enable people to age actively by: (i) recognizing the wide range of capacities and resources among older people; (ii) anticipating and responding flexibly to ageing-related needs and preferences; (iii) respecting the decisions and lifestyle choices of elderly individuals; and (iv) protecting those who are most vulnerable and promoting their inclusion in and contribution to all areas of community life. Sri Lanka's first age-friendly city was established in the Wellawaya area of Monaragala district,

and a 2013–2018 strategy is under way.[14] The first phase of the programme has been completed and involved a baseline assessment of all primary health-care facilities for age-friendly design and signage, human resources, tools and technologies, and interventions available for prevention and control of noncommunicable disease. Subsequent ongoing activities include advocacy and training, including training of volunteers, and enhancing the age-friendliness of services.[14]

REORIENTING THE HEALTH-CARE SYSTEM TO MEET THE NEEDS OF THE AGEING POPULATION

Despite the wealth of policies and initiatives in recent years, it is clear that the existing health infrastructure and systems in Sri Lanka still require considerable strengthening and reorientation to meet the needs of the growing population of elderly individuals. Although local data on care for the elderly are scarce, studies that exist indicate that many health problems in the elderly go undetected, owing to a lack of awareness, time, knowledge and human resources at all levels of care, from the community to the hospital (see Box 1).

According to the World Bank Sri Lanka Aging Survey, which was done in 2006 among Sri Lankans aged over 60 years, elderly individuals rely substantially more on public-sector services for their health care than do non-elderly individuals; 70% of health-care visits by elderly people were to government facilities, compared with 44% for the overall population.[20] A 2008 World Bank report on the challenges facing Sri Lanka in addressing the rapidly ageing population noted the lack of organization of public health services to provide integrated, continuing care for older patients at the primary-care level.[20] The report noted that most elderly individuals lack access to a regular doctor, and there is no infrastructure to ensure regular screening for illness and disability.[20] Furthermore, as noted in the *Health Strategic Master Plan 2016–2025*, many cross-cutting issues of health services for older people are suboptimal.[11] A national plan has been under development by the National Secretariat for Elders and is currently being finalized. The health-related action points of this plan have been developed in parallel with the national *Strategic Framework for Development of Health Services 2016–2025*.[21]

Clearly, more elderly-oriented improvements to the public health services and related welfare systems are needed, including establishment of long-term care and respite care. Key to continuing improvements in services will be building capacity for care of the elderly in the community and education of all cadres within the health workforce, to sensitize health systems to the needs of the elderly and to build multidisciplinary teams that specialize in care of older patients.

Strengthening services at the community level

A key way forward would be to apply the lessons learnt from Sri Lanka's impressive success in reducing maternal mortality to address community-based care of the elderly. The significant

Box 1. Local data on health and elderly people

The recently published *National Survey on Self-reported Health in Sri Lanka* comprises data collected throughout 2014 from 25 000 housing units (i.e. excluding those living in institutions) covering all districts in the country. Although the data are based on self-reports and not confirmed by clinical diagnosis or tests, it is the first island-wide household survey on health.[15] A total of 55.2% of respondents aged 60 years or older reported having at least one chronic illness. In respondents aged 65 years or older, 18.1% reported having diabetes, 30.4% reported hypertension, 6.6% reported having asthma and 8.9% reported having arthritis. Notably, of those not reporting hypertension, only 19.4% had had their blood pressure checked; of those reporting they did not have diabetes, only 24.1% had had their blood glucose levels checked; and of those reporting no heart disease, only 30.9% had had their cholesterol levels checked.

Data were also collected on respondents who had experienced an accident within the previous 3 months that had required treatment at a hospital or medical clinic. A total of 19% of men and 13% of women aged 60 years or older had experienced such an accident – higher proportions than for respondents in younger age groups. For men and women aged 60 years or over combined, the most frequent types of accident were those occurring in the home (50.4%) and road traffic accidents (28.5%).[15]

A preliminary study done among 150 patients aged 65 years and older admitted to the National Hospital of Sri Lanka detected depression in 40%, cognitive dysfunction in 73%, 6/60 or worse visual acuity bilaterally in 34%, hearing impairment in 8.3% and unprovoked falls in 23%, while 57.6% were unable to, or took longer than 30 s to, perform a "timed up and go" test. These problems were detected by the use of screening tools to detect the specific problems of the elderly and would have been missed during routine assessments in a general medical ward.[16]

In patients aged 65 years or older attending routine family-physician clinics, targeted screening enabled detection of dementia in 14.5%, depression in 17.1% and a significant percentage with impaired activities of daily living.[17]

A study to determine the incidence of home accidents during a period of 1 month found the incidence among those aged 60 years or above was 10.9 per 100, and these were mostly falls.[18]

In a study of community-residing elderly people in Colombo district, the presence of more than two chronic diseases, dizziness, history of falls within the previous year, and poor mobility were each significantly associated with falls. Individuals with a disability had a higher risk of falls than those with no disability.[19]

reduction in the maternal mortality ratio was achieved largely via a strong community health network, with the midwife family health worker playing a pivotal role at grass-roots level. It is therefore essential to replicate this success by having an officer to coordinate the welfare of elderly individuals in each community. The family health worker cadre could be expanded to provide assessment, prevention and rehabilitation services at the community level for the elderly population. Reorientation of the role of family health workers to include responsibility for the elderly population may increase the popularity of this profession. Applications for family health-worker posts have been dwindling and an expanded job definition with new opportunities for training and professional development may increase the appeal of this career option.

As described earlier, the work of the National Secretariat for Elders has resulted in the formation of a network of thousands of village elders' committees throughout the country. The leaders of these committees are a powerful resource in the development of community services for elderly people. Sri Lanka scores well in equitable provision of government health services for all ages.[20] There are at least 246 divisional elders' committees and 19 district-level committees. Elders' committees are linked with their local-level health authorities, especially with the medical officer of health and their staff for health-related activities and with social service officers for welfare needs. Continued strengthening of these community health services for older people would be the best way to ensure not only equity but also accessibility of services for older persons, especially those with limited mobility. The use of this already existing strong community network, together with the voluntary sector and the extended family, represents a very cost-effective strategy for scaling up a health-care system for older people in the community.

To strengthen this service provision, guidelines need to be developed for screening and treatment of diseases in elderly people. In addition, more education is needed to inform the public on the health needs of the elderly population, the services available and ways of accessing them. Communities need more awareness programmes for different target groups, to minimize the generational gap between elderly and younger age groups.

Strengthening the primary health-care level

Strengthening primary care is essential to scaling up services for elderly people. Preventive health services are provided through 338 health units, known as medical officer of health areas. The services are delivered by a team of field officers and led by a medical officer. The duties of the medical officer of health are broad and have a strong focus on maternal and child health, which restricts the time available to focus on elderly members of the community. A solution would be to follow the model of the Healthy Lifestyle Centres, whereby a new cadre of medical officers was created, who were specifically charged with coordinating activities related to noncommunicable diseases at the district level.[12] A similar cadre of medical officers of health for elderly care could coordinate the work of the family health workers working in the elderly community.

An additional weakness at the primary health-care level is the absence of a system of general/family practitioners in the public sector. Primary medical care in the state sector is provided at hospital outpatient departments and central dispensaries. Private general practitioners are often medical officers working in the state sector who work as general practitioners after office hours, in solo practices.[22] No qualification or training in family medicine is required to set up in general practice and there is no set procedure for referral from primary to secondary or tertiary care. There is some evidence that family medicine is an increasingly attractive option among doctors and undergraduates.[22] Given the growing demands for both preventive and curative services for the elderly population, it is timely to rethink the health infrastructure to include general practices to manage curative services in the community and reduce pressures on higher-level services.

In addition to the state provision at the community and primary-care levels, many nongovernmental organizations and private-sector organizations are involved in providing elderly-care services. This points to a clear need for systematic monitoring and evaluation of existing and new services. In the future, periodic reviews will be necessary to map the provision of care and to develop an evidence base on best practice, to ensure a sustainable health-care programme.

Reorientation of tertiary care: the importance of a multidisciplinary approach

Elderly patients in Sri Lanka are currently treated by general physicians in general medical wards. It has proved difficult to build dedicated elderly-care units with specialist staff, owing to financial constraints, although further development of such services is planned.[11] Such elderly-care units require both specialist multidisciplinary staff and assistive infrastructure such as ramps and accessible toilets, for which it has been difficult to obtain funding. In busy general medical wards, there is a rapid turnover of patients and a high demand for beds. Rehabilitation of elderly patients after acute illnesses is difficult in these wards, since staff lack the time to engage with elderly patients and work with them to improve mobility. Since regular wards also lack links with social services, the community-liaison aspect of rehabilitation that is essential in elderly care is lacking. Multidisciplinary teams for this purpose are currently only available in stroke units and some orthopaedic wards. Reorientation of tertiary care to the increasing number of elderly patients should include the provision of dedicated beds for the elderly in each general medical ward, plus development of multidisciplinary teams trained in elderly care to work in general medical wards.

The elderly patient poses many challenges to the physician. Clinical presentation in elderly individuals can be very nonspecific; patients may have several noncommunicable and degenerative diseases and may be taking multiple medications. An interdisciplinary/multidisciplinary service is therefore an absolute necessity to manage these complex physical, social and psychological needs. Evidence of the effectiveness of this approach to elderly care – mainly from high-income countries but also from some low- and middle-income

countries – supports the use of multidimensional packages, including pharmacological and psychosocial interventions; collaboration between different members of the primary-care team; involvement of patients and families together with a stepped-care approach and clear referral pathways; and appropriate supervision, depending on an individual's response to intervention and their severity of disease.[23]

In the Sri Lankan context, delivery of care by an interdisciplinary team consisting of a geriatrician/physician, nurse, physiotherapist, occupational therapist and social worker is needed to provide a comprehensive package to the elderly patient. Other team members such as dietitians, speech and language therapists, podiatrists and tissue-viability nurses also have a vital role. Instead of compartmentalized service provision, a holistic approach needs to be implemented at all levels of service provision, for a better programme of elderly care. As with all aspects of service provision, financial constraints are a challenge. Nevertheless, much progress could be made via partnership with other Member States in the region and collaborative capacity-building initiatives. All countries need to acknowledge that, in order to meet the challenge of their ageing populations, diverting resources towards care of the elderly is an investment rather than a burden. A healthy, economically active, elderly population will be an asset in a society with a shrinking workforce.

Social workers are crucial to the success of the multidisciplinary approach to care of the elderly, since they can ensure the delivery of the patient's post-discharge care plan within the community. The cadre of social workers are currently attached to the administrative sector within the Ministry of Social Services. To enable smooth functioning of a multidisciplinary team, a social worker should be recruited in each hospital. It is vital to establish this link between social services and the curative sector at the levels of both service provision and government ministries.

To strengthen multidisciplinary and multisectoral collaboration at all levels, a technical advisory committee has been established by the Ministry of Health, Nutrition and Indigenous Medicine, to advise on programme planning and policy-making. In addition, a Ministry of Health, Nutrition and Indigenous Medicine steering committee for elderly care is responsible for relevant policy decisions. Periodic reviews are conducted to share best practice pertaining to elderly health care at all levels.

Education and research in geriatric medicine

Strengthening clinical capacity at the community, primary care and hospital levels, and mainstreaming the multidisciplinary approach to care of the elderly, requires investment in training. The Sri Lanka Association of Geriatric Medicine was formed in 2014 by a group of energetic doctors committed to elderly care, with a vision to ensure active healthy ageing in Sri Lanka. The mission of the association is to ensure promotion of geriatric education among the medical fraternity and the public, in order to facilitate the development of elderly-friendly environments in health-care institutions and in the community.

In 2013, the Postgraduate Institute of Medicine at the University of Colombo started a diploma in elderly medicine, as a first step in establishing an academic specialty in geriatric health. This step was taken in direct recognition of the fact that specialist training to enable early intervention and prevention of future morbidities is likely to promote efficient utilization of health resources.[24] It is a full-time course in which the medical officers selected for the diploma by a competitive screening test are given 1-year release from their work stations by the Ministry of Health. The training is proving popular with applicants. However, since a new field of training with new opportunities usually attracts more trainees, incentives may be necessary in the future if the popularity of the course decreases. In addition, a doctor of medicine programme in geriatric medicine is due to be launched this year by the Postgraduate Institute of Medicine.

It is vital that training of nurses in geriatric medicine takes place simultaneously, to enable teamwork in the delivery of care to the elderly. Elderly care is included in the basic and post-basic nursing curricula. There are currently plans to increase training for physiotherapists, occupational therapists and social workers.[11]

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Perspective

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Sri Lanka's national assessment on innovation and intellectual property for access to medical products

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ABSTRACT

In 2008, the *Global strategy and plan of action on public health, innovation and intellectual property* (GSPA-PHI) was launched by the World Health Organization, to stimulate fresh thinking on innovation in, and access to, medicines and to build sustainable research on diseases disproportionately affecting low- and middle-income countries. As part of the activities of the GSPA-PHI, Sri Lanka has been the first country to date to assess the national environment for medical technology and innovation. This year-long, multistakeholder, participative analysis facilitated identification of clear and implementable policy recommendations, for the government to increase its effectiveness in promoting innovation in health products through institutional development, investment and coordination among all areas relevant to public health. The assessment also highlighted areas for priority action, including closing the technology gap in development of health products, facilitating technology transfer, and building the health-research and allied workforces. The Sri Lankan experience will inform the ongoing independent external evaluation of the GSPA-PHI worldwide. The assessment process coincided with the passing of the *National Medicines Regulatory Authority Act* in 2015. In addition, there is growing recognition that regional cooperation will be critical to improving access to medical products in the future. Sri Lanka is therefore actively promoting cooperation to establish a regional regulatory affairs network. Lessons learnt from the Sri Lankan assessment may also benefit other countries embarking on a national GSPA-PHI assessment.

Key words: access to medical products, innovation, intellectual property, Sri Lanka

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BACKGROUND

For the diseases that disproportionally affect low- and middle-income countries (LMICs), there is an urgent need to promote access to new and existing medicines and to develop new diagnostics and vaccines. Renewed focus on this vital task in the past two decades has seen fresh thinking and creative new approaches to pharmaceutical research. For example, World Health Organization (WHO) Member States, the for-profit sector, charitable foundations and nongovernmental organizations have undertaken partnering initiatives to develop new products for diseases that disproportionately affect LMICs. Some of these partnerships, such as the TB Alliance and Medicines for Malaria Venture, are financed by public agencies and private foundations, and have partnered with research institutes and private pharmaceutical companies to develop faster-acting, novel treatments. Recognition that the challenge is not only the inability to purchase existing medical products but also the lack of products that are specifically designed for resource-limited settings, has stimulated non-profit donors to focus on research projects that are not commercially attractive to the for-profit sector.[1]

These non-traditional approaches to pharmaceutical research and development (R&D) have largely been motivated in response to controversy in recent years over the appropriate roles of innovation and intellectual property in global health. Entrenched positions have been taken on both sides of the debate: on one side, defenders of patents for new medical products argue that this protection is essential if the pharmaceutical industry is to invest in future R&D; on the other side, civil-society groups cite the human rights of people in LMICs both to access essential medicines and to benefit from innovations in medical science.[2] As observed in *The world health report 2013: research for universal health coverage*: "Both free knowledge (as a public good) and highly restricted

knowledge (limited by its proprietary nature) can be obstacles to improving health; the former may discourage innovation and the latter may limit access to the products of innovation".[3]

Globally, balance between these two opposing forces has been sought through a series of activities, including multistakeholder initiatives convened by WHO. In 2004, the independent Commission on Intellectual Property Rights, Innovation and Public Health (CIPIH) was set up by WHO to examine these issues in response to the 2003 World Health Assembly resolution WHA56.27 on intellectual property rights, innovation and public health.[4] The comprehensive analysis done by CIPIH had a particular focus on funding and incentive mechanisms for the creation of new medicines, vaccines and diagnostic tests to tackle diseases that disproportionately affect LMICs.[5] The CIPIH report in 2006 made key recommendations aimed at fostering innovation and improving access to drugs.[6]

Responding to this changing R&D landscape, WHO established a Department of Public Health, Innovation and Intellectual Property in 2006, to address the resources needed for LMICs; assess the impact of innovation and intellectual property on access to medicines; explore innovative funding mechanisms for R&D; and provide evidence-based policy-making recommendations.[2]

GLOBAL STRATEGY AND PLAN OF ACTION ON PUBLIC HEALTH, INNOVATION AND INTELLECTUAL PROPERTY

Following extensive consultation on the CIPIH recommendations, an intergovernmental working group negotiated the *Global strategy and plan of action on public health, innovation and intellectual property* (GSPA-PHI),[7] which was launched in 2008. The aims of the GSPA-PHI are (i) to stimulate fresh thinking on innovation and access to medicines; and (ii) to secure an enhanced and sustainable basis for needs-driven essential health R&D relevant to diseases that disproportionately affect LMICs. The strategy is broad and comprises eight elements, 25 sub-elements and 108 specific actions. These elements and actions are designed to set, prioritize and promote research; foster and build innovation capacity; promote technology transfer and local production of medical products; promote the management and application of intellectual property rights to improve public health; improve access to medical products; mobilize resources for R&D relevant to this area; and monitor and evaluate the progress in all these areas.

A key theme of the strategy was that Member States should be responsible for a large portion of the 108 action points. To facilitate these activities at the national level, the WHO Department of Public Health, Innovation and Intellectual Property developed a questionnaire-based tool to enable systematic assessment of a Member State's environment in relation to medical technology and innovation.[8] Use of this tool allows benchmarking and identification of strengths and weaknesses in implementing the GSPA-PHI, and highlights where the Member State and other stakeholders, including WHO, need to focus attention and assistance. The assessment tool also allows identification of clear and implementable policy recommendations for governments to increase their effectiveness in promoting innovation within their countries, through institutional development, and investment in and coordination of areas relevant to health innovation.

The tool had been pilot-tested by the WHO Department of Public Health, Innovation and Intellectual Property in Kenya and employed by the United Republic of Tanzania. In the WHO South-East Asia Region, Sri Lanka took the lead for this assessment. Prior to the national assessment, Sri Lanka had been actively involved in the GSPA-PHI processes at regional and global levels. To date, the Sri Lankan assessment is the only report published by a ministry of health. This account of the participative processes used and lessons learnt may benefit other WHO Member States embarking on a national GSPA-PHI assessment.

THE PROCESS OF GSPA-PHI ASSESSMENT IN SRI LANKA

To lead the national assessment, the Ministry of Health, Nutrition and Indigenous Medicine nominated a focal point in February 2014, which was supported by a working group of WHO representatives and external experts. The multistage process of assessment was highly collaborative and efforts were made to include the widest range of stakeholders, such as from government, industry and academia. In brief, a list of potential stakeholder institutions was researched and members of the working group visited the institutions in person to explain the assessment tool and facilitate data collection. A discussion paper was drafted for validation by the stakeholder institutions during a national consultative workshop. A second consultative workshop was organized to produce a final draft report of the national assessment, incorporating all submissions and comments provided by the stakeholder institutions. The final report was launched in Colombo in March 2015, with the participation of all stakeholders.[9]

The step-wise process of the assessment brought together representatives from diverse institutions nationwide and across a range of government ministries. The very broad remit of the GSPA-PHI necessitated engaging not only stakeholders relevant to core areas of the health sector, such as policy-making on medical-product regulation and health-workforce retention, but also those involved in critical ancillary areas, such as basic sciences research, trade and tariffs on medical products and the management of intellectual property rights. The assessment workshops were therefore unique opportunities to bring together disparate specialists to focus on the future needs of the country.

RESULTS OF THE GSPA-PHI ASSESSMENT IN SRI LANKA

With respect to health R&D, the assessment enabled detailed identification and description of all relevant policies and public and private infrastructure. Funding for health-related R&D and the institutions responsible for disbursement and monitoring

the utilization of such funds were also mapped. In addition, the current status of discovery science and clinical research, especially in relation to conducting clinical research, regulatory and ethics governance of clinical research, and measures for protection of intellectual property, were delineated.

The assessment report noted that the science and technology policy of Sri Lanka should be updated and that the scope of the policy should be broadened to include specific provisions for pharmaceutical products. Although several institutions promote R&D in general, and health R&D in particular, there is a clear need both to improve coordination of these efforts to support public health and to prioritize investment in health R&D.

Critical gaps in the country's ability to build relevant human capital were identified. For example, the *Human resources for health strategic plan 2009–2018* of the Ministry of Health, Nutrition and Indigenous Medicine does not include any capacity-building of the health workforce in R&D.[10] And, since the local pharmaceutical manufacturing industry is relatively small in Sri Lanka, expertise in industrial pharmacy, technology management and other related areas of pharmaceutical manufacturing is limited. The Sri Lanka Inventors Commission, under the purview of the Ministry of Technology and Research, has fostered collaboration between inventors and industry. With appropriate modifications, this mechanism could be extended to the public health services sector in Sri Lanka.

The assessment's benchmarking of pharmaceutical manufacturing capacity illustrated that current capacity to develop health products, particularly pharmaceuticals and related technologies, is weak and that major investments in the pharmaceutical sector are needed if public health objectives are to be achieved. International transfer of technology, local production policies, capacity and legislation, and industry's capacity for local production of existing products were examined in detail. The analysis highlighted a concerning technology gap in health products and a limited amount of technology transfer. There is no formal process for technology assessment in Sri Lanka at present. The expertise available to undertake such an exercise also appears to be limited. Rectification of this situation was identified as an urgent need. Additional points for future consideration included the preparation and implementation of a national pharmaceutical industry development plan, and investment to increase the viability of the local manufacturing industry. Sri Lanka's need for more trained human resources to manage good manufacturing practice requirements was also noted.

Regarding the impact of trade agreements on intellectual property and patents that are relevant to public health, the assessment showed that there is no coordination within or among different stakeholder ministries. Participants proposed establishment of a permanent mechanism to bring together the ministries of health and trade and commerce, together with the National Intellectual Property Office.

With respect to improved delivery and access to affordable, quality medicines, the assessment process pointed towards the need for a high-level mechanism to coordinate relevant activities between the ministries of health, industry and finance. Currently, medical supplies account for around 20% of the annual health budget and there are well-established procurement procedures for pharmaceuticals, surgical supplies and equipment. Nevertheless, periodic shortages of medicines occur at public facilities. The urgent need to establish good storage and good distribution practices to overcome shortcomings in the supply chain was highlighted.

The assessment also highlighted the value of indigenous knowledge, including traditional medicine, noting that more research should be promoted to strengthen the evidence base. Although several attempts have been made to protect traditional knowledge, there is still no legal framework in place. Anecdotal evidence suggests that large amounts of traditional knowledge, particularly related to medicinal use, are exploited and taken out of the country through illegal means.

CONCLUSION AND NEXT STEPS

The Sri Lankan GSPA-PHI assessment has been timely. The assessment process coincided with the passing of the *National Medicines Regulatory Authority Act* in 2015.[11] The establishment of a new drug regulatory authority gives an opportunity to place a regulatory framework in line with the GSPA-PHI. There is growing realization that cooperation among Member States in the region is becoming increasingly important, owing to the complexity of pharmaceuticals, biologicals, vaccines, diagnostics and medical devices; globalization; threats to supply chains; and rising public expectations. Access to medical products is currently greatly influenced by regulatory requirements at national and international levels. Sri Lanka is thus actively promoting cooperation at regional level, to establish a regional regulatory affairs network.

From the global perspective, WHO has commissioned an independent external evaluation of the implementation of the eight elements and 108 specific actions of the GSPA-PHI.[7] Covering 2008–2015, the global evaluation will document achievements, gaps and remaining challenges and make recommendations on the way forward. The evaluators will look at activities of global, regional and national stakeholders, including assessing implementation by national governments, the WHO Secretariat and other relevant institutions and organizations. The analysis will include a global electronic survey of Member States. The findings and recommendations of this evaluation will be made available to Member States on completion and also presented to the 140th session of the Executive Board in January 2017.[12,13]

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Perspective

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Sustainable dengue prevention and control through a comprehensive integrated approach: the Sri Lankan perspective

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ABSTRACT

Dengue is a leading public health problem in Sri Lanka. All 26 districts and all age groups are affected, with high disease transmission; the estimated average annual incidence is 175/100 000 population. Harnessing the World Health Organization *Global strategy for dengue prevention and control, 2012–2020*, Sri Lanka has pledged in its National Strategic Framework to achieve a mortality from dengue below 0.1% and to reduce morbidity by 50% (from the average of the last 5 years) by 2020. Turning points in the country's dengue-control programme have been the restructuring and restrategizing of the core functions; this has involved establishment of a separate dengue-control unit to coordinate integrated vector management, and creation of a presidential task force. There has been great progress in disease surveillance, clinical management and vector control. Enhanced real-time surveillance for early warning allows ample preparedness for an outbreak. National guidelines with enhanced diagnostics have significantly improved clinical management of dengue, reducing the case-fatality rate to 0.2%. Proactive integrated vector management, with multisector partnership, has created a positive vector-control environment; however, sustaining this momentum is a challenge. Robust surveillance, evidence-based clinical management, sustainable vector control and effective communication are key strategies that will be implemented to achieve set targets. Improved early detection and a standardized treatment protocol with enhanced diagnostics at all medical care institutions will lead to further reduction in mortality. Making the maximum effort to minimize outbreaks through sustainable vector control in the three dimensions of risk mapping, innovation and risk modification will enable a reduction in morbidity.

Key words: dengue, dengue epidemic, dengue prevention and control strategies, sustainable integrated dengue control, Sri Lanka

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BACKGROUND

The dramatic spread of epidemic dengue in the World Health Organization (WHO) South-East Asian Region underscores the urgent need for better control and prevention of this disease across Member States of the region and Sri Lanka is no exception.[1,2] The infection was first reported in the country in the early 1960s, but it was not until the late 1980s that dengue haemorrhagic fever (DHF), the more severe form, became endemic.[3] Since 2000, the magnitude of dengue epidemics has increased and dengue viruses have started to spread from urban to semi-urban and rural settings. Since then, cases have been reported from all 26 districts and dengue has become a major public health burden.[4] All four serotypes of dengue virus circulate in the country. From 2009 to 2014, Sri Lanka experienced an exponential increase in the prevalence of dengue, with an average of 35 000 cases per year and an annual incidence of 175/100 000 population reported nationally.[5] Dengue generally affects a greater proportion of children and adolescents but has now expanded to affect young adults and adults as well. Today, however, Sri Lanka has reached the lowest-ever case-fatality rate of 0.2% (47 258 cases with 97 deaths) in 2014, from a high of 5% and 1% in 1996 and 2009 respectively, despite an increase in the proportion of DHF to 10–15%.[5,6]

The Ministry of Health, Nutrition and Indigenous Medicine of Sri Lanka has developed a sustainable dengue-prevention and control programme, through a comprehensive integrated approach aiming to reduce the morbidity and mortality due to dengue to such an extent that it will no longer be a major

public health issue by 2020. This paper presents the current epidemiological situation for dengue, and control and preventive strategies implemented through an evidence-based approach that have led to substantial capacity-building and system strengthening over the past decade. Finally, it discusses how the current strategies will be further enhanced in order to achieve a more robust sustainable reduction in both morbidity and mortality over the next 5 years.

EVIDENCE AND LESSONS LEARNT

Epidemiology

There are many contributory factors driving the emergence and transmission of dengue, related to the agent (dengue virus), human host and mosquito vector. Each of the contributory factors influences transmission of virus and operates against a background of the ecological and environmental factors in the country.[7] Improved surveillance, together with sequence data, strengthens the ability to characterize the patterns of evolution and circulation of the four dengue serotypes. Genetic changes in the virus may lead to changes in the epidemic potential: recent studies have shown that certain gene sequences can have considerable impact on pathogenicity and epidemic potential.[8,9] The emergence of epidemic DHF in Sri Lanka after 1989 led investigators to identify a clade replacement event as the critical factor.[10] More recently, the authors of this paper reported a dengue virus serotype 1, with a new strain circulating in Sri Lanka that coincided with the 2009 dengue epidemic.[11] On the other hand, individuals infected with any of the dengue virus types can have a wide spectrum of infection outcomes. While most will remain asymptomatic or develop undifferentiated fever, a lesser number will develop classical dengue fever (DF), a debilitating but self-limiting illness. A minority will develop DHF, with increased vascular permeability (plasma leakage), thrombocytopenia and haemorrhagic manifestations. Patients with DHF could gradually leak critical amounts of plasma into the interstitial (pleural and peritoneal) spaces, resulting in hypovolaemic shock, which, without early recognition and appropriate treatment, may lead to death. Hence, the more severe form of DHF is also known as dengue shock syndrome, or DSS. The acute phase of DHF/DSS begins in a similar way to that of dengue fever, with few or no clinical parameters to differentiate the two conditions early.[12] Antibody-dependent enhancment due to a secondary infection by any one of the four dengue viruses is one of the most important risk factors for severe disease.[13] Now considered to be a fully domesticated mosquito, *Aedes aegypti* is an efficient epidemic vector because it lays eggs in artificial containers and remains indoors, with easy access to humans. While *Aedes albopictus* remains a less efficient secondary vector, in recent years its importance has increased because it is rapidly expanding its range, resulting in epidemic transmission.[14]

Restructuring the prevention and control programme

In 2004, following a large epidemic with 15 463 dengue cases reported, on the request of the Ministry of Health, WHO conducted an external in-depth review of the dengue-control programme in Sri Lanka. At that time, as seen in other countries, the Ministry of Health anti-malaria campaign was leading the overall vector surveillance and control of dengue. The deliberations led to several policy decisions:

- establishment of a separate unit in the Ministry of Health to develop and implement the national dengue-prevention and control plan with an annual budget allocation;
- supplementation of passive surveillance data by a surveillance system based on sentinel sites, in order to detect early epidemics;
- standardization of clinical diagnosis and management of dengue and DHF, through regular training for all types of clinical workers, including general practitioners;
- hospitals were to be provided with necessary equipment, including microscopes and microcentrifuges, and in large hospitals, a biochemistry laboratory and haematology facility were to be made available (e.g. blood gas electrolytes and coagulogram);
- an effective laboratory-based surveillance system was identified as a priority need and it was planned to provide adequate staffing and support to develop the Medical Research Institute, Colombo, into a national reference laboratory for dengue;
- the urgent need for dedicated entomological staff both centrally and peripherally was emphasized, in order to encourage integrated vector management;
- the necessity of a multidisciplinary approach for vector control, including involvement of other government sectors, the private sector and local nongovernmental organizations, was recognized as a priority;
- it was also decided that an ongoing communication and social mobilization plan was to be established, with sound monitoring and evaluation and specific indicators to measure the actual behaviour to be changed.[15]

The National Dengue Control Unit was established in 2005, to coordinate entomological surveillance, integrated vector control and intersectoral collaboration, social mobilization and capacity-building, along with regular monitoring and evaluation of both national and subnational activities for control and prevention. Based on the growing need for intersectoral collaboration, a presidential task force was established in 2010, incorporating several related ministries such as the Ministries of Local Government, Environment, Law and Order, Defence, Education, Public Administration, Disaster Management, and Media, with the Ministry of Health maintaining the task of overall coordination.[16] The presidential task force meets regularly, with the guidance of the President and the patronage of the Minister of Health, together with relevant stakeholders, in order to arrive at important policy decisions. The multidisciplinary partnership created at the national level flows across provincial, district and divisional levels, to finally reach the communities, where acceptance of the programme has been high by all community members. The overwhelming contribution in rolling out emergency response activities, particularly during outbreaks, has boosted successful community participation, helping to create sustainable coordination mechanisms.[17]

Surveillance

In Sri Lanka, an integrated surveillance system for communicable diseases has included dengue since 1996 and has island-wide coverage through trained clinical and public health staff. National surveillance data are largely based on clinical diagnosis and therefore depend on early notification by both indoor and outdoor public and private-sector institutions. The surveillance system combines both passive and enhanced sentinel surveillance methods and largely relies on clinical diagnosis. Laboratory diagnosis is optional, but the majority of indoor patients have their diagnosis confirmed by commercial assays (rapid diagnostic test for dengue virus NS1 protein and/or enzyme-linked immunosorbent assay [ELISA] immunoglobulin M [IgM]). A recent study done in the capital, Colombo, has shown that the sensitivity of clinical diagnosis by clinicians in the country is as high as 84% concurrence with molecular and serological diagnosis.[6] This finding is similar to the reported sensitivity of 86% in Philippines in 2009–2010.[18] The Central Epidemiology Unit is leading disease surveillance, coordination of clinical management training, outbreak response and operational research activities. For disease surveillance, both online and paper-based systems function in parallel, with weekly reporting and daily updates online, where feedback reports are generated weekly and quarterly. Further, an online sentinel hospital-reporting system established more recently serves as an early-warning system for timely detection and mitigation of outbreaks.

Clinical management

Over the past few years, a number of activities have been initiated to strengthen the clinical management and prevention of dengue. Sri Lanka was proactive in developing guidelines for clinical management way back in 2005. More recently in 2010, based on advanced training on management of DHF received from the WHO collaborating centre in Bangkok, Thailand, a new set of guidelines was developed, which were further revised and updated in 2012 based on Sri Lankan experience.[19,20] National reviews conducted have revealed that these guidelines are currently being used throughout the island, ensuring standardized clinical management encompassing all levels of clinical care facilities. Further, capacity-building of laboratories in all secondary-care facilities at district level and above has ensured basic laboratory testing, including serology on demand by a practising clinician. Further, high-dependency units have been established in all major hospitals, with the necessary equipment, including portable ultrasound scanners, in order to detect plasma leak early in DHF, even before clinical and haematological evidence becomes apparent. Training of clinical staff, based on national guidelines, institutionalizing mandatory patient monitoring charts, and regular clinical and death audits were a few key activities undertaken to strengthen clinical management. The Medical Research Institute is the centre of excellence in the country for both clinical and public health laboratory diagnostics. A new dengue molecular reference laboratory was set up at the Medical Research Institute, to further explore additional information on circulating dengue virus, aiming to strengthen both clinical management and surveillance in the country.[6] National-level death audits have revealed that late admission to hospital, particularly for young adults and adults, has significantly contributed to the number of avoidable deaths due to dengue. Adaptation of clear hospital admissions criteria, based on both clinical and basic laboratory parameters (including complete blood counts after 2 days of fever), has had a tremendous impact on timely admission of patients for proper monitoring and care, thereby avoiding many deaths in the past few years.

Vector control

The practice of spraying adulticides and larvicides indiscriminately during peak monsoon seasons had demonstrated little effect in preventing outbreaks of dengue in the past.[21] However, proactive integrated vector management led by source-reduction campaigns, with the participation of diverse groups of stakeholders, based on strong real-time web-based epidemiological and entomological surveillance data on an environmental management platform, is gaining momentum, with promising results. A unique opportunity was created with the end of the long armed conflict, which allowed the release of a vital source of trained and disciplined human capital (armed forces and police personnel) who could be mobilized to augment systematic premises-inspection campaigns in localities with high case reporting.[17] Despite all these efforts, the challenges of sustainable vector-control activities should not be underestimated, particularly with respect to public participation and resource mobilization.

Economic impact

During the epidemic year 2012, the economic burden of dengue to the health sector was assessed in the heavily urbanized and populous Colombo district, where dengue reporting has been the highest in the island. It was estimated that the total cost of the dengue response for control and hospital care was US$ 3.45 million (US$ 1.50 per capita), with a per capita cost of US$ 0.42 for control activities.[22] The average cost of hospitalization ranged between US$ 216 and US$ 609 for paediatric cases and between US$ 196 and US$ 866 for adult cases, according to the disease severity and treatment setting. These results indicate that dengue poses a serious economic burden to the public health sector in Sri Lanka.[22]

Sharing experience

In 2011, Lahore, the capital of Punjab, Pakistan, experienced its first major dengue epidemic, with over 20 000 confirmed cases and 350 deaths.[23] At the invitation of the Government of Punjab, a multidisciplinary national team from Sri Lanka, comprising clinical, public health and entomology professionals, visited Lahore to assess the situation and to assist in their outbreak-management efforts.[24]

Recently, an international conference on dengue, themed "Dengue: to stem the tide" was held in Colombo. This event was organized by the Epidemiology Unit, Ministry of Health, Sri Lanka, in collaboration with the European Community's Dengue Tools project,[25] and brought together renowned international scientists, clinicians, researchers and scholars with a common interest and concern in the global dengue situation. The overall objective of the project was to develop a comprehensive early-warning and surveillance system that has predictive capability for epidemic dengue and benefits from novel tools for laboratory diagnosis and vector monitoring. At the conference, the findings of this project were disseminated among the stakeholders as part of the country's advocacy programme. This kind of academic session also provides a broader evidence-based practice for dengue prevention and control. This event was an opportunity for Sri Lankan professionals to listen to global experts on dengue, which is an important activity for any country to consider. The deliberations on improved tools for surveillance, better diagnosis and clinical management, prevention and prediction of the spread of dengue signals much hope for the future.

Research

In general, the ability to predict and explain the epidemiological and clinical presentations of dengue using currently available knowledge is as yet rather limited. To understand the effect of infection and disease both over time and by place, in an endemic setting, the present authors established a community cohort (initially among children and then whole families) living in the Colombo metropolis.[26] At enrolment, the seroprevalence of dengue among children younger than 12 years was 53.1% (by 5 and 9 years of age 51% and 70% were seropositive respectively).[27] The risk of primary infection was 14.1% per year (95% confidence interval [CI]: 12.7–15.6%), indicating that among initially seronegative children, approximately 1 in 7 experiences their first infection within 12 months.[28] Over the study period, the incidences of dengue virus infection and disease were 8.39 (95% CI: 6.56–10.53) and 3.38 (95% CI: 2.24–4.88) per 100 children per year, respectively, demonstrating high transmission in that urban population.[29] An association of high rainfall with a lag time of 6–12 weeks before the onset of an outbreak of dengue was revealed in an ongoing study conducted in an urban district.[30] This underscores the need for, and usefulness of, utilization of climate parameters in disease surveillance and preparedness in the country.

Given the heavy burden of disease occurring at young ages and the distinct strains of dengue virus circulating locally, it is important to note that, at the very least, pilot vaccination projects should be conducted in such settings, in order to make decisions about how best to introduce future dengue vaccines.

FRAMEWORK FOR ACTION

Repeated epidemics and increasing endemicity, possibly leading to more severe disease outcomes, make dengue prevention and control a challenging proposition to any lower-middle-income nation. It is imperative that available vector-control strategies use multisectoral involvement, while long-term multisectoral involvement needs substantial responsibility and accountability. Despite the awareness created, getting the community to respond on their part remains a key challenge. Although vaccine introduction has become a possibility, it will need time to make a significant contribution as a primary prevention strategy. Therefore, the health sector is expected to strive to diagnose dengue early and improve clinical management, so that the severity of disease, as well as its case-fatality can be minimized. In addition, introduction of new control and prevention interventions using an evidence-based decision-making process remains an important task of the health sector. All other stakeholders must concentrate on ways to make the necessary environmental changes from positive to negative vector breeding, and adopt new technologies on water management, waste management and building construction and maintenance. To this end, the authors believe that the WHO *Global strategy for dengue prevention and control, 2012–2020* provides a good platform to reverse the growing trend.[31] As such, in order to achieve and maintain a mortality rate below 0.1%, to bring down the current morbidity level (i.e. reported average for the past 5 years) by 50% by 2020, and to strengthen surveillance for prevention and control, Sri Lanka has reviewed its national strategic framework (see Fig. 1).[32]

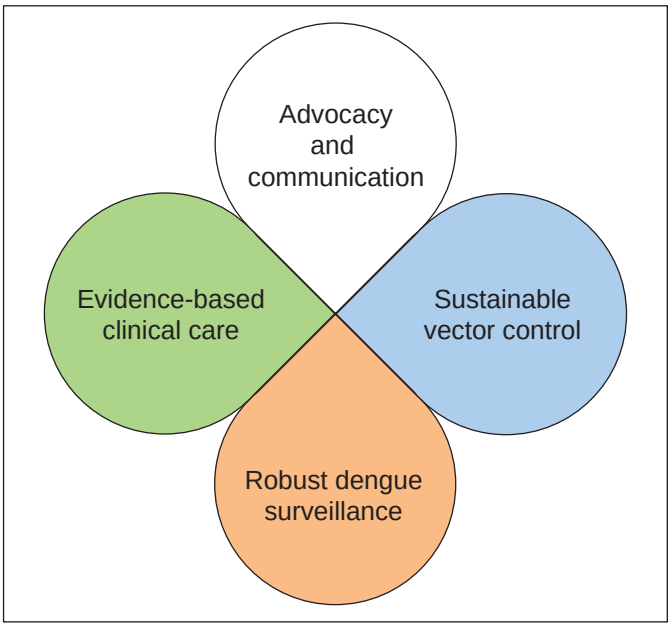

Fig. 1. Key strategies for dengue prevention and control, 2016–2020

Reducing mortality

Lowering the mortality from the current case-fatality rate of 0.2% to 0.05% is the country's top priority. Early detection and standardized management of DHF based on national guidelines have significantly contributed to lowering the mortality over the past few years. In order to minimize dengue-related deaths during the next 5 years, the health sector has to further strengthen health care and laboratory capacities for early diagnosis through enhanced fever screening and emergency care at the level of first contact. Establishment of clinical management training centres in each of the nine provinces in the country; publishing and disseminating scenario-based case-management training guides; providing hands-on training to all levels of clinical workers; and increasing the number of high-dependency units in every secondary care facility across the country, in order to minimize unnecessary referrals, are several important actions for consideration.

A pool of clinical experts will be identified who are trained and skilled to provide a 24-h helpline to all clinicians serving small institutions, including private-sector facilities. Enhancing laboratory surveillance in existing facilities at state and private-sector institutions, and improving first-contact screening through standardized use of rapid diagnostic tests, especially in non-endemic areas, will help to improve early identification, while enhancing specificity. Further, a satellite case-management system will be developed for smaller institutions and general practitioners managing non-severe and recovering dengue patients. In-depth technical investigation into all suspected dengue deaths, and continuous community awareness on early health-care seeking, will not be overlooked. Mortality- and morbidity-based national quality indicators will be agreed upon by all levels of clinical care setting, including private-sector institutions and general practitioners. Avoiding the use of unconventional treatment modalities and nonsteroidal anti-inflammatory drugs for presumptive dengue will be adopted.

Reduction of morbidity

The task of reducing dengue morbidity is equally challenging and requires adaptation of specific collaborative actions. Multiple opportunities have opened up in terms of advocacy, social mobilization and legislation, with the presidential task force providing a platform for both intra- and intersectoral collaboration. Making maximum use of the opportunity created to forecast, detect and curtail outbreaks early, an evidence-based decision-making process will be developed. For this purpose, the country will work on three dimensions: risk mapping, innovation and risk modification (see Fig. 2).

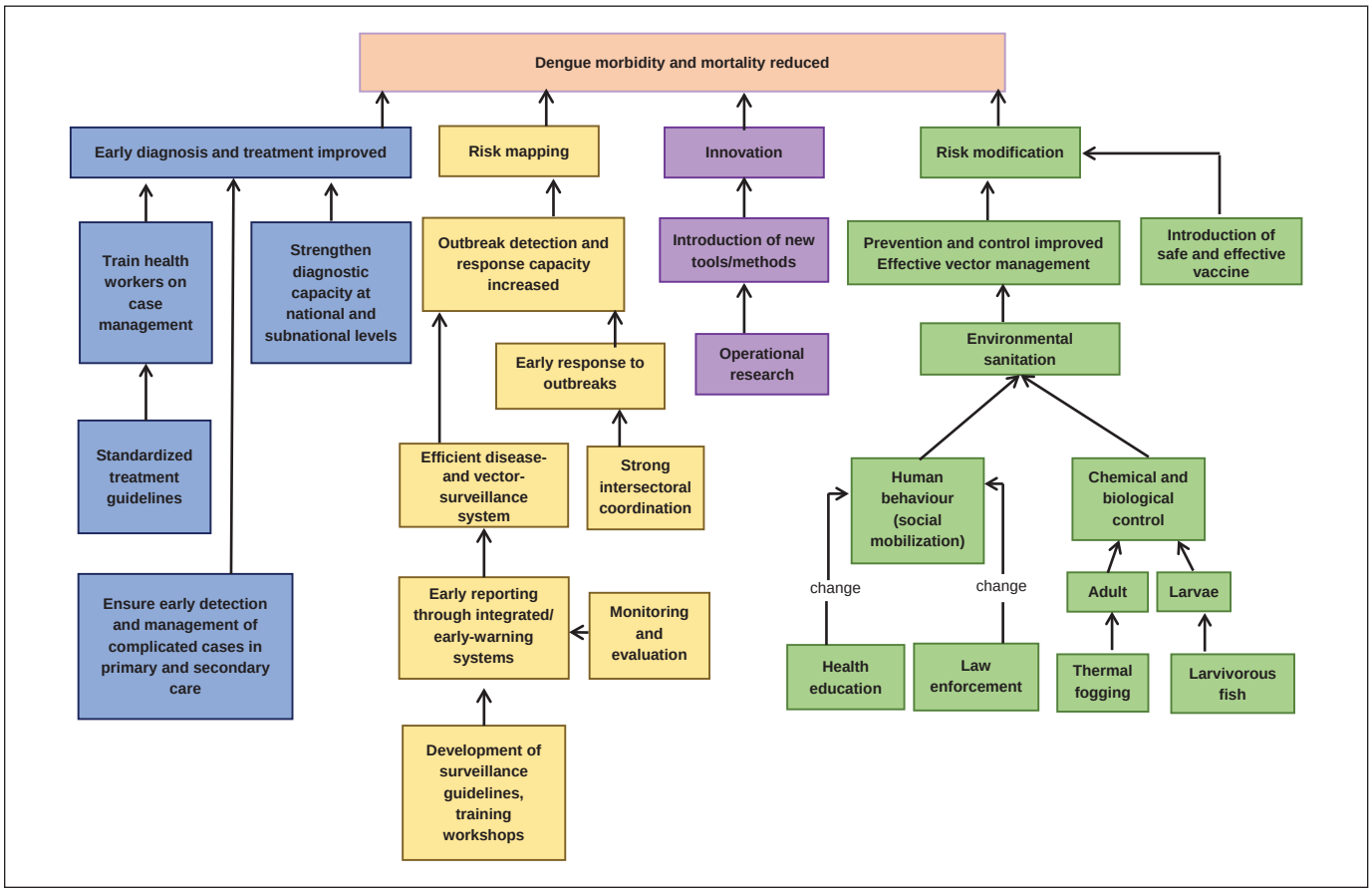

Fig. 2. Logic framework for dengue prevention and control, 2016–2020

Risk mapping

Current activities related to control and prevention are carried out based on a more general process of ranking risk as priority high-risk, high-risk and low-risk areas, decided mainly upon historical outbreaks and the number of dengue cases reported in the past few years for each geographic health division. A more scientific real-time risk-mapping system will enable better resource allocation, as well as timely interventions. Development of a composite scoring system using the rich epidemiological and entomological data available, and a divisional high-risk approach that has already been adopted, would enable identification of the smallest geographic areas for proactive interventions. To this end, a composite risk mapping for action, based on predetermined criteria, will help not only objective interventions but also indicator-based monitoring by supervisory staff. The population density of the locality; the proportion of reported dengue cases in individuals below 15 years of age (indicating high local transmission); and the premises index, indicating the abundance in vector habitats during the current year and existence of additional potential breeding sites such as construction sites, schools and bare land, would collectively give an indication of the additional risk of transmission in that particular location. This background information will help the public health fieldworkers to make quick decisions on the intensity of control measures to be exercised in such localities (outbreak clusters mitigation). In response, source-reduction activities for *Aedes* breeding, use of adult and larval mosquito-control measures, communication using public address systems, and taking legal action against repeated offenders are important considerations. To ensure effective and sustainable execution, trained and committed field inspection teams will be established in highly affected divisions, on a priority basis, by recruiting additional staff.

Innovation

Further strengthening of disease surveillance will be ensured by the introduction of modern information technology and diagnostics. These new technologies will be applied to all sentinel reporting sites and also expanded into the private-sector institutions. Satellite technological advancements for mapping climate parameters will be used to predict and monitor trends and outbreaks of the disease.

Introduction of a mosquito inspection card through young schoolchildren, as a curriculum-based activity, is expected to bring about behavioural change in families, encouraging greater community participation through regular inspection of their surroundings. By developing a mobile application for the community to report potential *Aedes* breeding habitats in their own premises, the school card system will be taken a step further. A gradual change in the community to be more socially responsible will be expected through these novel campaigns, which will be monitored regularly by both local and higher-level public health workers.

Risk modification

Urban Sri Lanka has a growing population density, with a rapid and large demand for urbanization. The process of urbanization over many decades has been largely unplanned and the urban lifestyle is frequently not environmentally friendly. Expansion of the urban lifestyle to peri-urban areas is spatially extending the risk of dengue. All these factors contribute to an abundance of breeding places for *Aedes* mosquitoes. Rapid urbanization is probably one of the main drivers of dengue, resulting in public health and built-environment professionals working more closely together than ever before to address the needs of the communities they serve. This new relationship will be further encouraged and facilitated to ensure a well-integrated approach to issues relating to the built environment.[33] Sri Lanka has passed a number of laws and regulations for prevention and control of mosquito breeding, which will be further strengthened in view of future demands. It is important to pass an act that will help to regulate the use of roof gutters for new building developments, to implement new guidelines, and to develop an efficient and effective system for maintaining existing roof gutters. Further, it is essential to exercise strict laws for maintaining construction sites free of mosquito breeding during the entire period of construction. Emerging new horizons and challenges facing Sri Lanka over the coming 5 years, with mega-cities, port cities and both public and private economic development plans, will no doubt be testified by the sustained effectiveness of the proposed approaches for dengue prevention.

CONCLUSION

The intention of this perspective is not to give an exhaustive list of strategies and activities for dengue prevention and control adopted in Sri Lanka. No doubt many nations have established multiple approaches thus far, to strengthen clinical management to reduce mortality, and vector-control interventions to minimize morbidity. However, sustaining such interventions needs meticulous planning and a holistic approach in implementation, with contributions from multiple stakeholders. Sri Lanka wishes to continue the partnership with WHO and other collaborators in the fight against dengue, utilizing both old and new interventions in the dengue-prevention and control pipeline.

In coming years, the country will pay more attention to reducing morbidity, which is a challenging task. However, with the new strategies of risk mapping, innovation and risk modification, more positive results should be expected. One would also expect that, with a reduction in morbidity, the country can focus in parallel on further improving case-management, leading to the most vital task – the reduction of mortality, where the highest public and media concerns are raised. None of the above would be achieved without two important factors: adequate funds and availability of resources, and a trained and skilled workforce. While the first is more within the political and management radar, human-resource mobility is highly dependent on individuals. It is hoped that the country will move forward with these two requirements in harmony, to achieve the goal of eradication of dengue as a public health problem in the country.

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Perspective

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Sri Lanka takes action towards a target of zero rabies death by 2020

PA Lionel Harischandra[1], Amila Gunesekera[2], Navaratnasingam Janakan[3], Gyanendra Gongal[4], Bernadette Abela-Ridder[5]

ABSTRACT

Rabies is a 100% vaccine-preventable and 100% fatal zoonotic, viral disease. It is usually spread to humans by saliva, through bites or scratches. Dogs are the source of the vast majority of human deaths from rabies. Political will and leadership have been the main drivers for success of the Sri Lankan effort to reduce the burden of disease attributable to rabies. Post-exposure prophylaxis, which is available in government health facilities, at no cost, to all bite patients, has been a main axis of the rabies-elimination strategy. To attain the last mile in rabies elimination in Sri Lanka by 2020, more will need to be done to scale up dog vaccination, enforce responsible dog ownership, strengthen surveillance for animals and humans and conduct mass awareness programmes. Sri Lanka is the first country in the World Health Organization South-East Asia Region to develop a national strategy for elimination of dog-mediated rabies and is a key country in sharing knowledge, expertise and capacity-building in the region, towards a global target of zero rabies deaths by 2030.

Key words: dog bites, rabies, rabies elimination, Sri Lanka

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BACKGROUND

Rabies is a 100% vaccine-preventable and 100% fatal zoonotic, viral disease. It is usually spread to humans by saliva, through bites or scratches. Dogs are the source of the vast majority of human rabies deaths. Each year worldwide, the number of human rabies deaths caused by canine rabies is estimated to be between 35 410[1,2] and 59 000 (95% confidence interval [CI]: 25 000–159 000),[3] many of which are in children. Rabies is also responsible for an estimated 3.7 million (95% CI: 1.6–10.4 million) lost disability-adjusted life years (DALYs) and US$ 8.6 billion (95% CI: 2.9–21.5 billion) in economic costs each year.[3] An estimated 95% of human deaths from rabies occur in Africa and Asia, where dog rabies is poorly controlled. Rabies disproportionately affects poor rural communities, where access to appropriate post-exposure prophylaxis (PEP) is limited or non-existent and dog vaccination programmes are rare.[4]

Louis Pasteur discovered the first rabies vaccine over 130 years ago. Although safe, efficacious and life-saving vaccines for humans and animals have been available for a long time, political will and leadership are required to put these tools to use in successfully reducing the burden of rabies.

PROGRESS IN DOG-MEDIATED RABIES IN SRI LANKA

Reaching the target in Sri Lanka of elimination of rabies by 2020 lies within grasp, with only five cases of human rabies recorded in the first half of 2016 compared with 24 in all of 2015.[5] Human rabies has been a notifiable disease since 1971, with a programme led by the Ministry of Health, Nutrition and Indigenous Medicine (MoH), and rabies in domestic animals became notifiable in 2012. An island-wide comprehensive rabies-control programme was launched in 1975, with support from the World Health Organization (WHO). Progress in reducing rabies in Sri Lanka has been mostly attributable to the MoH setting rabies as a national health priority and making PEP available, free of charge, to victims of animal bites, at government hospitals throughout Sri Lanka. The Public Health Veterinary Services of the MoH are responsible for rabies control in the country. Under the decentralized health system, regional directorates of health implement the control activities island-wide. Mass dog vaccination, female dog sterilization and programmes for the adoption of puppies at community level have been introduced, raising awareness and addressing both the human and animal aspects in coordination with local authorities, in a multipronged approach to combat

rabies. The number of dogs with rabies has remained relatively unchanged, while the number of suspected human rabies cases is decreasing gradually.[6] Currently, the provision of PEP to bite victims is not necessarily linked by default to the animal's vaccination history, the bite circumstances or observation of whether a biting animal develops rabies.

Sri Lanka is one of the first countries in Asia to have initiated the cost- and dose-saving intradermal administration of PEP, after phasing out the use of nerve-tissue vaccine in 1995. PEP for victims of animal bites has increased from fewer than 100 000 treatments in 1992 to more than 400 000 during 2002–2004. It has now levelled out to about 300 000 PEP treatments annually. The decrease in the number of cases of human rabies can largely be attributed to access to PEP free of charge at public health services. The residual rabies deaths are mostly in adult men who do not seek PEP. Equine-derived rabies immunoglobulin is being increasingly used as an alternative to human-derived rabies immunoglobulin, which is more expensive and difficult to procure. This shift is projected to continue (see Table 1) and the savings could be invested in the weaker parts of the rabies-elimination programme, namely prevention of rabies at source, through, for example, strengthening of large-scale dog-vaccination programmes.

Vaccinating dogs is a powerful and essential public health intervention to break the transmission cycle. Dog vaccination in Sri Lanka has increased gradually, from about 400 000 vaccinations in 1990 to about 1.5 million dogs vaccinated in 2015 (see Fig. 1).[7] To reach the goal of complete elimination of rabies, dog vaccination will need to be scaled up, as vaccination coverage remains uneven, slow and insufficient to break transmission. The MoH forecasts an increase in the number of animal rabies vaccinations from the current 1.8 million to 2.4 million in 2020 (see Table 1). One of the options to increase coverage is to vaccinate puppies aged less than 3 months,[8] and to include cats as much as possible in vaccination campaigns. In addition, a "no kill" policy for roaming dogs was introduced in 2006, supported by a "capture, neuter, vaccinate and release" (CNVR) policy, to stabilize the population of roaming dogs. However, it is acknowledged that in the future, as responsible dog ownership and garbage-disposal practices improve, a significant reduction in populations of stray dogs can be expected.

Surveillance is an important pillar to inform understanding of trends and to guide action in rabies elimination, including identification of risk areas and providing assurance of absence of disease as elimination targets are reached. Surveillance in humans and animals remains an area for further strengthening. The Department of Rabies Diagnosis and Research, Medical Research Institute, in Colombo Laboratory, provides the necessary national capacity for diagnosis and surveillance of rabies for animals and humans. The Medical Research Institute has also provided other countries in the WHO South-East Asia Region with opportunities for technical capacity-building. Additional capacity is being developed at the University of Peradeniya and Department of Animal Production and Health of the Ministry of Livestock and Rural Community Development.

TOWARDS ENDING HUMAN DEATHS GLOBALLY FROM DOG-MEDIATED RABIES BY 2030

A multi-sector rabies-elimination advisory committee has been established to guide the national rabies programme under the leadership of the Director-General of Health Services, including representation from the Public Health and Veterinary Services, Environmental Health, Health Promotion and Epidemiology sectors of the Ministry of Health; the Medical Research Institute; the Ministry of Education; the Ministry of Livestock and Rural Community Development; the Faculty of Veterinary Sciences; the Department of Police; the Veterinary Council for Sri Lanka; municipalities; provincial councils; local government; and the media. The MoH is now progressively trying to hand over responsibility for the dog component of rabies control to the veterinary sector and to scale up human resources by subcontracting to the private sector. Supporting the activities of nongovernmental organizations can thus be better coordinated and harnessed to scale up efforts in rabies elimination.

Sri Lanka is the first country in WHO South-East Asia Region to develop a national strategy for elimination of dog-mediated rabies and is a key country in sharing knowledge, expertise and capacity-building in the region; the most recent collaborations have been with Bangladesh, Bhutan, Indonesia, Iran, Myanmar and Thailand. Upcoming exchange will be on policy advice and

Table 1. Projected requirements for rabies-related biologicals in Sri Lanka, 2016–2020

	Number of vials required				
	2016	2017	2018	2019	2020
Human anti-rabies vaccine (1 mL vials)	310 000	300 000	290 000	280 000	270 000
Human rabies immunoglobulin (300 IU)	15 000	15 000	15 000	15 000	15 000
Human rabies immunoglobulin (700 IU)	10 000	10 000	10 000	10 000	10 000
Equine rabies immunoglobulin (1000 IU)	100 000	90 000	80 000	70 000	60 000
Animal rabies vaccine (10 mL vials)	1 800 000	2 000 000	2 200 000	2 400 000	2 400 000

IU: International Unit.

Source: internal data from the Ministry of Health, Nutrition and Indigenous Medicine.

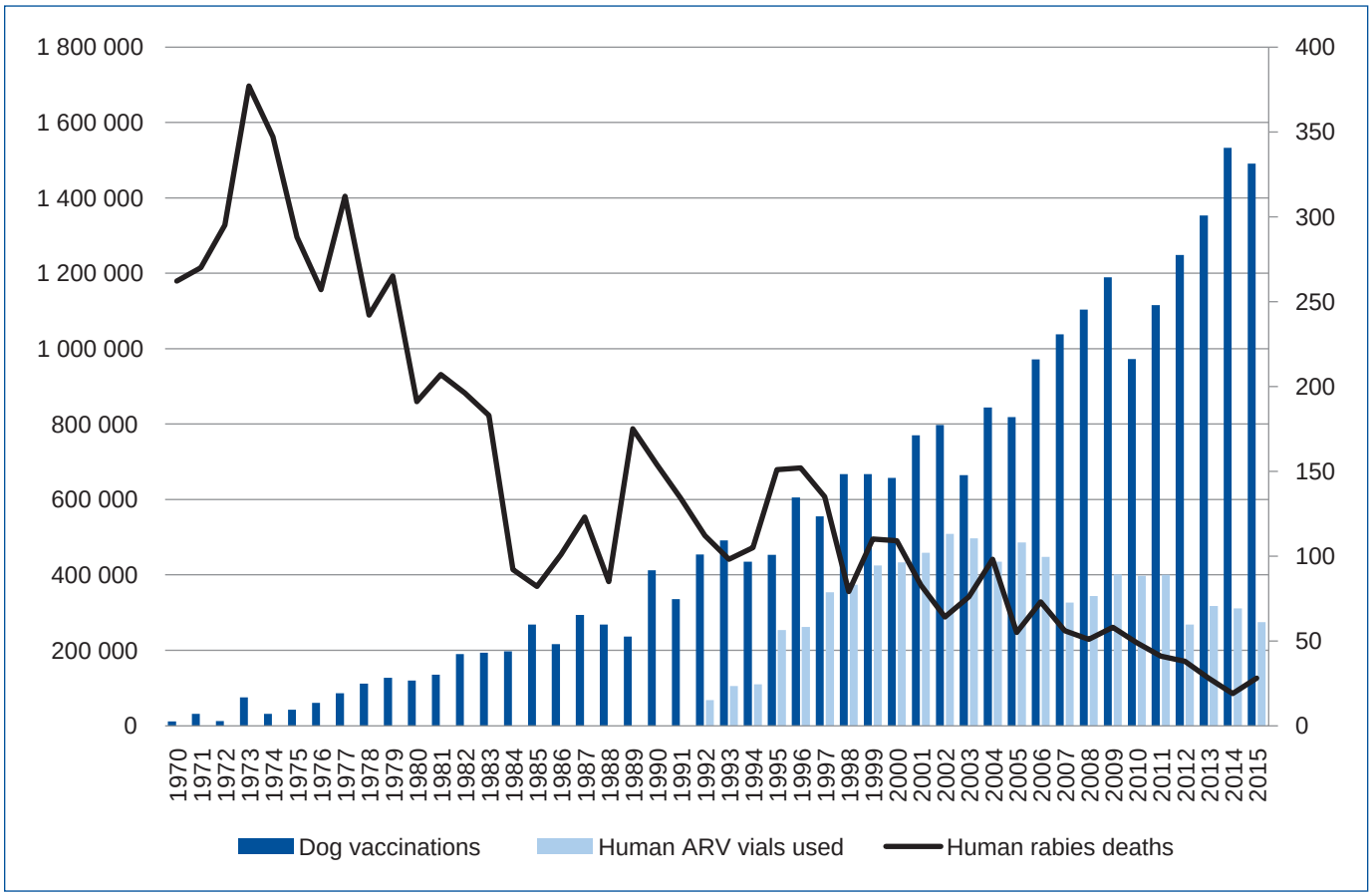

Fig. 1. Human rabies deaths, dog rabies vaccinations and human anti-rabies vaccinations in Sri Lanka, 1970–2015

ARV: anti-rabies vaccination.
Source: Public Health Veterinary Services Ministry of Health.[7]

training in intradermal administration of rabies vaccine in humans in Myanmar and Nepal, planned for the third quarter of 2016.

The momentum has been building, and in August 2015 Sri Lanka hosted a meeting on rabies, leading the countries in the WHO South-East Asia Region and the South Asian Association for Regional Cooperation to reinforce the target of zero rabies deaths by 2020,[9] as a next step of the *Strategic framework for elimination of human rabies transmitted by dogs in the South-East Asia Region*.[10] Some of the successes in the region can be highlighted as follows:

- in Bhutan, the National Centre for Animal Health has taken a strong lead and has implemented a successful CNVR programme, significantly reducing rabies in animals and humans, while building a buffer zone to the highly porous and rabies-endemic national border of India;
- the Bangladesh Ministry of Health provided leadership in the country not only to introduce intradermal PEP in 65 districts of the country but also to lead intensive dog-vaccination campaigns;
- Thailand has world-class expertise in rabies control and has pioneered intradermal techniques for rabies vaccination;
- India made rabies a priority disease for control for the first time in 2014, in its 12th national programme of work.

Subsequently, in December 2015, WHO, the World Organisation for Animal Health, the Food and Agriculture Organization of the United Nations, and the Global Alliance for Rabies Control, noting that reaching zero rabies deaths is feasible, hosted a global meeting attended by public health and veterinary government representatives of countries affected by rabies, and other stakeholders. The meeting agreed on a strategic framework to end human deaths globally from dog-mediated rabies by 2030.[11] Dr Margaret Chan, WHO Director-General, addressed the meeting to lend her support to ending this horrific, yet preventable disease, stating that "Rabies belongs in the history books". The WHO Regional Office for South-East Asia is leading the way and, with champion countries like Sri Lanka setting the pace, success is on the horizon.

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Review

Scrub typhus in Bhutan: a synthesis of data from 2009 to 2014

Tshokey Tshokey, Tashi Choden, Ragunath Sharma

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ABSTRACT

Scrub typhus is an acute, febrile illness, caused by the bacterium *Orientia tsutsugamushi*, that affects millions annually in the endemic Asia-Pacific region. In untreated cases, the case-fatality rates range from 6% to 35%. In Bhutan, there was a probable outbreak in Gedu in 2009, which resulted in heightened awareness of the disease. Nevertheless, information on scrub typhus in Bhutan is limited and scattered and the epidemiology has yet to be established. To report the current picture of scrub typhus in Bhutan, this review gathered data from scholarly databases, surveillance reports, the *Annual health bulletin*, research publications and laboratory test reports from hospitals. The weight of evidence indicates an increasing burden of scrub typhus since the Gedu incident, coupled with increased awareness and testing. Another outbreak in a rural primary school in 2014 resulted in two deaths. More hospitals now have testing facilities and laboratory-confirmed cases have been increasing since 2009, with seasonal trends. This review highlights the need for in-depth surveillance and reporting, increased awareness among health-care workers, and initiation of prevention and control programmes in the country.

Key words: Bhutan, Gedu, *Orientia tsutsugamushi*, scrub typhus

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BACKGROUND

Scrub typhus is an acute febrile illness caused by the bacterium *Orientia tsutsugamushi.* The infection results from bites of chigger mites that are primarily associated with rodents of the genus *Rattus*. With an incubation period of 10–14 days, scrub typhus presents with acute onset of fever, headache, malaise, swollen lymph nodes and maculopapular rashes by the end of the first week of fever.[1] Without treatment, the case-fatality rate remains at 6–35% but can be as high as 60% in some outbreaks.[1] It has been described as a seriously neglected life-threatening tropical disease.[2] It is also a travel-associated disease,[3] and has great importance among military personnel.[4] Scrub typhus is known to be endemic to the Asia-Pacific region, covering a triangular area known as the "*tsutsugamushi* triangle", extending from Afghanistan and Pakistan in the west to China and Korea in the east and the islands of the south-western Pacific and northern Australia in the south. In this region, an estimated one million cases occur annually, especially among those engaged in logging, clearing of land and working in rice fields.[3] The disease is focally distributed throughout the region, from the low coastal lands to a height of over 3200 m in the Himalayas.[1] Scrub typhus is being increasingly reported from new areas within the endemic Asia-Pacific region and also beyond the described triangle, with recent descriptions in a patient from Dubai in the Middle East[5] and in children in Kenya, Africa.[6]

In the Indian city of Darjeeling, a study in 2005 showed that the incidence of scrub typhus increased from 2/100 000 population in July to 20/100 000 population in September and decreased to zero in December.[7] One of the first studies on scrub typhus in Bangladesh, a prospective sero-epidemiologic survey across six major teaching hospitals in Bangladesh using an immunoglobulin M (IgM) enzyme-linked immunosorbent assay, found that 24% (287/1209) had evidence of recent exposure to *Orientia tsutsugamushi*. Seropositivity differed between regions but there was no clustering of cases and no difference between urban and rural residents.[8] Cases of scrub typhus have been increasingly reported in mainland China, from 1248 in 2006 to 8886 in 2012.[9] There have been several studies on outbreak or clusters of scrub typhus cases from different states of India.[10–15] In a survey of the eastern Himalayas (Indian districts bordering the Bhutan foothills) for endemicity of scrub typhus among small mammals, chiggers were the most prevalent ectoparasites, with clusters of single hosts harbouring up to 600 mite larvae.[16] Of the 573 mammals sampled, 357 (62%) were infested with trombiculid larvae, and rodents and insectivores were both equally good hosts for larval mites, with 68% infestation in both cases.[16] Despite increasing reports of significant burden, the true incidence of human infections in south central Asia still remains unknown.[1]

Bhutan is a small Himalayan country between India and China. It has a population of about 750 000, with a population density

of 9 to 64 people/km^2 in different districts.[17] The country has over 70% forest cover and the economy is mostly agricultural, with 70% of the population living in rural areas. Bhutan can be conveniently divided into three regions: the north bordering China, dominated by the Great Himalayas with terrains and high mountains above 3700 m; the lesser Himalayas above 1500 m; and the Duars plain, bordering India in the south. With four distinct seasons, the mean daily temperature can vary from 5 °C in winters to 25 °C in summer and the average annual rainfall varies from less than 500 mm in the northern Himalayas and 500–1000 mm in the inner central valleys to 2000–5000 mm in the southern foothills.[1] Bhutan lies within the zone that is endemic for scrub typhus, and the environment of wide scrub vegetation, high humidity, extensive agricultural activities and abundant rodent population, especially in the middle and southern part of the country, makes it conducive for transmission of the organism, although the disease was not documented until recently. Earlier infections may have been missed, owing to a lack of diagnostic facilities and poor awareness among health-care workers. However, many non-malarial and non-typhoid febrile cases that responded rapidly to doxycycline or chloramphenicol in daily medical practice could have been scrub typhus. The disease was only highlighted with a probable outbreak of some febrile illness in 2009. The infection is now increasingly reported from many parts of the country.

Scrub typhus has been included in the national list of notifiable diseases since 2008 and reporting was initiated in 2010 but the notification system is weak and many health-care workers are unaware of the need to notify, resulting in minimal reports. The surveillance manual defines scrub typhus as "characterized by acute onset of fever after several days, headache, profuse sweating, myalgia, eschar, lymphadenopathy and rash" and defines a suspected case as "a case that is compatible with [the] clinical description".[18] Since 2010, reports on scrub typhus (as rickettsial diseases) have been included in the annual mortality and morbidity reports submitted by the district health offices to the Ministry of Health. These are compiled by the Health Management Information System, in the *Annual health bulletin*.[19–22] Almost all of these cases are clinically diagnosed cases, since most hospitals did not have laboratory tests until 2013. At present, the limited data available, in the form of departmental reports and publications, are scattered. This review aimed to compile all the available epidemiological data, to obtain a current picture of the disease in Bhutan.

METHODOLOGY

All available information on scrub typhus in Bhutan was gathered using web-based searches, surveillance and outbreak reports, the *Annual health bulletins* of the Ministry of Health, and laboratory test data from the Public Health Laboratory, the Jigme Dorji Wangchuck National Referral Hospital and other district hospitals. The terms "Bhutan" and "scrub typhus" or "*Orientia tsutsugamushi*" were used to search for any mention of the disease in Bhutan in scholarly databases. The sources of data obtained and used for this synthesis of information are presented in Table 1.

All laboratory-confirmed cases were tested by a single rapid antibody test kit that detects *O. tsutsugamushi* IgM, IgG and IgA antibodies (SD Bioline Tsutsugamushi assay, Standard Diagnostics Inc, Republic of Korea). The manufacturers of the test kit claim a sensitivity of 99%, a specificity of 96% and a serological agreement of 97.5% with indirect immunofluorescent assay, the accepted gold-standard method.

The current laboratory surveillance system was limited to selected district hospital laboratories in the southern part of Bhutan that collect serum samples from suspected patients and ship them to the Public Health Laboratory in Thimphu. However, any health centre can report any suspected or confirmed cases through the weekly, monthly or annual morbidity and mortality report to the Public Health Laboratory and/or Ministry of Health.

Table 1. Data sources obtained and used for the review

Topic of research/report	Author/year	Type of report/study population
Vector-borne Disease Control Programme tour report to Chukha Dzongkhag (27–31 July 2009)	Lhazeen, 2009	Personal communication, site visit and investigation report
Annual health bulletins (2011–2014)[19–22]	Health Management Information system, Ministry of Heath, Bhutan	Annual reports from health centres to the Ministry of Health
Outbreak investigation report on scrub typhus in Singye Namgyel Primary School, Wangduephodrang[23]	Phuentsho, 2015	Outbreak investigation report
Clinical characteristics of scrub typhus in Gedu and Mongar (Bhutan)[24]	Dorji, Wangchuk, Lhazeen, 2009	Surveillance report submitted to the Ministry of Health
Study on clinico-laboratory profile of children with scrub typhus	Bhandari, 2011	Personal communication, clinical study and oral presentation at the Second Annual Clinical Conference, JDWNRH, Thimphu, 2011

JDWNRH: Jigme Dorji Wangchuk National Referral Hospital.

Since there was no involvement of patients and only existing data were used, ethical clearance was not required by local guidelines. No personally identifying information was collected. Data analysis was descriptive of the number of cases reported, number of samples tested and annual and seasonal trends of scrub typhus.

RESULTS

Two probable outbreak investigation reports, one surveillance report, one hospital-based clinical research study, four Ministry of Health annual reports and one newspaper report of an outbreak were found.[19–24] Some laboratory reports were also obtained by referring to past records and personal communication with the laboratory staff concerned. No regional or international publications relating to scrub typhus in Bhutan were found.

Bhutan experienced two probable outbreaks of scrub typhus. The first occurred during July 2009 in Gedu, a locality in the south-western part of the country, but similar cases were also noted during the same month in the previous year (personal communication). Cases presented with fever, headache, joint pains and maculopapular rash. Initially, patients were managed as for dengue fever or dengue shock syndrome and some of them tested positive for IgM dengue antibody. During the incident, several people, mostly farmers from the locality, were seen in the outpatient unit, 18 were admitted and three lives were lost. Two of the deceased had signs and symptoms of dengue shock syndrome and also tested positive for dengue IgM. One of the deceased had enteric-fever-like symptoms and gastrointestinal perforation. Overall, the incident had a case-fatality rate of more than 10%. During the investigation, five of the seven febrile patients in the ward had typical eschar. No laboratory test for scrub typhus was carried out. With signs and symptoms of febrile illness, the presence of eschar in many cases, and rapid response to doxycycline in those treated, this was described as a probable outbreak of scrub typhus, the first recognition of the disease in the country. The second outbreak was recent and occurred at a remote boarding primary school in August to October 2014, at Athang, Wangduephodrang district in central Bhutan.[23] In this boarding school, there was abundant scrub vegetation and students lived in crowded rodent-infested hostels. The outbreak affected about 36 children, with seven hospital admissions and two deaths. The cases commonly presented with typical scrub-typhus-like symptoms and most had eschar but the two deceased had signs and symptoms of meningitis/encephalitis. Many cases had severe thrombocytopaenia and all of the 12 blood samples collected by the investigating team tested positive for scrub typhus with a rapid-test kit.

Following the report of high numbers of febrile cases in 2008 in Gedu, the Public Health Laboratory collected blood samples for scrub typhus from Gedu hospital in March 2009.[24] A few samples were also, coincidentally, received from Mongar hospital. Of the 33 serum samples sent to the reference laboratory outside Bhutan, 23 (69.7%) had acute scrub typhus infection as tested by indirect immunofluorescent assay.[24] Cases were seen in all age groups, including children as young as 1 year. One patient tested positive for three infections (dengue, scrub typhus and murine typhus). This was the first definite laboratory-confirmed case of scrub typhus in Bhutan using the gold-standard laboratory technique. At the same time, a hospital-based retrospective study looked at the clinico-laboratory profile of children with suspected scrub typhus in the Eastern Regional Referral Hospital, Mongar, between August and October 2009 (personal communication). Participants were severely ill children admitted to the ward with fever and thrombocytopaenia. Of the 18 children admitted, 12 had a scrub typhus test result and 10 (83%) of these were positive (personal communication). Three of the children with scrub typhus also tested positive for dengue fever. None were positive for malaria, typhoid or leptospirosis.

The Public Health Laboratory initiated testing for scrub typhus on samples from the district hospitals from 2009. However, without a properly established system, and fuelled by lack of awareness among health-care workers, very few samples were received initially. However, over the years, the number of referred samples and the number of positive results increased, as depicted in Table 2. The test positivity ranged between 22% and 60% among the cases sampled. It was noted that the number of samples increased from two per month in December/January to about 30–75 in June to October, on average, over the 4 years (2009–2012). By November, both the number of samples and the number of positive test results gradually decreased. This showed a seasonal trend of the disease in the hot monsoon and subsequent months, as shown in Fig. 1.

The Jigme Dorji Wangchuck National Referral Hospital took over the testing of scrub typhus from the Public Health Laboratory by end of 2012. The record showed an increase in the number of samples tested for scrub typhus from 269 in 2013 to 336 in 2014. Fig. 2 shows a summary of the total number of cases, depicting an increasing case-load, positivity and seasonal trend similar to the Public Health Laboratory results. Few district hospitals received the test kit by end of 2013 or early 2014. The five hospitals that submitted their test results for this study performed 560 tests in 2014. The Eastern Regional Referral Hospital tested 244 samples but could not provide the number of positive results. Thus, considering the four hospitals, the total number of samples tested was 316, with 38 (12%) positive results.

Table 2. Scrub typhus tests in the Public Health Laboratory with samples received from the district hospitals (2009–2012)

Year	Number tested	Number (%) positive
2009	5	3 (60)
2010	70	23 (33)
2011	153	55 (36)
2012	92	20 (22)
Total	320	101 (32)

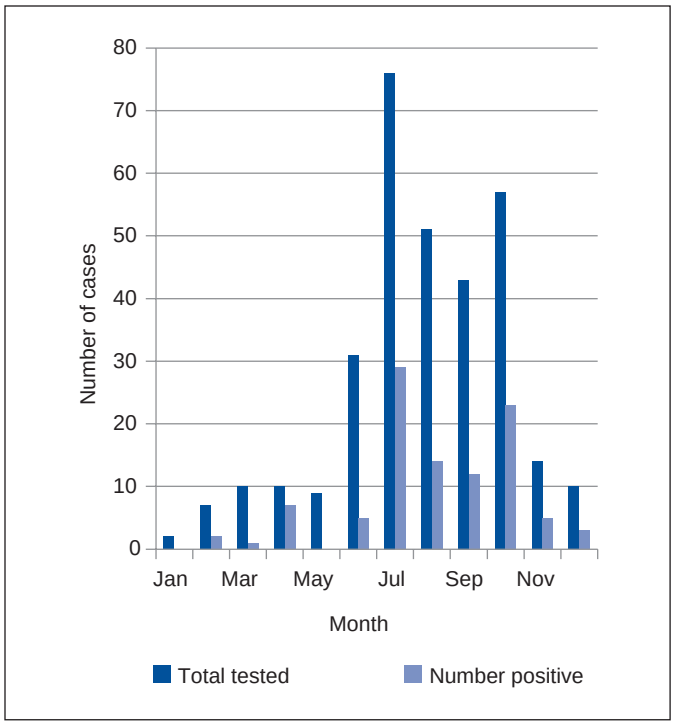

Fig. 1. The seasonal trend of scrub typhus tested in the Public Health Laboratory (2009–2012)

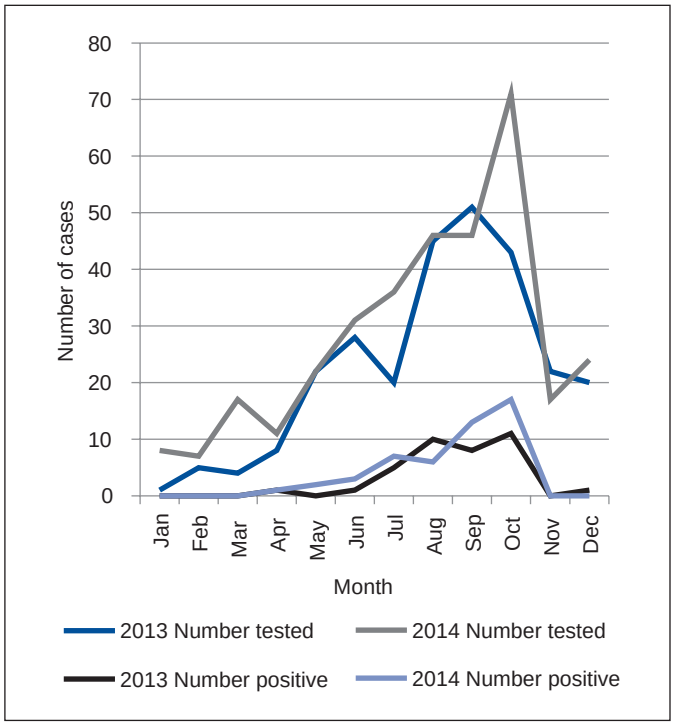

Fig. 2. Monthly number of samples and seasonal trend in the Jigme Dorji Wangchuck National Referral Hospital, Thimphu (2013 and 2014)

A review of the reports in the *Annual health bulletin* from 2011 to 2014 showed an increase in the number of cases reported, from 91 in 2010 to 351 in 2013 (see Table 3). The reports did not mention any demographic, seasonal or geographic details, or limits to the total number of cases each year. About 59% of the patients required hospitalization and 12% were children aged under 5 years. Despite the increase in reported cases, mortality was rare and sporadic, with only 2 (0.3%) deaths over the time period.

DISCUSSION

This review is the first of its kind to put the limited and scattered data on scrub typhus together. It has highlighted substantial facts about scrub typhus in Bhutan. Bhutan has environmental, climatic and occupational conditions that are favourable for transmission of *Orientia tsutsugamushi*, especially in the central and southern part of the country. Although awareness of the disease among health-care workers is increasing, the current surveillance activities, notification system and prevention and control programmes are inadequate.

Table 3. Rickettsial diseases reported in the *Annual health bulletin*, Ministry of Health, Bhutan (2011–2014)[19–22]

Year	Total number of cases reported	Inpatient	Outpatient	Deaths	Cases in children aged under 5 years
2010	91	70	21	0	14
2011	118	75	43	1	17
2012	218	146	72	0	21
2013	351	169	182	1	45
Total	778	460 (59.1%)	318 (40.9%)	2 (0.3%)	97 (12.5%)

Despite inclusion in the national manual of notifiable diseases in 2008[18] and initiation of reporting since 2010, the surveillance and reporting of scrub typhus has been weak, leading to minimal reports. It often happened that a manual or guideline was developed but this was not conveyed to field staff for proper implementation. In addition, without adequate laboratory support, febrile illnesses like malaria, enteric fever, leptospirosis, dengue and viral fevers, which remain prevalent, often challenge the diagnosis of rickettsial diseases. In the Bhutanese setting, it is still a clinical dogma to test every unexplained febrile case for malaria and enteric fever. During the past decade, the number of cases of malaria has dropped dramatically but the emergence of dengue fever since 2004 has complicated the matter.

The probable outbreak of scrub typhus in Gedu included some cases of dengue shock syndrome, supported by positive dengue IgM antibody. Apart from the presence of eschar in some cases, supported by a rapid response to doxycycline, there were no laboratory tests confirming scrub typhus in this cluster of febrile cases. Thus, this cluster could have been either dengue or scrub typhus or both. Similar cases in the future need to be taken more seriously and properly investigated, even at the cost of sending biological samples out of the country to establish the causal agent.

Documented cases of scrub typhus have presented with classical symptoms of fever, headache, skin rash and joint pain, with or without eschar in most cases. However, the two deceased during the outbreak in 2014 had meningitis-like signs and symptoms. Scrub typhus has been known to occur with symptoms of meningitis/encephalitis,[25–27] pneumonia and acute respiratory distress syndrome,[25,28,29] and multi-organ dysfunction syndrome.[25] All these support the fact that, in endemic areas, scrub typhus should be considered in the differential diagnosis of patients presenting with meningeal or respiratory symptoms or multi-organ dysfunction syndrome. One of the deceased in the Gedu incident had intestinal perforation and it is worth noting that scrub typhus can precipitate intestinal perforation.[30]

All laboratory tests reported here were solely based on one rapid-test kit and this has been the only test available, even to the present. Although they are rapid and easy to use, the rapid-test kits are not the ideal tool. With increasing reports of cases with sporadic outbreak potential, it would be valuable to have different diagnostic methods at different levels of health facilities, with, for example, rapid-test kits in the lowest-level health centres and more specific tests at the referral hospitals and the Public Health Laboratory. At present, only hospitals in the southern part of the country are supplied with the test kits, on the assumption that scrub typhus is prevalent only in a warm humid climate. This assumption needs to be proven, and until then test kits should be supplied to all hospitals in the country, to help understand the focus of the infection in different areas throughout the country.

There is an urgent need to invest in research on scrub typhus and other rickettsial diseases, to establish their true epidemiology and understand the social, environmental, occupational and behavioural determinants, in order to help develop prevention and control strategies. Health-care workers need to be educated and made aware of the disease and its differential diagnosis with other febrile illnesses. Laboratory test kits should be made available, to enable early diagnosis and prompt treatment of this serious but treatable disease. The general public needs to be educated on recognition of the disease, so they seek medical care early and take measures for prevention and control.

The study has some limitations. Firstly, the overall information available was very limited. No detailed demographic and clinical data could be extracted from the laboratory registers, thereby making inferences difficult. Test kits were not widely available, a situation that prevails even now, and the number of tests would have been an underestimate, owing to erratic supply of test kits. Many district laboratories could not give the actual number of tests performed, owing to poor record keeping. Unfortunately, all the laboratory data reported here relied on only one commercial rapid-test kit and it should be understood that such test kits are not the gold standard.

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Social impacts on adult use of tobacco: findings from the International Tobacco Control Project India, Wave 1 Survey

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ABSTRACT

Background: Social impacts on tobacco use have been reported but not well quantified. This study investigated how strongly the use of smoked and smokeless tobacco may be influenced by other users who are close to the respondents.

Methods: The International Tobacco Control Project (TCP), India, used stratified multistage cluster sampling to survey individuals aged ≥15 years in four areas of India about their tobacco use and that of their close associates. The present study used logistic regression to calculate odds ratios (ORs) for tobacco use for each type of close associate.

Results: Among the 9780 respondents, tobacco use was significantly associated with their close associates' (father's, mother's, friends', spouse's) tobacco use in the same form. After adjusting for confounding variables, women smokers were nine times more likely to have a mother who ever smoked (OR: 9.0; 95% confidence interval [CI]: 3.3–24.7) and men smokers five times more likely (OR: 5.4; 95% CI: 2.1–14.1) than non-smokers. Men smokers were seven times more likely to have close friends who smoked (OR: 7.2; 95% CI: 5.6–9.3). Users of smokeless tobacco (SLT) were five times more likely to have friends who used SLT (OR: 5.3; 95% CI: 4.4–6.3 [men]; OR: 5.0; 95% CI: 4.3–5.9 [women]) and four times more likely to have a spouse who used SLT (OR: 4.1; 95% CI: 3.0–5.8 [men]; OR: 4.3; 95% CI: 3.6–5.3 [women]), than non-users. The ORs for the association of the individuals' tobacco use, whether smoked or smokeless, increased with the number of close friends using it in the same form.

Conclusion: The influence of family members and friends on tobacco use needs to be appropriately addressed in tobacco-control interventions.

Key words: India, smokeless tobacco, smoking, social environment, tobacco, tobacco use.

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BACKGROUND

Tobacco use is a recognized public health problem worldwide and in India. It is implicated in cancer, cardiovascular disease, stroke, chronic lung diseases, adverse reproductive effects[1] and higher mortality, with half of users dying prematurely.[2] Therefore, it is important to understand the factors influencing individuals' use of tobacco. In India, the prevalence of smoking is 14.0% overall (24.3% of men; 2.9% of women) and 25.9% use smokeless tobacco (SLT; 32.9% of men; 18.4% of women), as shown by the Global Adult Tobacco Survey.[3] Tobacco use in India is higher in rural areas compared to urban areas, increases with age, and decreases with education[3] as well as income.[4]

It is important to understand the social context of tobacco use, to develop interventions promoting its cessation.[5,6] Community surveys and interventions in India have shown that tobacco use is often learnt from parents, other elders and peers.[7,8] Studies at workplaces and in educational institutions have reported similar findings.[9–12]

The rationale for the present study was that the pattern of impact of close social contacts using tobacco on individuals' tobacco use has not yet been well quantified or studied by sex in India and that this information might be useful when designing effective interventions to control tobacco use. It was expected that the pattern of social impact on women's use of tobacco, which is mainly SLT,[3] would differ from that for men. The purpose of this study was to quantify the associations of tobacco use with its use by close social contacts, according to sex, in a large general population across different states of India.

METHODS

The International Tobacco Control Policy Evaluation Project (the ITC Project), which in India is called the Tobacco Control Project (TCP), to avoid associations with the India Tobacco Company, conducted its baseline survey between August 2010 and December 2011.[13] This provided an opportunity to study how strongly tobacco use (in smoked and smokeless forms) and specific product choices may be influenced by other users in the close social context. All study materials and procedures used in the TCP India Survey were reviewed and cleared for ethical issues by the Office of Research Ethics at the University of Waterloo, Canada, and by the Institutional Review Board at the Healis-Sekhsaria Institute for Public Health, Navi Mumbai, India. All participants gave informed consent and gave their consent for the publication of this study. Most participants signed the consent form, but many villagers were reluctant to sign it, owing to a misconception that signing any consent would force them to give up their land.[14]

Sampling method and data collection

A stratified, multistage cluster sampling design was used to collect samples of adults (defined as persons aged 15 years and older), who included users of smoked tobacco, users of smokeless tobacco and non-users. Four major cities of four states (Mumbai, Maharashtra; Indore, Madhya Pradesh; Patna, Bihar; Kolkata, West Bengal), and rural areas within 50 km from city centres, were chosen for sampling.[13,14]

In each city, 10 wards were selected with probability proportional to their size. Within each ward, 10 census enumeration blocks (CEBs) were randomly selected. Selected CEBs were completely mapped within the defined geographic boundary and households in them were approached in random order for individual interviews. The intention was to include the maximum number of enumerated households in the first CEB and then proceed to the next, and so on, until the desired sample size of 150 households in the given ward was reached.[14]

In each chosen rural district, two or three subdistricts were selected purposively, from which four villages with at least 1000 households were selected from a list of all villages in the selected subdistricts, using probability proportional to size. Using a map of each selected village, dwellings were sampled randomly (preferred) or systematically, enumerating 125 households in each village.[14]

Up to four tobacco-using members were interviewed in each enumerated household and if there were more than four users, then four were selected with the role of a die. One adult non-user was selected from every third household containing at least one adult non-user of tobacco.[14]

The sampling procedure aimed to recruit at least 2000 adult tobacco users and 600 non-users from approximately 1500 urban and 500 rural households in each state, which finally amounted to a total of 9699 households from the four states. Eligible persons included those living in households and belonging to one of four categories: smokers only, users of smokeless tobacco only, users of both smoked tobacco and smokeless tobacco, and non-users;[14] for the present study, users of both smoked and smokeless forms of tobacco were excluded from the data analyses.

Trained interviewers used structured questionnaires to collect information in face-to face interviews with each respondent, in Hindi, Marathi, Bengali or English. As per the protocol, an information letter was provided and consent obtained from each participant.

Definitions

Current use of any tobacco by respondents was defined as at least one use in the past 30 days by self-report. Tobacco users were categorized according to the form of tobacco they used: smoked, smokeless or mixed use (smoked and smokeless). For this study, all 805 mixed users from the original sample[13] were excluded, in order to study the relationship between respondents' smoking or SLT use with a similar form of tobacco use by close associates. The concept "close associate" in this paper includes father, mother, spouse and the five closest friends. Respondents were asked about current smoking and SLT use by their spouse (if married) and five closest friends, as well as about "ever" smoking and "ever" use of SLT by each parent (a parent could have died or quit tobacco use before the survey).

Products

Smoked tobacco products included cigarettes, *bidis* (tobacco flakes wrapped in a *tendu* or *temburni* leaf), pipes, including the *hookah* (water pipe), other pipes (including the *hookli* and others), *chuttas*, cigars and other products.[15,16] SLT products included: (i) those for chewing or holding in the mouth, e.g. plain chewing tobacco, generally sold loose; *zarda*, which is scented, branded chewing tobacco; *khaini*, consisting of finely cut tobacco mixed with slaked lime, either by the user or in packaged form, which is placed between the lips and gums; (ii) areca nut and tobacco mixtures for chewing: *gutka*, of which there are many brands sold all over India and that contains crushed areca nut with tobacco and slaked lime; betel quid, which is areca nut, tobacco, slaked lime and condiments, wrapped in a fresh betel leaf, prepared by vendors or at home; (iii) products commonly used for application to teeth and gums and as dentifrice, such as dry snuff (also called *tapkir*), *gudhaku* (a paste of tobacco and unrefined sugar, mainly used in West Bengal and Bihar), pyrolized products (*gul* and *mishri*, the latter being mostly used in Maharashtra) and *lal dantmanjan* (red toothpowder). *Lal dantmanjan*, of which there are several brands, although not claiming to contain tobacco, nor legally permitted to, has been found in some analyses to contain nicotine.[17–19]

Data analysis

Binary logistic regression was used to calculate separate odds ratios (ORs) for (i) current exclusive smoking of tobacco and (ii) current exclusive SLT use and its use by close associates, using the Statistical Package for Social Studies (SPSS) Licensed Version 20. All ORs were adjusted for age (in three age groups: 15–39 years; 40–54 years and 55+ years), residence (urban or rural), state, and three levels of monthly household income (low: <₹5000; moderate: ₹5001–15 000; high: ≥₹15 001). ORs for smoking and for SLT use were also separately calculated for the number of closest friends who used tobacco of the same type (smoked or smokeless). ORs were also calculated for any one, any two, any three and any four types of close associates who also smoked or used SLT. The chi-squared test for linear trend was performed using Epi Info Version 7. Sampling weights were applied to the data for all logistic regression calculations, to ensure better representativeness of the data.

RESULTS

The sample consisted of 9780 respondents aged 15 years and above, with 5536 men (56.6%), as shown in Table 1 . Among all respondents, 7015 (71.7%) were married and 7140 (73.0%) were from urban areas. A total of 1255 were exclusive tobacco smokers (of which 97% were men), while 5991 exclusively used SLT and 2534 were non-users of tobacco. Tobacco users were more concentrated in higher age groups compared to non-users. Higher proportions of tobacco smokers were rural, married and older compared to SLT users and non-users. West Bengal had the highest proportion of tobacco smokers; Maharashtra and Bihar had higher proportions of SLT users compared to the other states.

Tables 2 and 3 show crude and adjusted ORs for use of smoked or smokeless tobacco, according to their use by close associates. Almost all of the adjusted ORs for tobacco users with close associates who used tobacco in the same form were elevated, and most were highly significant.

Table 1. Sample characteristics by tobacco-use status in the International Tobacco Control Project India, Wave 1 Survey in 2010–2011 (*n* = 9780: 4244 women; 5536 men)

	Non-tobacco users		Users of smoked tobacco		Users of smokeless tobacco (SLT)	
Category	***n***	**%**	***n***	**%**	***n***	**%**
All	2534	100.0	1255	100.0	5991	100.0
Sex						
Men	879	34.7	1218	97.0	3439	57.4
Women	1655	65.3	37	3.0	2552	42.6
Age group, years						
15–39	1687	66.6	483	38.5	2879	48.1
40–54	523	20.6	442	35.2	1703	28.4
55+	324	12.8	330	26.3	1409	23.5
Residence						
Urban	1890	74.6	852	67.9	4398	73.4
Rural	644	25.4	403	32.1	1593	26.6
State						
Bihar	600	23.7	117	9.3	1696	28.3
West Bengal	625	24.7	631	50.3	1077	18.0
Madhya Pradesh	621	24.5	327	26.1	1459	24.4
Maharashtra	688	27.2	180	14.3	1759	29.4
Household income						
Low	591	24.2	398	32.5	1570	27.0
Medium	1376	56.4	621	50.7	3482	59.8
High	474	19.4	205	16.7	773	13.3
Marital status						
Married	1671	65.9	1023	81.5	4321	72.2
Single	715	28.2	181	14.4	923	15.4
Other	148	5.9	51	4.1	739	12.4

Table 2. Odds ratios of association between tobacco use (exclusive smoking) by respondent and use by close associates, among men and women in the International Tobacco Control Project India, Wave 1 Survey in 2010–2011[a]

User category and sex[b]	*n*	Father ever smoked				Mother ever smoked				Close friend smokes			
		Crude OR	95% CI	Adjusted OR[c]	95% CI	Crude OR	95% CI	Adjusted OR[c]	95% CI	Crude OR	95% CI	Adjusted OR[c]	95% CI
Smoking (exclusive)													
Men	1218	4.5	3.7–5.3	2.4	2.0–3.0	4.1	1.8–9.6	5.4	2.1–14.1	8.0	6.5–9.9	7.2	5.6–9.3
Women	37	4.2	2.1–8.7	7.3	3.1–17.5	18.3	8.1–4.6	9.0	3.3–24.7	2.7	1.4–5.4	3.5	1.5–7.9
Cigarettes													
Men	495	3.0	2.4–3.8	2.2	1.7–2.9	4.5	1.8–11.6	5.3	2.0–14.4	8.4	6.3–11.3	7.1	5.2–9.7
Bidis													
Men	418	5.3	4.1–6.8	2.6	1.9–3.6	4.4	1.6–11.7	15.1	3.3–69.2	5.3	4.0–7.1	5.7	3.8–8.5
Women	18	3.8	1.3–10.8	7.9	2.4–26.1	25.9	8.9–75.3	14.9	4.3–51.3	4.3	1.6–11.3	4.7	1.6–13.3
Cigarettes and *bidis*													
Men	274	7.7	5.7–10.5	4.0	2.8–5.7	3.1	1.0–9.9	4.0	0.7–22.2	14.5	9.0–23.1	9.5	5.6–15.9
Other smoking													
Men[d]	30	4.0	1.9–8.6	2.6	1.1–5.9			[e]	—	[e]	—	[e]	—
Women[f]	18	5.0	1.6–15.8	8.6	2.2–33.9	13.1	3.5–48.8	6.7	1.0–47.2	[e]	—	[e]	—

CI: confidence interval; OR: odds ratio. Odds ratios could not be calculated for women who smoked cigarettes exclusively or both cigarettes and bidis, since the numbers were <5.

[a]Weighted data were used.

[b]Products listed indicate their exclusive use.

[c]Adjusted for age group, urban/rural residence, state, and income level.

[d]For men, "Other smoking" includes other products used exclusively and smoking combinations.

[e]For cells with frequency <5 cases ORs were not calculated.

[f]For women, "Other smoking" is only exclusive hookah smoking as there were no other categories.

Table 2 shows the results for smoking. The adjusted ORs for association with smoking by either parent were especially strong for women smokers (OR = 7.3 and OR = 9.3 for father and mother who ever smoked, respectively), while for men, having close friends who smoked showed the strongest (OR = 7.2) association. Product-wise, for men, the highest associations with close associates were for the combination of cigarettes and *bidis*, while for women, they were highest for exclusive *bidi* smoking. Since there were only two women who smoked cigarettes exclusively and only three women who smoked both cigarettes and bidis, these categories of women smokers were excluded from the table, as ORs could not be obtained. Further, since fewer than five married respondents reported that their spouse smoked, among both men smokers and women smokers, ORs for smoking by the spouse could not be calculated. This was partly due to poor response to this question.

Table 3 shows the results for SLT use. The association of SLT use by parents with individual SLT use appeared strong for both men and women. This was significantly higher for mothers and daughters (OR: 4.0), than for mothers and sons (OR: 2.1). For women, the ORs for father's ever use of SLT, were highest for use of *khaini, gul* and snuff and close to 3; again for women, for mother's ever SLT use, ORs ranged from 2.5 to 5.4 for all SLT products. For men, ORs for use of specific SLT products for father's ever SLT use were highest for *gul, gudhaku* and "other SLT", but ORs for mother's ever SLT use were highest for *lal dantmanjan* and *gudhaku*.

The association of SLT use with having any close friends who also used SLT was five-fold higher compared to non-tobacco users, for both men and women (see Table 3). For men who used *gutka*, *khaini*, plain chewing tobacco or *zarda*, the ORs for close friends' SLT use were significantly higher than those for father's or mother's SLT use (no overlap of confidence intervals). For women, the same was true only for *gutka*. The highest OR for *betel quid* use was for women whose close friends used SLT.

Among SLT users, the high response rate for spouse use of SLT provided more than adequate numbers for OR calculation. ORs for SLT users whose spouse used SLT were generally intermediate between those for parents and friends using SLT (see Table 3). Women's use of SLT was strongly associated with SLT use by their spouse, especially *gutka, khaini*, plain chewing tobacco, *zarda, mishri* and snuff. For men, *lal dantmanjan* use was highly associated with their spouse's SLT use, as well as their mother's SLT use. ORs for use of products applied to teeth and gums and used as dentifrice were elevated for all close associates using SLT, but tended to be highest for spouse's SLT use, for both men and women.

Fig. 1 shows the association of tobacco use with the number of close friends using the same form of tobacco. The ORs increased rapidly with increasing numbers of friends using tobacco in the same form, for both men and women. Chi-squared values for linear trend were highly significant ($P < 0.0001$).

Table 3. Odds ratios of association between smokeless tobacco (SLT) use by respondent and use by close associates, among men and women in the International Tobacco Control Project India, Wave 1 Survey in 2010–2011[a]

User category and sex[b]	*n*	Father ever used SLT				Mother ever used SLT				Close friend uses SLT				Spouse uses SLT				
		Crude OR	95% CI	Adjusted OR[c]	95% CI	Crude OR	95% CI	Adjusted OR[c]	95% CI	Crude OR	95% CI	Adjusted OR[c]	95% CI	Number married	Crude OR	95% CI	Adjusted OR[c]	95% CI
Exclusive SLT use																		
Men	3439	2.0	1.8–2.3	2.3	1.9–2.7	1.9	1.6–2.3	2.1	1.7–2.5	4.7	4.1–5.5	5.3	4.4–6.3	687	4.1	3.0–5.6	4.1	3.0–5.8
Women	2552	2.0	1.8–2.3	2.1	1.8–2.4	3.6	3.1–4.2	4.0	3.3–4.7	4.1	3.6–4.7	5.0	4.3–5.9	1106	4.4	3.7–5.2	4.3	3.6–5.3
Gutka																		
Men	725	1.6	1.3–1.9	1.8	1.4–2.2	1.9	1.5–2.3	1.9	1.5–2.4	6.3	4.9–8.2	5.7	4.3–7.5	58	1.6	1.0–2.4	2.2	1.4–3.4
Women	160	1.8	1.3–2.5	2.4	1.6–3.4	3.9	2.8–5.5	4.2	2.8–6.1	10.8	7.0–16.8	10.3	6.4–16.5	79	4.5	2.8–7.3	7.8	4.5–13.7
Khaini																		
Men	612	3.1	2.5–3.8	2.7	2.1–3.6	1.2	0.9–1.5	2.2	1.6–3.1	9.6	7.1–13.0	7.7	5.4–11.1	138	4.8	3.3–6.8	5.1	3.1–8.5
Women	27	2.8	1.3–6.1	2.8	1.2–6.3	2.3	1.0–5.1	2.7	1.2–6.2	9.8	3.7–26.4	9.0	3.3–25.0	12	9.4	2.1–42.0	6.5	1.3–31.5
Plain chewing tobacco																		
Men	591	1.1	0.9–1.4	1.7	1.3–2.3	2.0	1.6–2.5	1.4	1.0–1.8	2.5	2.0–3.1	3.4	2.6–4.6	118	3.4	2.3–4.9	2.3	1.4–3.6
Women	202	1.3	0.9–1.8	1.6	1.0–2.3	3.3	2.4–4.5	3.2	2.1–4.8	7.0	4.9–9.9	6.7	4.3–10.3	78	6.0	3.6–10.1	7.5	4.1–13.3
Zarda																		
Men	145	1.8	1.3–2.6	2.3	1.5–3.4	2.1	1.4–3.1	2.5	1.6–3.8	10.0	5.5–18.5	11.3	5.9–21.6	34	4.3	2.6–7.2	7.1	3.7–13.7
Women	84	1.0	0.6–1.7	1.6	1.0–2.7	3.7	2.4–5.8	4.5	2.7–7.4	4.5	2.8–7.2	6.3	3.7–10.6	68	2.8	1.5–4.9	4.3	2.3–8.0
Betel quid with tobacco																		
Men	95	1.7	1.1–2.6	2.3	1.4–3.7	2.1	1.3–3.3	1.8	1.0–3.0	1.8	1.1–2.7	2.8	1.7–4.6	85	3.2	1.8–5.8	2.2	1.2–4.3
Women	130	1.2	0.8–1.9	1.5	0.9–2.4	4.2	2.9–6.2	3.3	2.1–5.2	3.0	2.0–4.4	4.9	3.1–7.8	80	1.6	0.9–2.7	2.4	1.3–4.3
Lal dantmanjan[d]																		
Men	94	4.6	2.9–7.3	2.4	1.4–4.2	5.8	3.8–8.9	9.7	5.3–17.8	6.6	3.5–12.4	4.4	2.2–9.0	40	19.6	9.5–40.4	18.2	7.3–45.6
Women	649	3.5	2.9–4.3	1.5	1.1–2.0	2.1	1.7–2.7	2.5	1.8–3.6	6.4	5.2–8.0	3.8	2.8–5.1	457	7.2	5.4–9.6	2.7	1.9–3.9
Mishri																		
Men	37	1.2	0.6–2.3	1.7	0.8–3.6	4.4	2.3–8.4	1.6	0.8–3.3	0.6	0.3–1.2	1.1	0.5–2.3	33	31.3	13.9–70.2	18.2	6.7–49.4
Women	412	1.5	1.2–1.9	2.0	1.4–2.8	4.2	3.3–5.3	2.7	2.0–3.8	1.8	1.4–2.2	3.8	2.6–5.4	284	3.1	2.3–4.1	5.3	3.6–7.9
Gul																		
Men	31	2.4	1.1–5.0	2.9	1.2–6.8	1.6	0.7–3.6	1.7	0.6–4.6	3.3	1.4–8.1	2.9	1.1–7.6	27	2.8	1.0–7.8	6.9	1.9–25.1
Women	89	2.9	2.0–4.5	3.3	2.1–5.2	2.0	1.3–3.1	3.3	2.0–5.5	4.5	2.9–6.9	4.0	2.5–6.5	64	4.4	2.5–7.5	3.3	1.8–6.0
Snuff																		
Men	28	1.2	0.5–2.6	1.9	0.8–4.7	2.7	1.3–5.8	1.7	0.7–4.1	0.7	0.3–1.5	1.2	0.5–2.9	23	12.0	5.1–28.4	6.5	2.1–20.1
Women	134	2.0	1.4–3.0	2.9	1.8–4.8	5.7	3.9–8.4	4.3	2.6–7.1	1.4	1.0–2.1	2.8	1.7–4.7	78	4.9	2.7–8.9	10.8	4.8–24.3

User category and sex[b]	*n*	Father ever used SLT				Mother ever used SLT				Close friend uses SLT				Spouse uses SLT				
		Crude OR	95% CI	Adjusted OR[c]	95% CI	Crude OR	95% CI	Adjusted OR[c]	95% CI	Crude OR	95% CI	Adjusted OR[c]	95% CI	Number married	Crude OR	95% CI	Adjusted OR[c]	95% CI
Gudhaku																		
Men	22	2.3	1.0–5.2	5.2	1.8–15.5	3.7	1.6–8.2	4.7	1.8–13.0	1.9	0.8–4.5	3.1	1.1–9.0	23	7.9	3.0–20.8	17.6	3.8–81.5
Women	158	1.3	0.9–1.9	2.4	1.5–3.8	4.7	3.4–6.7	5.4	3.5–8.5	4.3	3.0–6.1	5.9	3.8–9.2	122	3.5	2.1–5.7	4.8	2.7–8.7
Other SLT use																		
Men	27	2.7	1.2–6.1	4.1	1.6–10.0	3.9	1.7–9.0	3.5	1.4–8.9	4.8	1.5–15.5	5.1	1.5–17.1	16	11.5	3.8–34.4	17.0	4.2–68.3
Women	50	1.9	1.0–3.5	2.4	1.2–5.0	4.8	2.6–8.8	4.3	2.0–8.9	2.5	1.3–4.7	2.5	1.2–5.3	26	8.2	2.1–31.9	6.7	1.5–28.8
SLT combinations																		
Men	1027	2.6	2.2–3.1	3.0	2.5–3.7	2.2	1.8–2.6	2.3	1.8–2.9	5.8	4.7–7.3	5.3	4.2–6.8	793	4.9	3.5–6.9	5.6	3.9–8.1
Women	457	1.9	1.6–2.4	2.2	1.7–2.8	5.2	4.2–6.6	5.3	4.0–6.9	4.8	3.8–6.1	5.3	4.1–7.0	290	4.2	3.1–5.8	4.5	3.2–6.4

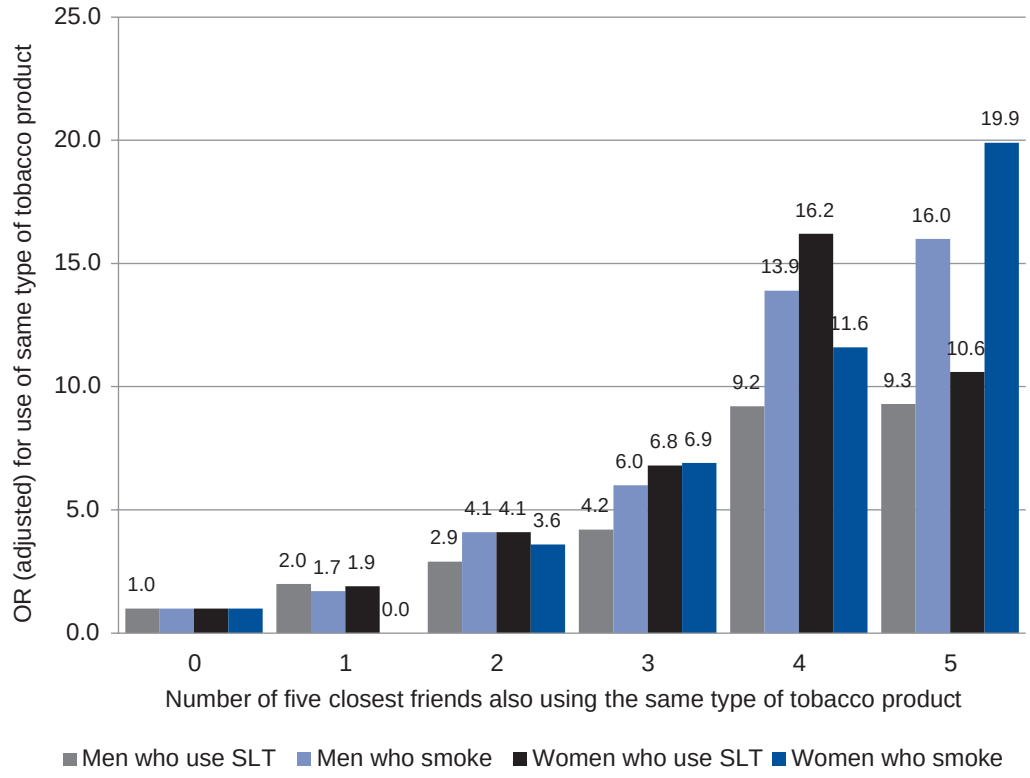
CI: confidence interval; OR: odds ratio.

[a]Weighted data were used.

[b]Products listed indicate their exclusive use.

[c]Adjusted for age group (with first two groups combined as the reference category), urban/rural residence (urban as reference), state (Maharashtra as reference), and income level (with highest category as reference).

[d]*Lal dantmanjan* may not necessarily contain tobacco.



X^2 for linear trend (weighted): men (SLT use): 537.4; $P < 0.0001$; women (SLT use): 470.0; $P < 0.0001$; men (smoking): 594.1; $P < 0.0001$; women (smoking): 23.3; $P < 0.0001$. For women smokers, odds ratios were significant ($P < 0.05$) for only two of the five categories, owing to few cases.

Fig. 1. Tobacco use and close friends using tobacco: odds ratios (OR, adjusted for age group, urban/rural residence, state and income) for respondents smoking tobacco and using smokeless tobacco (SLT) for the number of friends (among the five closest) using the same tobacco type as the respondents, by sex

Fig. 2 shows that the ORs for SLT use rose with increasing numbers of associates who used SLT (any one, any two, any three or all four among father, mother, close friends and spouse). The trend was highly significant ($P < 0.0001$).

DISCUSSION

This study shows that the use of tobacco by close social contacts is very likely to influence, i.e. impact or reinforce, tobacco use among adults in India. Friends appear to strongly influence both men and women to use SLT. For smoking, friends appear to strongly influence men more than parents, while the reverse is true for women. The influence of mothers on daughters to use tobacco appears especially strong. Among married SLT users, the spouse is also likely to be a user and, in particular, wives seem to influence their husbands to use tobacco-based dentifrices, like *lal dantmanjan* or *mishri*. Individuals are increasingly likely to use tobacco in any form, as more of their close social contacts use it. The implications of this survey, conducted in both urban and rural areas of four states, may well be generalizable to the whole of India.

Considering that the sampling criteria for this study (persons aged 15 years and above) included a large part of the adolescent age group, it seems relevant that a previous study of adolescents in Noida city, Uttar Pradesh found a similar order of association: among 4786 students aged 11–19 years in classes VII to XII, tobacco users were more than eight times more likely to have friends or classmates who also used tobacco (OR: 8.6; 95% confidence interval [CI]: 6.3–12.0), seven times more likely to have a mother who used it (OR: 7.2; 95% CI: 4.2–12.1) and three times more likely to have a father who used tobacco (OR: 3.0; 95% CI: 2.2–4.1).[11]

Four earlier studies from India quantified associations of tobacco use by individuals with that by friends or peers. In a study among 1587 male students (aged 16–23 years) at 11 colleges in southern Karnataka, smokers were five times more likely to have friends who smoked compared to non-smokers.[12] A community study among 500 youth aged 15–24 years in urban and rural Chandigarh found that youth were much more likely to smoke if their friends smoked (OR: 40; 95% CI: 11.4–142.8).[8] In a study of use of smokeless tobacco among 336 office workers in Mumbai, 61% of lower-level workers and 83% of male clerks reported that peer pressure was an influence on their use of SLT, especially *gutka*.[9] In a small intervention study of 104 factory workers in Ratnagiri district of Maharashtra, peer influence for tobacco use on and

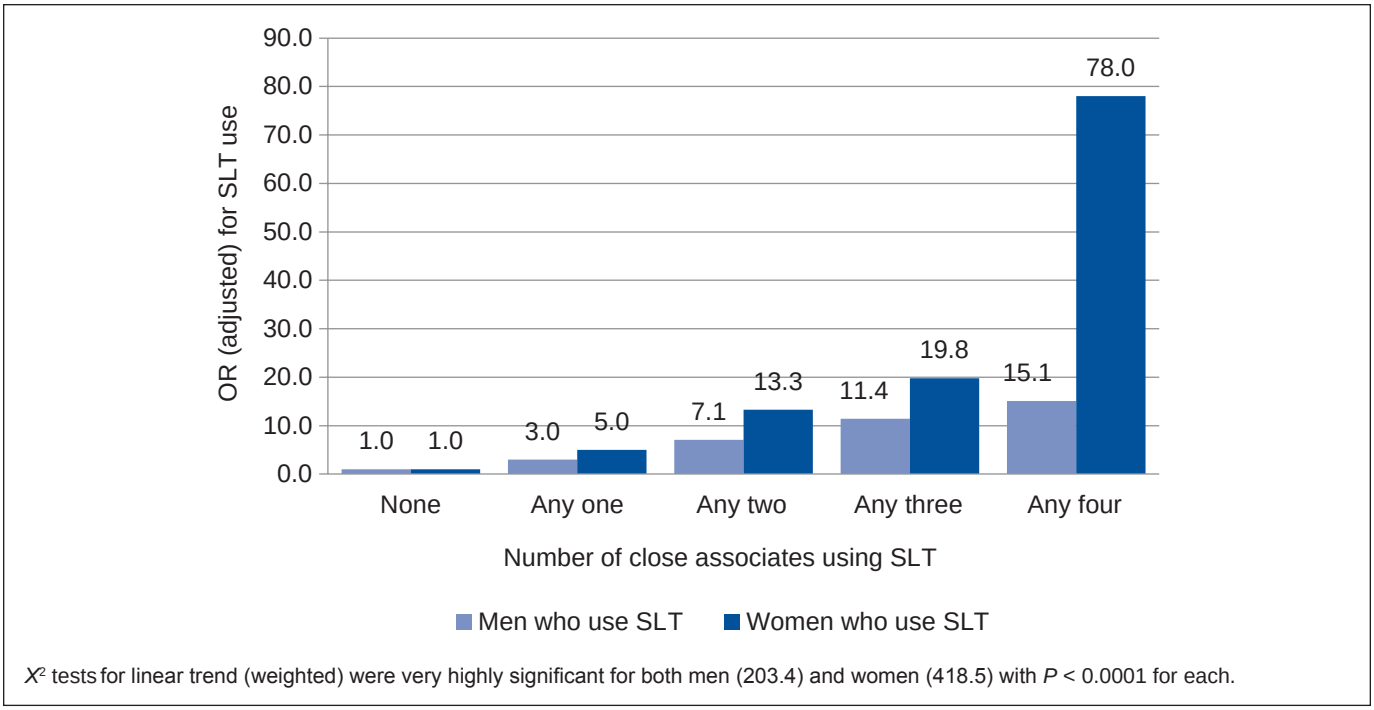


Fig. 2. Use of smokeless tobacco (SLT) and number of close associates using SLT: odds ratios (OR, adjusted for age group, urban/rural residence, state and income) for exclusive respondent SLT use for close associates (father, mother, spouse, any close friend) using SLT, by sex

off the job was found to be important (but not quantified), mainly for SLT in that population.[10] In a qualitative study using focus groups of teachers in India, in the two states of Maharashtra and Bihar, on patterns of tobacco use and social norms, a response from Bihar indicated that tobacco use is culturally ingrained, owing to tradition, is inherited from fathers and forefathers and is considered a right.[20]

Studies available from other countries also report social influence or impact on tobacco use by friends and/or parents.[21–24] For example, in a study in Italy on 7469 persons aged 15 years and above, 61% reported smoking as a result of the influence of friends; men were more likely to report the influence of friends, but women more frequently reported the influence of parents or their partner.[22]

The present study shows that in India, mothers' influence on women's smoking is especially strong. Although not studied previously in India, a similar phenomenon has been reported in a 20-year literature review of 51 studies published during 1989–2009 on mothers' smoking and adolescent smoking, which included studies from North America, Europe, Oceania and Asia. Forty-three studies (84.3%) found a positive association between the mothers' smoking and that of their adolescent offspring; among these, 21 found the mothers' tobacco smoking was more strongly associated with girls' own smoking than that of boys.[25]

The phenomenon of parental and peer influence on smoking has sometimes been explained with the help of the social learning theory from psychology, according to which individuals imitate behaviours they observe being modelled by individuals with whom they identify closely, such as parents, elder siblings and peers/friends, teachers and the media.[26,27] While initiation to tobacco use may occur in adolescence or earlier, and may be partly influenced by parents and friends, role modelling by these significant others may remain important for continuation of tobacco use into adulthood, aided by addiction to nicotine.

The present study also showed that SLT use is highly associated with spouses' use of SLT, and these associations were intermediate in value between those for parents and close friends. In particular, use of SLT products as a dentifrice by men appears strongly associated with the use of these products by their wives.

The significance of having friends who smoke may extend to quitting intention and behaviour. In a qualitative study among 60 disadvantaged women users of SLT in Delhi, participants expressed that seeing others around them chewing tobacco would pose a challenge to quitting.[28] On the other hand, the ITC Four Country Survey found that smokers who lost touch with smoking friends between two waves of the survey were significantly more likely to have attempted to quit (OR: 1.5; $P < 0.0001$) and to have quit successfully (OR: 1.6; $P < 0.01$) than those who did not lose any smoking friends during the same period.[29]

The present results converge with the social impact theory, in which the impact of other people on the individual (in terms of behaviour, beliefs, values and feelings) is a multiplicative function of the number of other people involved.[30] Also

according to that theory, the importance of those people to the individual increases their impact and so does their immediacy, i.e. in space or time. For adults, a spouse and close friends would have considerable influence, perhaps more than parents, as shown in the present study.

A limitation of the study data was that substantial proportions of married respondents did not want to address the possibility of tobacco smoking by their spouse: 16.9% of married men (169 out of 999) who said they were smokers and 66.7% of married women (16 out of 24) who identified themselves as smokers did not respond to the question on spouse smoking; also, 11.7% (52/445) of men non-users and 34.7% (425/1226) of women non-users did not answer the question on spouse smoking. The low numbers of men as well as of women smokers responding on spousal smoking was partly due to the paucity of women smokers, since the prevalence of women smokers is low in India, and partly due to considerable non-response on tobacco smoking by the spouse. By contrast, non-response among SLT users on SLT use by their spouse was only 2% among men and 14% among women; in addition, as many as 26.4% of married men who used SLT and 64.5% of married women who used SLT said their spouse also used SLT (data not shown). Also, since many women SLT users (13.7% [235/1715]) and non-users (16.2% [199/1226]) were unaware of, or unwilling to discuss, their husband's use of SLT, results on husbands' use of SLT might be somewhat biased. Only 2.0% (51/2606) of men did not answer about their wife's use of SLT. Lack of knowledge or reluctance to answer questions about parental or friends' tobacco use in any form varied only from 0% to 4.1% (104/2552; the latter for women answering whether their father ever used SLT). Investigation of the reasons for non-disclosures on spousal tobacco use could shed light on underlying views and feelings on the acceptability of tobacco use.

A second limitation was that specific products used by close associates were not recorded. A third limitation was that the study did not look at the sex-wise direction of friends' influence.

The findings of this study suggest that tobacco-control interventions might be more effective if they distinctly addressed social influences on tobacco use generally and on specific products. Better enforcement of laws against tobacco in dentifrices could also greatly help to reduce their use, since these products are used by whole families. The influence of any form of advertising (including point-of-sale or surrogate advertising) on an individual is potentially amplified by the influence of that person's tobacco use on their close social contacts. Thus, enforcement of rules banning tobacco advertising can potentially prevent or reduce tobacco use even by those not exposed to the advertisements. Future research could design and analyse interventions that address social networks to encourage cessation of tobacco use.

Conclusion

In India, adult use of tobacco is strongly associated with having one or more close social contacts who use tobacco in the same form. The influence of family and friends on tobacco use needs to be addressed in tobacco-control interventions, to reduce its social acceptability.

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Composition and distribution of the health workforce in India: estimates based on data from the National Sample Survey

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ABSTRACT

Background: The availability of reliable and comprehensive information on the health workforce is crucial for workforce planning. In India, routine information sources on the health workforce are incomplete and unreliable. This paper addresses this issue and provides a comprehensive picture of India's health workforce.

Methods: Data from the 68th round (July 2011 to June 2012) of the National Sample Survey on the *Employment and unemployment situation in India* were analysed to produce estimates of the health workforce in India. The estimates were based on self-reported occupations, categorized using a combination of both National Classification of Occupations (2004) and National Industrial Classification (2008) codes.

Results: Findings suggest that in 2011–2012, there were 2.5 million health workers (density of 20.9 workers per 10 000 population) in India. However, 56.4% of all health workers were unqualified, including 42.3% of allopathic doctors, 27.5% of dentists, 56.1% of Ayurveda, yoga and naturopathy, Unani, Siddha and homoeopathy (AYUSH) practitioners, 58.4% of nurses and midwives and 69.2% of health associates. By cadre, there were 3.3 qualified allopathic doctors and 3.1 nurses and midwives per 10 000 population; this is around one quarter of the World Health Organization benchmark of 22.8 doctors, nurses and midwives per 10 000 population. Out of all qualified workers, 77.4% were located in urban areas, even though the urban population is only 31% of the total population of the country. This urban–rural difference was higher for allopathic doctors (density 11.4 times higher in urban areas) compared to nurses and midwives (5.5 times higher in urban areas).

Conclusion: The study highlights several areas of concern: overall low numbers of qualified health workers; a large presence of unqualified health workers, particularly in rural areas; and large urban–rural differences in the distribution of qualified health workers.

Key words: health-worker distribution, health workers in India, health workforce, human resources for health

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BACKGROUND

India's health workforce has expanded considerably in the past decade. The supply of qualified health workers has increased, owing to the substantial growth in training institutes for doctors, nurses and other health workers. Moreover, the National Rural Health Mission (now National Health Mission) has substantially augmented the workforce by adding 870 089 accredited social health activists (ASHAs) to serve as community health workers.[1] These developments are significant, given the findings from earlier studies that India faces an overall deficit of health workers and that health workers are largely concentrated in urban areas of the country.[2,3] It is far from clear, however, to what extent the growth in the health workforce has reduced the overall deficit or inequity in geographical distribution of health workers.

Information on the health workforce remains weak in India, as the routine sources of information on the health workforce provide fragmented and unreliable data. Government sources

provide information on the public-sector health workforce in rural areas, but are silent on that for urban areas (at secondary and tertiary levels), as well as the private sector. Professional councils of doctors, nurses, pharmacists and Ayurveda, yoga and naturopathy, Unani, Siddha and homoeopathy (AYUSH) providers routinely publish statistics of the number of registered members; however, the absence of live registers in these institutions casts doubt on the reliability of these estimates, since they do not account for health workers exiting the workforce due to migration, death or retirement. Moreover, determining the size of the health workforce is even more problematic, since professional councils typically require only a one-time registration by new graduates, and this is usually done in the state where they studied, and not where they currently practise. Finally, several other cadres of health workers, such as physiotherapists, laboratory technicians and midwives, do not have professional councils, and so their presence in the workforce is largely undocumented by routine information sources.

Earlier studies have provided estimates of the Indian health workforce using non-routine sources such as census and household surveys. These data sources, collected at intervals of 5–10 years, derive information directly from individuals, thereby potentially overcoming many of the inadequacies of official sources. However, as these estimates are based on self-reports (i.e. a "doctor" is classified as a doctor based on a reported description of his/her occupation), they are susceptible to misclassification, and need to be adjusted for reported education qualifications. One recent study using data from the 2001 census of India estimated the density per 10 000 population of all health workers as 20.1 (4.7 qualified), allopathic doctors as 8.0 (2.6 qualified) and nurses and midwives as 6.1 (0.6 qualified).[3] Another study using both the 2001 census and the 61st round (2004–2005) of the National Sample Survey (NSS) reported the density per 10 000 population of all health workers as 19.5 (8.6 qualified), allopathic doctorsas as 8.0 (3.8 qualified) and nurses and midwives as 7.3 (2.3 qualified).[2] Several common patterns emerge from these studies. Both studies point out that India faces an overall shortage of health workers – the combined density of allopathic doctors, nurses and midwives is much below the World Health Organization (WHO) benchmark of 22.8 workers per 10 000 population for achieving 80% of deliveries attended by skilled personnel, in cross-country comparisons.[4] Importantly, both studies suggest that a substantial part of the health workforce consists of unqualified providers. Further, there is a critical imbalance in the distribution of the workforce across states, and between urban and rural areas. Further, the low doctor-to-nurse ratio suggests an inefficient skill-mix, since there are efficiency gains in having a larger number of nurses compared to doctors.

This paper presents a comprehensive picture of India's health workforce, using a recent nationally representative household survey conducted in 2011–2012.[5] It offers national and state-level estimates of the size, composition and distribution of the workforce, and the representation of women in the workforce. As such, the workforce estimates presented here provide a recent picture of the Indian health workforce and allow determination of temporal trends by comparison with previous studies using similar data sources.

METHODS

Data from the 68th round (July 2011 to June 2012) of the NSS, on the *Employment and unemployment situation in India* were analysed to produce estimates of the health workforce in India.[5] The NSS employed multistage stratified cluster sampling to cover 101 724 households and 456 999 persons in 7469 villages and 5268 urban blocks throughout the country. Data were collected, based on self-reported occupations, categorized using both National Classification of Occupations (NCO)[6] and National Industrial Classification (NIC) codes.[7] While the NCO codes allow classification based on actual occupations (such as doctors, nurses, ayurvedic doctors, medical assistants), NIC codes are categorized based on the industry where respondents are employed (hospitals, medical practices, diagnostic laboratories, etc.).

This study used a combination of both NCO (2004) and NIC (2008) codes to enumerate and group those who reported to be health professionals into the following categories:[6,7] allopathic doctors, nurses and midwives, dentists, AYUSH practitioners, health associates (paramedics or allied health professionals) and traditional practitioners (see Table 1). Allopathic doctors included those in medical practices, hospitals, diagnostic/pathological laboratories, and other agencies relating to health, as well as teaching professionals in medicine. Nurses and midwives were grouped as one category, as NCO codes did not provide distinct job descriptions for the two cadres. Health associates incorporated a broad range of paramedical staff, including medical assistants, laboratory assistants, sanitarians, nutritionists, optometrists and opticians, dental assistants, physiotherapists, pharmacists, speech therapists, and other medical and health technicians. All estimates were based on the usual principal activity of a person and pertained to the majority of time spent on an activity during the reference period of 365 days.

Since the occupations were based on self-reports, there was a possibility of unqualified health workers being included in the total estimates. To differentiate the qualified from unqualified providers, information on the technical education (degree, certificate/diploma) and general education of respondents was used (see Table 1). Allopathic doctors were classified as qualified if they had a minimum of higher secondary (10 + 2 years) education, along with either a technical degree or postgraduate diploma/certificate in medicine. Nurses and midwives were considered as qualified if they had higher secondary education combined with any technical education in medicine, or possessed a diploma/certificate. These estimates included nurses and midwives with qualifications in general nursing and midwifery and above. Auxiliary nurses and midwives (ANMs) were separately classified as qualified if they had a minimum of secondary education (10 years) and had received formal vocational training. Qualified ANMs were grouped together with qualified nurses and midwives, as qualified nurses and midwives. Health associates were considered qualified if they had higher secondary education plus any technical education in medicine or any diploma/certificate.

To estimate health-worker densities, the weighted totals of different categories of health workers were first calculated.

Table 1. Classification of health workers and their qualifications

Type	Health-worker categories included	Qualifications of qualified workers
Allopathic doctors	• Physicians in: medical practice, hospitals, diagnostic/ pathological laboratories, industries and service-related activities (water transportation and public services), regulatory agencies relating to health • College/university/higher education teaching professionals in: medical practice, hospitals	10 + 2 years' education plus a technical degree or postgraduate diploma/certificate in medicine
Nurses and midwives	• Nursing professionals • Nursing and midwifery associates (general/industrial/ other nurses, midwives/lady health visitors, midwifery attendants, midwifery associate professionals)	Nurses: 10 + 2 years' education plus any technical education in medicine or a diploma/certificate Auxiliary nurses and midwives: 10 years' education plus a formal vocational training
Dentists	• Dentists, excluding those working in hospitals	10 + 2 years' education plus a technical degree or postgraduate diploma/certificate in medicine
AYUSH practitioners	• Practitioners of Ayurveda, yoga and naturopathy, Unani, Siddha and homoeopathy, excluding those working in hospitals	10 + 2 years' education plus a technical degree or postgraduate diploma/certificate in medicine
Health associates	• Modern health-associate professionals (medical assistants, laboratory assistants, sanitarians, nutritionists, optometrists and opticians, dental assistants, physiotherapists, pharmacists, speech therapists, other medical and health technicians) • Life-science and health-associate professionals in: hospital, medical practice • Optical and electronic equipment operators in: hospitals, diagnostic/pathological laboratories • Non-nursing health professionals who were not allopathic doctors, dentists or AYUSH practitioners	10 + 2 years' education plus any technical education in medicine or diploma/certificate
Traditional practitioners	• Practitioners of traditional medicine, faith healers	

AYUSH: Ayurveda, yoga and naturopathy, Unani, Siddha and homoeopathy.

Because the totals are based on a probability sample, they are subject to sampling errors. This paper reports both the density point estimates of the totals and their 95% confidence intervals. These estimates were divided by the relevant population (state or country) and multiplied by 10 000 to get estimates of the health-worker density per 10 000 population.

RESULTS

The number of health workers in the different categories (qualified and unqualified) sampled in the NSS 68th round is shown in Table 2. The estimates of national health-worker totals used are the weighted estimates of the samples shown in Table 2. The majority of the sample comprised allopathic doctors and nurses and midwives. Importantly, Table 2 indicates that a small number of health workers were sampled by the NSS, with particularly small sample sizes for some categories, notably dentists (36) and traditional practitioners (14).

Size, composition and qualifications of the health workforce

The NSS estimates suggest that during 2011–2012 there were 2.53 million health workers in India, which translates into a density of 20.9 health workers per 10 000 population (see Table 3).[5] The estimated densities by cadre were as follows: allopathic doctors, 5.8; nurses and midwives, 7.6; dentists, 0.4; AYUSH practitioners, 1.3; health associates, 5.8; and traditional practitioners, 0.1 (see Table 3).

After adjusting for qualification, the density of health workers declined from 20.9 to 9.1 per 10 000 population. The estimated densities of qualified workers by cadre were as follows: allopathic doctors, 3.3; nurses and midwives, 3.1; dentists, 0.3; AYUSH practitioners, 0.6; health associates, 1.8; and traditional practitioners, 0.0. The largest decline in density after adjusting for qualification was observed in nurses and midwives (7.6 to 3.1 per 10 000 population) and health associates (5.8 to 1.8 per 10 000 population) (see Table 3).

Table 2. Sample sizes of qualified and unqualified health workers from the 68th round of the National Sample Survey, 2011–2012[5]

Health workers	Urban, number qualified (unqualified)	Rural, number qualified (unqualified)	Total, number qualified (unqualified)
Allopathic doctors	164 (99)	57 (112)	221 (211)
Nurses and midwives	155 (167)	118 (124)	273 (291)
Dentists	17 (12)	2 (5)	19 (17)
AYUSH practitioners	31 (30)	18 (37)	49 (67)
Health associates (includes pharmacists)	102 (173)	59 (143)	161 (316)
Traditional practitioners	0 (5)	0 (9)	0 (14)

AYUSH: Ayurveda, yoga and naturopathy, Unani, Siddha and homoeopathy.

Table 3. Health-worker density and female participation in the health workforce, from the 68th round of the National Sample Survey, 2011–2012[5]

Health workers	Density per 10 000 population		Female (%)
	Total (95% CI)	Qualified (95% CI)	
Allopathic doctors	5.8 (4.5–7.1)	3.3 (2.1–4.6)	27.7
Nurses and midwives	7.6 (6.4–8.9)	3.1 (2.4–4.0)	88.8
Dentists	0.4 (0.2–0.6)	0.3 (0.1–0.4)	42.2
AYUSH practitioners	1.3 (0.9–1.7)	0.6 (0.3–0.8)	17.2
Health associates	5.8 (4.8–6.8)	1.8 (1.3–2.3)	20.4
Traditional practitioners	0.1 (0.0–0.2)	0.0	—
All	20.9 (18.9–23.0)	9.1 (7.6–10.7)	47.2

AYUSH: Ayurveda, yoga and naturopathy, Unani, Siddha and homoeopathy; CI: confidence interval.

There were 1.3 nurse-midwives per allopathic doctor, which, after correcting for qualifications, reduced to 0.9.

The education adjustments highlight the large presence of unqualified providers in India's health workforce. Overall, there are 1.4 million unqualified health workers in India, representing 56.4% of the health workforce. The weighted estimates of unqualified (i.e. did not possess the necessary qualification for their cadre) health workers by cadre are as follows: 42.3% of allopathic doctors, 58.4% of nurses and midwives, 27.5% of dentists, 56.1% of AYUSH practitioners, and 69.2% of health associates.

The presence of unqualified health workers is higher in rural (71.2%) compared to urban (48.8%) areas. The weighted estimates for unqualified health workers in rural India were: 69.1% of allopathic doctors, 68.2% of nurses and midwives, 62.9% of dentists, 74.3% of AYUSH practitioners, and 75.8% of health associates. In urban areas, the weighted estimates of unqualified health workers were: 31.4% of allopathic doctors, 52.6% of nurses and midwives, 25.5% of dentists, 44.1% of AYUSH practitioners, and 65.5% of health associates.

Qualified female health workers constitute almost half of the qualified health workforce (see Table 3). Among different categories of health workers, qualified nurses and midwives were dominated by women (88.9%). This was followed by dentists (42.2%), allopathic doctors (27.7%), AYUSH practitioners (17.2%) and health associates (20.4%) (see Table 3).

Distribution of health workers

As expected, the distribution of qualified health workers was skewed towards urban areas; 77.4% of all qualified workers were in urban areas, even though the urban population accounted for only 31% of the total population. The density of qualified health workers was 22.7 per 10 000 population in urban areas, as compared to 3.0 per 10 000 population in rural areas. This urban dominance was seen across all health-worker categories (see Table 4). The maldistribution was higher for allopathic doctors (density 11.4 times higher in urban areas), as compared to nurses and midwives (5.5 times higher in urban areas). Almost all the dentists were in urban areas. The density

Table 4. Density of qualified health workers in urban and rural areas, from the 68th round of the National Sample Survey, 2011–2012[5]

Health workers	Mean (95% CI) density per 10 000 population		
	All	Rural	Urban
Allopathic doctors	3.4 (2.1–4.6)	0.8 (0.3–1.2)	9.1 (5.3–12.8)
Nurses and midwives	3.2 (2.4–4.0)	1.3 (0.9–1.7)	7.2 (4.8–9.6)
Dentists	0.3 (0.1–0.5)	0.0 (0.0–0.0)	0.9 (0.3–1.4)
AYUSH practitioners	0.6 (0.3–0.8)	0.2 (0.1–0.3)	1.4 (0.6–2.2)
Health associates	1.8 (1.3–2.3)	0.7 (0.4–1.0)	4.1 (2.7–5.5)

AYUSH: Ayurveda, yoga and naturopathy, Unani, Siddha and homoeopathy; CI: confidence interval.

of AYUSH practitioners was 7.0 times, and health associates was 5.9 times higher in urban compared to rural areas (see Table 4).

In both rural and urban areas, around 70% of the health workers were privately employed in the nongovernment sector (rural, 67.0%; urban, 74.0%). More than 80% of allopathic doctors in urban (87.1%) and rural (83.5%) areas were engaged in private employment. Similarly, more than 90% of dentists (rural, 96.7%; urban, 91.9%) and AYUSH practitioners (rural, 95.5%; urban, 93.9%), and around 70% of health associates in both rural (68.3%) and urban (75.5%) areas were working in the nongovernment sector. However, among nurses and midwives, 48.8% of those in rural and 59.8% of those in urban areas were privately engaged.

There was wide variation in the density of qualified health workers across states (see Table 5). North-eastern and north-central states had a lower density of qualified health workers compared to the national average. Similarly, the densities of qualified allopathic doctors and nurses and midwives varied across states, though they did not necessarily follow the same distribution pattern as for qualified health workers. Kerala (31.6 per 10 000) had the highest density of qualified health workers in India, which was 20 times higher than for Bihar (1.5 per 10 000), the state with the lowest density. The highest density of qualified allopathic doctors was in Maharashtra (8.7 per 10 000); in comparison, states like Bihar (0.3 per 10 000) and Himachal Pradesh (0.1 per 10 000) had among the lowest densities of qualified doctors. The density of qualified nurses and midwives was highest in Kerala (18.5 per 10 000) and lowest in the states of Uttar Pradesh (0.5 per 10 000), Bihar (0.4 per 10 000) and Tripura (0.3 per 10 000).

DISCUSSION

This study used a recent nationally representative household survey, the 68th round of the NSS conducted in 2011–2012, to enumerate the size, composition and distribution of India's health workforce. Workforce estimates based on this survey suggest that the density of all health workers is 20.9 (9.1 qualified), allopathic doctors 5.8 (3.3 qualified), nurses and midwives 7.6 (3.1 qualified) and AYUSH practitioners 1.3 (0.6 qualified) per 10 000 population. The overall estimates of health-worker density are similar to those based on the 2001 census.[2,3] The combined density of qualified allopathic doctors and nurses and midwives of 6.4 per 10 000 population is considerably below the WHO benchmark of 22.8 workers per 10 000 population for achieving 80% of deliveries attended by skilled personnel, in cross-country comparisons.[4] This suggests that there is a shortage of qualified providers of clinical care in India. There is considerable variation across states in the availability of qualified health workers, with those in north-central and north-eastern India having lower densities as compared to the national average. Kerala is the only state in India to achieve the WHO benchmark. This highlights that shortage of providers of clinical care is a feature of almost every Indian state. The results also confirm the skewed distribution of the workforce favouring urban areas, a phenomenon that is present in most countries.[4,8]

Earlier studies have offered estimates of the health workforce based on census and sample surveys. A study using the 2001 census estimated the density of all health workers as 20.1 (4.7 qualified), allopathic doctors as 8.0 (2.6 qualified) and nurses and midwives as 6.1 (0.6 qualified) per 10 000 population.[3] Another study, which used the 2001 census data adjusted to 2004 levels, reported the density of overall health workers as 19.5 (8.6 qualified), allopathic doctors as 8.0 (3.8 qualified) and nurses and midwives as 7.3 (2.3 qualified) per 10 000 population.[2] Comparing unadjusted estimates from these and the present study indicates how the workforce has changed between 2001 and 2012. Qualification-adjusted estimates are difficult to compare, owing to the different educational criteria used. Comparing the unadjusted estimates of health-worker density between 2001 and 2012 indicates that the overall health-worker density increased from around 20.0 per 10 000 population to 20.9 per 10 000 between 2001 and 2012. Further, the density decreased for allopathic doctors (8.0 to 5.8) and increased for nurses and midwives (6.1 to 7.6).

The large presence of unqualified health workers in the workforce is both remarkable and alarming. The weighted estimates of this study indicate that up to 42.3% of allopathic doctors operating in India do not have the requisite qualification. Remarkably, the weighted estimates revealed that the majority (69.1%) of allopathic doctors in rural India, where most of India's population

Table 5. State-wise density of qualified health workers from the 68th round of the National Sample Survey, 2011–2012[5]

State	Density of qualified health workers per 10 000 population		
	Allopathic doctors	Nurses and midwives	All health workers
Bihar	0.3	0.4	1.5
Himachal Pradesh	0.1	1.1	2.2
Assam	[a]	2.0	2.2
Jharkhand	0.7	1.6	2.3
Orissa	1.3	1.0	3.1
Rajasthan	0.4	2.6	3.4
Tripura	3.7	0.3	4.0
Arunachal Pradesh	2.0	2.4	4.9
Madhya Pradesh	0.3	1.7	5.1
West Bengal	3.5	0.8	5.4
Meghalaya	2.1	2.7	6.9
Goa	5.8	0.7	7.6
Uttar Pradesh	6.2	0.5	7.8
Manipur	1.0	4.2	7.8
Andhra Pradesh	2.3	1.9	8.3
Sikkim	[a]	4.5	8.3
Jammu and Kashmir	2.3	1.8	9.1
Karnataka	5.2	1.3	9.2
Chhattisgarh	3.6	2.3	9.8
Nagaland	1.9	1.3	10.5
Lakshadweep	6.2	4.9	11.1
Tamil Nadu	1.6	6.3	12.5
Punjab	2.2	6.8	12.6
Mizoram	0.5	10.6	14.8
Uttarakhand	6.8	4.7	15.2
Andaman and Nicobar Islands	[a]	11.8	16.5
Gujarat	1.4	13.1	16.6
Maharashtra	8.7	4.2	16.8
Haryana	3.3	5.1	17.1
Delhi	7.5	1.4	17.9
Kerala	3.2	18.5	31.6
Whole of India	**3.4**	**3.2**	**9.1**

[a]Inadequate sample size.

resides, were unqualified. Estimates from the 2001 census suggest that between 37% and 57% of the allopathic doctors at that time did not have a medical qualification.[2,3] These findings indicate that a large number of people in India, particularly in rural areas, receive health care from unqualified providers, whose quality of care is likely to be harmful to their patients' health. Several studies in India have also documented the role of unqualified or informal providers in providing health services to both rural and poor-urban populations in different parts of the country.[9–11] Studies have also found the quality of care provided by these providers to be inadequate.[12,13] The question of how to engage with informal providers is a complex challenge. On one hand, they do provide health care to populations that do not have access to qualified providers, while on the other hand, their lack of proper training will always be a source of concern.

The findings of the present study suggest that the majority of health workers in India work in the nongovernment sector. Given that more than 70% of outpatient visits and 60% of hospital admissions take place in the private sector,[14] these results are not surprising. An interesting exception to the above finding, however, is the proportional presence of nurses and midwives in the government and nongovernment sectors in both urban and rural areas. This suggests that while doctors have a strong preference for working in nongovernment and urban facilities, it could be easier to fill a larger number of positions for nurses/midwives in rural government facilities. Nurses are often the most predominant category of the so-called "front-line" health workforce and are capable of providing a wide range of basic curative and preventive services at lower costs than doctors. Strengthening the nursing cadre, in terms of both size and competencies, has also been found to improve the quality of health care in other low-resource settings.[15] This is also crucial in the Indian context, given that the present study finds that the skill-mix of the workforce, particularly the doctor-to-nurse ratio close to one, is suboptimal.

The use of non-routine sources of information on the workforce, such as sample surveys and censuses, can provide a comprehensive picture of India's health workforce. Moreover, they enable several of the fragmentation and other challenges present in routine sources of information on the workforce to be overcome. There are, however, several areas in which the quality of these non-routine sources can be strengthened. First, self-reported occupations were coded only up to the initial three digits of the 2004 NCO codes; this resulted in loss of valuable information on the finer distinction of all health-worker categories. However, this shortcoming was partially overcome by combining codes from the 2004 NCO and 2008 NIC. In addition, 2004 NCO codes do not distinguish clearly between nursing and midwifery cadres, resulting in both being combined as one category even though, particularly in the Indian context, their job profiles and qualifications are very different. Finally, the NCO classification does not have a code for community health workers and hence these estimates do not take account of the additional 846 309 ASHAs recruited through the National Rural Health Mission up to 2011–2012.[16] Although sample surveys are nationally representative, sample sizes at the state level are too small to calculate robust state-specific estimates. Moreover, these data cannot be further disaggregated to the district level, where most of the planning and management decisions for primary health care are taken.

Areas with poorer health outcomes and service-delivery indicators typically have a lower density of health workers. The low health-worker density in rural areas, particularly of qualified doctors, could be a reason for low uptake of health services in these areas. Globally, and in India, several strategies have been tried to increase the presence of qualified health workers in rural areas, by offering either higher salaries or non-monetary incentives tied to further educational opportunities to those posted in rural areas.[17] Studies conducted among graduating medical and nursing students in India have also found that substantial salary increases, combined with adequate facility infrastructure and good living conditions, are likely to result in acceptance of rural jobs.[18,19] These strategies need to be further studied within the context of every individual state and integrated into human-resource planning and management.

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Factors enabling women with pelvic organ prolapse to seek surgery at mobile surgical camps in two remote districts in Nepal: a qualitative study

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ABSTRACT

Background: Pelvic organ prolapse (POP) is a major reproductive health problem in Nepal, though many women delay seeking treatment. To address this, the Nepalese government has been providing free vaginal hysterectomies with pelvic floor repair to women in mobile surgical camps. Studies exploring factors that enable women to attend these camp settings are limited. This study aimed to identify factors that affected women seeking surgical treatment for POP at mobile surgical camps.

Methods: The study used a qualitative approach. Twenty-one women with POP were recruited in two week-long mobile surgical camps held in two remote districts in Nepal during April and May 2013. Data were collected from individual face-to-face interviews and were analysed thematically.

Results: Three themes and six subthemes emerged from the analysis. The first theme, "health-system factors", suggests that accessibility and affordability of the treatment, and the supportive role of female community health volunteers facilitate women to seek treatment in the camp. The second theme, "factors related to sociocultural norms", reveals that reaching the end of reproductive years and approval by relevant influential family members empowers women to take up surgical treatment in the mobile surgical camp. Similarly, the third theme, "individual-level factors", includes women's experience of POP, such as worsening symptoms and fear of development of cancer, as factors enabling women to seek treatment.

Conclusion: Enablers to seeking treatment at mobile surgical camps for women are related to the Nepalese health system, sociocultural norms and individual experiences of women. Each of these factors should be considered when conducting mobile surgical camps, if women's uptake of treatment is to be enhanced.

Key words: enablers, facilitators, mobile treatment camp, Nepal, seeking treatment, uterine prolapse

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BACKGROUND

Pelvic organ prolapse (POP) is major reproductive health problem in Nepal, affecting 6–37% of women.[1–4] It is a progressive condition where the cervix descends into the vagina or beyond because of weakened pelvic muscles.[2] Based on the level of descent of the uterus, POP can be graded as first degree if the uterus sags into the upper vagina, second degree if the uterus descends to the introitus, third degree if the cervix is outside the introitus, or fourth degree if the uterus and cervix are completely outside the introitus. Third- and fourth-degree prolapse require surgery; most often this will involve a vaginal hysterectomy (VH) with pelvic floor repair (PFR).[5]

While POP is considered a disease of postmenopausal age in other parts of the world,[6] a Nepalese woman's journey with POP can start when she is just in her 20s.[7,8] Additionally, POP is not only a reproductive health outcome related to women's

age, parity, obstetric history or menopause; its causes are also deeply rooted in complex Nepalese sociocultural norms that tend to devalue women.[2,9] A substantial proportion of Nepalese women seek treatment only after living with POP for many years.[7–9] Women's uptake of POP treatment is a complex process affected by many factors, including embarrassment, household duties, the availability and affordability of health services, the patriarchal nature of families, a lack of control over family earnings and especially women's lack of power and involvement in making decisions about their own health care.[10,11] A majority of women with POP progress to the more severe form and many need surgery by the time they seek treatment. However, surgical treatment like VH with PFR is not available as routine health service at district- or local-level health institutions.[12]

In 2008, the Supreme Court of Nepal declared POP a human rights issue , in response to litigation filed by womens' rights activists. The government was criticized for its insensitivity towards the issue and the court ordered the Ministry of Health and Population and Ministry of Women, Children and Social Welfare to initiate effective interventions to prevent, as well as treat, the condition. As a result of the court proceedings and continuous advocacy of Nepali Civil Society, the Ministry of Health and Population pledged to provide free VH with PFR for reducing the prevalence of prolapse.[13,14] The decision to provide this service was based on findings from a study that indicated that about one third of the women in Nepal with POP were in immediate need of surgical correction.[8] The government strategy aimed to provide free surgery to 200 000 women by 2014/2015 through static and mobile outreach clinics.[13] POP mobile surgical camps are mobile outreach clinics that provide VH with PFR for the treatment of POP. The study reported on in this paper was conducted in 2013, when a mobile surgical camp was widely preferred to a static clinic, as it used information, education and communication activities to create demand and increase the accessibility of the service for rural, marginalized and other underserved populations.[15]

Factors that enable women to attend the mobile surgical camps for treatment remain under-researched. It was important to understand such factors from the women's perspectives, in order to enhance the uptake, as well as the delivery, of the services offered in the mobile surgical camps and subsequently for effective management of POP in Nepal. This study therefore explored factors that acted as facilitators for affected women to seek surgical treatment at mobile surgical camps.

Recently, there have been varied stances on the effectiveness of mobile surgical camps as a treatment option. There are significant discussions about the management of POP in Nepal and whether the approach of mobile surgical camps should be offered. This study may contribute insights into the relevance of the mobile-camp approach and subsequently for informing trade-offs between different approaches for effective management of POP in Nepal.

METHODS

Setting

The Ministry of Health and Population sent out an invitation to tender, and nongovernmental organizations (NGOs) had opportunities to submit bids. The organizations that won the bid conducted a screening camp to identify cases for treatment. The dates and locations for the mobile surgical camps were decided in consultation with the District Public Health Office and other stakeholders. Information about the surgical camps was provided to the target audience through a variety of means, such as broadcasting in local media, and announcements by female community health volunteers in mothers' groups.

This study was conducted during April and May 2013 at two mobile surgical camps in two different districts (see Table 1). Each lasted a week, with one taking place in a remote district hospital (District A) and the other in a remote primary health-care facility (District B). At each surgical camp, gynaecological outpatient clinics were held from 08:00 to 14:00 daily and staffed by a medical team comprising a male gynaecologist, a male physician and two female nurses. About 100 women presented per day. Each woman attending the camp was registered at the registration desk. Personal information such as age, educational status, address and contact details were recorded. The women were then guided to a room where their obstetric history, medical history, treatment history, behavioural factors and main reasons for presenting for treatment were recorded.

A team of the camp staff, consisting of a physician, a nurse and health workers from the local health facility, conducted general and systematic examination of patients. The team explained and encouraged women to undergo internal examination. Women who agreed were taken to a separate room where a male gynaecologist, in the presence of a female nurse, performed a pelvic examination to ascertain the presence and degree of prolapse. The Pelvic Organ Prolapse Quantification System (POP-Q) was used for grading the prolapse.[17] Symptomatic patients with third- or fourth-degree prolapse were recommended for surgery and referred to the laboratory for blood and urine tests. Those who were deemed medically fit and consented to surgical treatment waited 40–45 minutes before undergoing surgery. Each woman undergoing surgery in the camp was provided with free treatment, medicine and food during their hospital stay, as well as reimbursements for transportation costs to return to their homes post-surgery.[18] Women were hospitalized for 3 days post-surgery, where they were monitored for discomfort and complications and given relevant medication, including for relieving pain. Patient counselling was also done regarding taking relevant precautions and the recovery period. Table 1 summarizes district-specific settings and the study methods.

Table 1. Description of settings and methods according to district

	District A	District B
Setting		
Location by ecological region	Hilly	Himalayan
Transportation facilities	Limited in rural areas	Limited
Health facilities	Major hospitals offering VH service in urban areas of the district	No major hospitals offering VH service in the district
Mean age of first marriage[3]	18 years	17 years
Female literacy rate[3]	51.7%	17.8%
Ranking of district (out of 75)[16]		
Poverty and Deprivation Index	Ranked top 20th to 30th	Ranked last 15th
Socioeconomic and Infrastructural Development Index	Ranked top 20th to 30th	Ranked last 15th
Women Empowerment Index	Ranked top 20th to 30th	Ranked last 15th
Overall composite score	Ranked top 20th to 30th	Ranked last 15th
Methods		
Sampling technique	Convenience	Purposive, using criterion sampling technique
Inclusion criteria	• Confirmed by the medical team as requiring VH • Medically fit to undergo VH • Willing to participate in the study	• Confirmed by the medical team as requiring VH • Medically fit to undergo VH • Willing to participate in the study • Able to understand and speak Nepali language fluently
Number of participants interviewed	16	5

VH: vaginal hysterectomy.

Recruitment

Twenty-five women were invited to participate in this study and 21 agreed. Reasons for non-participation were poor health, unease about being audio-recorded and reluctance to talk to the interviewer. Sixteen participants were recruited in District A, using convenience sampling. Inclusion criteria were that women required surgery (VH with PFR), were medically fit to undergo surgery and were willing to be interviewed. It was decided to attend a second camp to ensure an adequate number of participants. Five women were recruited in District B, using criterion sampling. The interviewer (first author) was unfamiliar with the local dialects and had no funding to employ interpreters. Therefore, an additional criterion for selecting women in the second camp was that they could understand and speak Nepali.

Data collection

Individual face-to-face interviews were conducted. An interview guide, informed by other studies,[8–11] was prepared by researchers and was pretested in one of the camps in District A. Open-ended questions were used, related to the history of onset of uterine prolapse, symptoms experienced by the participants, treatment history, decision-making process for seeking treatment at a mobile surgical camp, and factors influencing women to attend the camp for treatment. The first author conducted the interviews. In both districts, women were approached while they were waiting for surgery. The interviewer explained the study to women in Nepali and invited them to participate. Women who agreed to be interviewed were guided to a separate room by the first author, to maintain privacy. Interviews lasted for 20–35 minutes and were audio-recorded. Interviews were stopped when data saturation was reached.

Analysis

The interviews were first transcribed verbatim in Nepali and then translated into English. Where necessary, informal help from a bilingual translator was sought and a bilingual dictionary was used as a reference. The translated interviews were read by an independent public health professional and matched with the recordings to ensure the completeness, accuracy and clarity of translation. The translated interviews were analysed thematically, based on Braun and Clarke's guide to six-phase

thematic-analysis.[19] Data were stored and organized for analysis using Nvivo 10 (QSR International). Emerging issues in the transcripts were coded into categories. Later, similar categories were identified and grouped together to form themes. After that, the themes and their subthemes were structured into a hierarchy to form a thematic map. Observations from the field notes were later used to supplement the description of the themes that emerged from the analysis. Confidentiality was maintained by using anonymous identification details with a letter and a number (W1–W21).

Ethics

The Human Research Ethics Committees of the University of Adelaide, Australia, and the Nepal Health Research Council approved the study. Many women in Nepal are illiterate. Detailed information about the study was provided verbally in Nepali and verbal consent was audio-recorded. Participants were reassured that the decision regarding participation would not influence or impact their treatment process. Consent included permission to audio-record the interviews.

RESULTS

Characteristics of the participants according to districts are presented in Table 2 .

"Facilitators to seeking treatment in the mobile surgical camp" was the overarching theme. The analysis yielded three themes around (i) health-system factors; (ii) factors related to sociocultural norms; and (iii) individual-level factors. Six subthemes were also identified. The themes and their associated subthemes are presented in Table 3 and are discussed next .

Health-system factors

This theme comprises two subthemes. The first, "geographical accessibility and affordability of treatment", relates to the location of camps and the cost of VH with PFR. The second subtheme, "the supportive role of female community health volunteers", describes the positive influence of these volunteers on decision-making by affected women.

Table 2. Characteristics of participants

	All (*n* = 21)	District A (*n* = 16)	District B (*n* = 5)
Median age, years	41 (SD = 9.3; range = 25–60)	45 (SD = 9.1; range = 30–60)	35 (SD = 5.4; range = 25–40)
Duration of prolapse, years	13 (SD = 9.6; range = 3–22)	17 (SD = 9.8; range = 3–21)	7 (SD = 3.0; range = 3–11)
Mean number of live children	4	4	4

SD: standard deviation.

Table 3. Subthemes, themes and overarching themes describing reasons to attend the mobile surgical camp for surgery

Subthemes	Themes	Overarching theme
Geographical accessibility and affordability of treatment	Health-system factors	Facilitators to seeking treatment in the mobile surgical camp
The supportive role of female community health volunteers		
Reaching the end of reproductive years	Factors related to sociocultural norms	
Approval by relevant influential family members		
Increasing severity of symptoms	Individual-level factors	
Fear of potentially fatal consequences such as developing cancer		

Geographical accessibility and affordability of treatment

Women with POP would usually have to travel long distances, often over difficult terrain, for treatment. The mobile camps allow women to access treatment closer to home, by overcoming the transportation barrier. Participants articulated the positive aspects of proximity:

> It is near. We don't need to travel far because of this camp. It has come to our doorstep. [W13]

> We have to walk down the hill for three – four hours to reach bus station. There is no fixed schedule […] have to wait for long to catch a bus to get there [hospital]. Buses do not come here during rainy season. They [drivers] say it is difficult to drive bus due to bad condition of the road. We have to walk all the way to hospital during rainy season […] travelling to city [for treatment] is not easy for us. It is far easier to come here for treatment. [W17]

Women indicated that treatment costs in major hospitals, where surgical treatment would have otherwise been done, would constitute a huge proportion of their income. Provision of free VH with PFR in the camp made it affordable and this acted as a motivator.

> Our financial condition is not so good. If my family was well-off, I would have been taken to hospital at farther places […] travelling to [the] regional centre [the nearest place where a major hospital is located] costs much. We are not able to afford [it] even if we sell our house and land […] I have not been able to seek treatment due to poverty. [W12]

The supportive role of female community health volunteers

Several participants revealed that they heard about the camp from female community health volunteers, during mothers' group meetings where information is provided to local women on maternal and child health issues. The female community health volunteers encouraged women to attend for surgical treatment and provided them with current information about the location of a mobile camp. One woman stated:

> I knew about this [mobile surgical camp] from [the] female community health volunteer. There was a meeting of the mothers' group in our village. In that meeting, the female community health volunteer said to me, "you are suffering from this condition. Please go there [to the camp] and get your treatment done. Also please share this information with other women who are facing this problem". That's why I have come here. [W7]

Factors related to sociocultural norms

This theme comprises two subthemes that relate to the impact of complex sociocultural values embedded in Nepalese society. The first subtheme "reaching the end of reproductive years", relates to reproductive expectations from women, and the second subtheme "approval by relevant influential family members", encompasses obtaining permission from the head of the household as an enabler in seeking treatment.

Reaching the end of reproductive years

Women in Nepalese society are expected to give birth to several children, at the very least until they have a boy.[20] Participants who did not have a son explained that their decision to seek treatment was influenced by the fact that they were reaching the end of their reproductive years and were now biologically unfit for further childbearing. An older woman who wanted to give birth to a baby boy reasoned:

> They say that [a] woman will not be able to conceive after she is 50 years. I might have given birth to another one too if I hadn't been this age and if I did not have any problem in my uterus. I have been trying but unable to conceive [for] 5 years. Now I don't have any hope. [W10]

Approval by relevant influential family members

For the younger participants, the decision to seek treatment had to be approved by family members (especially the mother-in-law and/or husband). One participant explained:

> My husband suggested me for this [seeking treatment in the camp]. Later I talked to them [in-laws]. They agreed on it. I could come here only after obtaining permission from them. [W1]

Individual-level factors

This theme incorporates two subthemes, namely "increasing severity of symptoms" and "fear of potentially fatal consequences such as developing cancer".

Increasing severity of symptoms

Women were embarrassed to talk about their condition with others and had been hiding the condition for years. Women reported that, prior to seeking treatment, they were experiencing severe pain to such a level that they could no longer bear it. These seriously disruptive symptoms prompted women to seek treatment in the camp. One woman verbalized this decision to seek treatment as follows:

> I experience extreme pain these days. It pains a lot around this area [lower abdomen and genital area]. […] I cannot sit in squatting position, walk long distance and take a leak. If I try [to urinate], it [urine] gets blocked and does not pass away from the body [...] it [the pain] is getting terrible day by day. Therefore, I have come here for treatment. [W10]

Fear of potentially fatal consequences such as developing cancer

Participants mentioned that they had heard about the risk of having worse health outcomes if prolapse was not treated in time. They were worried that they might develop cancer if they did not seek treatment soon. The fear had a "positive" outcome, in that women sought treatment in the camp. For example, an affected woman who had been suffering for 7 years without telling anyone stated:

> I had heard from my sister-in-law saying that one might suffer from cancer if the condition is left untreated […] I gathered courage to tell her, "Kanchi" [sister-in-law], I am suffering from uterine prolapse and want to undergo treatment. [W16]

DISCUSSION

This study investigated factors that enabled women with POP to undergo treatment in the mobile surgical camps in two remote Nepalese districts. Geographical accessibility and affordability of treatment; the supportive role of female community health volunteers; reaching the end of reproductive years; approval by relevant influential family members; increasing severity of symptoms; and fear of potentially fatal consequences such as developing cancer were identified as facilitators to seeking treatment in the mobile camps. These factors were organized into three themes, i.e. health-system factors; factors related to sociocultural norms; and individual-level factors. This study aids understanding of treatment-seeking behaviour in the setting of a mobile surgical camp, unlike other studies of health-seeking behaviour that have examined the issue in static facilities such as hospitals. It is important to understand such factors, in order to achieve the government's goal of offering treatment options.

The way in which the Nepalese health system is organized has a profound effect on the treatment for POP. Although most people reside in rural areas, there is an acute shortage of health services in these regions. Consequently, as participants indicated, remote-living women have to travel long distances to urban areas for appropriate treatment. This is also often unaffordable, not only because the treatment is expensive,[4] but because of the high costs (direct, indirect and opportunity costs) associated with travelling and undergoing the treatment.[21] Poverty and geographical inaccessibility of health services limit the treatment options available to women. The mobile surgical camps make treatment options accessible, because the surgery is offered free of charge closer to home and women are reimbursed for transportation costs. The findings of this investigation complement those of earlier studies conducted in the context of low-income countries,[22,23] which found that the affordability and accessibility of treatment have a significant impact on utilization of maternal and reproductive health services.

However, use of mobile surgical camps has been criticized for several reasons. First, in the absence of any clinical protocols to guide the procedure, the quality of service delivered was uncertain. Second, remuneration provided to the NGOs delivering the service was based on the number of surgical procedures performed. Consequently, the providers had an incentive to create a supplier-induced demand, which could have resulted in doing unnecessary surgery.[13] Lastly, NGOs lacked follow-up plans to assess and manage post-surgical complications once the women left the camps. Therefore, the government has discontinued use of mobile surgical camps. While screening is still done in mobile camps, surgery is now done in listed medical institutions,[14] where women are offered free surgery and post-surgical care and their transportation cost is reimbursed. Moreover, a reference manual on management of POP has been published to assure the quality of surgical management for POP.[24]

Nevertheless, the study provides evidence that costs associated with transportation are not the only barrier in accessing surgical treatment at hospitals. Lack of an appropriate transportation system to reach treatment centres is another hindrance in accessing service. This means that reimbursement of transportation costs is not enough to address transportation barriers. Therefore, solutions to overcome these challenges are needed if free surgery is to be performed at static hospitals alone. One way to do this would be to establish community support groups where members of these groups help women to travel to health centres and back home after surgery.[25] In addition, the government should ensure that listed hospitals are in reasonable proximity to women in need of surgery. Where demand for surgery is high in remote areas, listed hospitals could provide services through a mobile surgical camp by adhering to specified standards[24] as an extension of their service, to meet the demand.

The role of female community health volunteers in the uptake of treatment is important, as they have up-to-date information about treatment options for affected women and can link these women with the mobile screening camps. A strong relationship between the provision of information on the availability of health services and addressing barriers to accessing these services has been reported in the literature.[26] There is, therefore, a definite need for mobilizing female community health volunteers during the planning and implementation of the camps, so that more women could be informed and motivated to seek screening.

The complex sociocultural norms of Nepalese society have an impact on women seeking treatment. Women hold inferior positions to men within the family unit and in Nepalese society in general. Male members of a household are typically expected to be the head of the family and maintain the family legacy by fathering a son.[27] Conversely, wives are accorded a lower status in a household and are expected to consider their husband an object of absolute veneration. A woman is also expected to perform all household chores, and, in doing so, to be servile to other members of family as well, especially her husband and mother-in-law. The pervasive inequalities in gender roles borne out of these hierarchical relationships complicate the process of seeking treatment,[21] thereby placing the decision-making autonomy of women in the hands of their mothers-in-law and/or husbands.[22] As observed in this and other studies,[10,11] it is customary for women to obtain approval from their decision-makers to seek treatment. The practical implication

is to target key decision-makers to recognize the impact of POP and to encourage them to value the benefits of treatment for affected women. This might allow more women to seek treatment. A reasonable approach to address this issue could be to encourage couple communication, family interaction and joint decision-making in seeking treatment for POP.[4,28] In the meantime, addressing existing gender inequalities by educating girls, increasing employment opportunities for girls and women, and increasing women's control over household finances is also critical.

Sociocultural norms, such as strong preference for a son, are still prevalent in Nepalese society, and have a negative effect on treatment-seeking behaviour. A study that explored women's experiences of POP in a hilly district of Nepal identified that it is not uncommon for a woman to delay treatment for reasons such as shame or fear of discrimination.[29] In addition, this study also found that a woman will delay treatment until she has given birth to a son or has become biologically incapable of childbearing.

It is considered socially inappropriate to discuss gynaecological problems, such as POP, openly,[7] and POP carries a social stigma.[2] Women are, therefore, more likely to refrain from seeking treatment, owing to fears of being humiliated and rejected by their society members.[15] As evident in this study, it was only when symptoms worsened to the point where women found them unbearable, or experienced a fear of developing cancer, that they considered surgical treatment. A number of other studies have also found that increasing symptom severity acts as a motivator for seeking treatment.[30,31] This finding needs to be interpreted with caution, however, as delaying treatment until symptom severity increases can have adverse health impacts. Hence, we propose that it is necessary to educate women about the progression of the condition, its potential health impacts and the importance of seeking timely care. More importantly, the social stigma and taboos around "female issues" need to be addressed. Strategies for minimizing the social stigma could include health education and social marketing approaches, to correct misconceptions related to POP and its consequences.[32]

The study has some limitations. First, the pressing deadline for completing the study within 4 months did not allow exploration of the heterogeneity of women's experiences by participants' caste, class, ethnicity and geographical area. Consequently, the way in which these diversities shape women's journeys in seeking surgery remains unexplored. Understanding the influence of this heterogeneity is essential, in order to offer targeted and nuanced recommendations for timely treatment of POP in Nepal, and further research on these aspects is recommended. Second, participants in District B had to be chosen on the basis of their ability to speak Nepali. The study may have missed out elucidating other enablers, as it is likely that women would have been more comfortable and less restricted in sharing their views had the interviews been conducted in the regional dialect.

Conclusion

This study explored factors that facilitated women in two remote districts in Nepal to seek surgery in mobile surgical camps. It found that factors associated with the Nepalese health system, women's personal experiences of POP and the deeply rooted sociocultural Nepalese norms were significant in influencing women seeking treatment. These factors lie on a continuum and should be addressed in different ways simultaneously if the prevalence of POP is to be reduced by enhancing timely uptake of surgical treatment in this population.

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Costing of immunization service provision in Kalutara district, Sri Lanka: a cross-sectional study

Hemali Jayasekara[1], Amala De Silva[2], Ananda Amarasinghe[1]

ABSTRACT

Background: Immunization is regarded as the single most cost-effective way to prevent vaccine-preventable diseases. With the rising cost of the National Immunization Programme (NIP) in Sri Lanka, immunization costing studies could help programme managers to ensure sustainable immunization financing in the country.

Methods: Four medical officer of health (MOH) divisions in Kalutara district were included, to estimate the cost incurred for the NIP programme. Fifteen immunization clinics from urban and rural settings were selected from the selected MOH divisions, by a simple random sampling method. Data were collected for a period of 3 months, using pretested check-lists. In addition, related data at national and district levels were also collected. Cost estimates were made for direct capital and recurrent costs.

Results: The cost of vaccines under the national immunization schedule for infants was 1361.84 SL Rs (US$ 10.32). For children under 5 years of age, it was 1535.64 SL Rs (US$ 11.63). The majority of these costs were direct recurrent costs (93.4%). Vaccines (84.3%) and staff salaries (6.4%) were the main components of direct recurrent costs, while cold-chain equipment (5.3%) was the main contributor to direct capital cost.

Conclusion: The cost of vaccine is the highest proportion among all other cost components in the NIP in Sri Lanka, and this is largely attributable to new costly vaccines. Staff payments are not significant, as they are a shared cost of public health service providers. Studies exploring the costing of the NIP in the country would be beneficial, to ensure sustainable immunization financing.

Key words: cost, immunization, immunization costing, Sri Lanka, vaccines

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BACKGROUND

The history of immunization in Sri Lanka goes back to the 19th century. The law relating to compulsory vaccination against smallpox is referred to in the *Vaccination Ordinance* of 1886. Bacille Calmette–Guérin (BCG) vaccination was introduced in Sri Lanka in 1949. The Expanded Programme on Immunization (EPI) was introduced in Sri Lanka in 1978 and has continued to make excellent progress since then. In 1978, all EPI vaccines were donated by the United Nations Children's Fund (UNICEF) but in 1990, the Government of Sri Lanka began financing for selected vaccines and by 1995 all EPI vaccines were fully funded by the government.[1] In 2007, a separate budget line within the allocation for drugs and medical supplies was identified for vaccines. This ensures that the government is committed to providing the necessary funds for the National Immunization Programme (NIP). However, the high cost of new vaccines will be a challenge to balancing the sustainability of the programme and its expansion.[2]

The Global Alliance for Vaccine and Immunization (GAVI) funded the introduction of hepatitis B vaccine in 2004 and pentavalent vaccine (diphtheria, tetanus pertussis, *Haemophilus influenzae* type B, hepatitis B) in 2008. The total cost for hepatitis B (Hep B) vaccine was provided as a donation and pentavalent vaccine was provided under a co-financing strategy. Since the gross national income per capita of Sri Lanka has now exceeded the eligibility threshold of GAVI's graduation policy, all funding was taken over by the government by 2015.[2] Notably, the contribution of the private sector to immunization services

in the country is not significant, except in Colombo.[3] Health care, including immunization, in Sri Lanka is free of charge; therefore, virtually all the financial burden of immunization service in the country is borne by the public sector.

It is accepted that vaccines are the single most cost-effective, long-lasting method to eliminate vaccine-preventable diseases in all age groups. However, financing the NIP is challenged by many factors, including increased vaccine costs, high demand for new vaccines and competing priorities in the health sector. The strategies required to make immunization financing sustainable include: ensuring continued government commitment to the NIP, increasing budgetary allocation, reducing costs, monitoring and supervision of the programme, raising awareness of all stakeholders, and guaranteeing donor support.[1] Limited data are available on the financing of vaccine and immunization services in Sri Lanka. This creates a challenge for programme managers in their decision-making. Thus, this study was carried out with the aim of estimating the cost incurred by the NIP of immunizing children aged less than 5 years in the district of Kalutara.

METHODS

Study design and setting

The setting for this descriptive cross-sectional study, which was done in 2013, was Kalutara district. Kalutara is one of 25 districts in Sri Lanka, which are organized into nine provinces. This district is situated in the Western Province of Sri Lanka, on the southern coastal belt. It has an estimated population of 1.1 million, with a total area 1606.4 km^2. The infant population in 2012 was approximately 20 427.[4]

Sample size

There are 13 medical officer of health (MOH) divisions in the district, with 136 immunization clinics. Four MOH divisions, representing both urban and rural divisions, were purposely selected to estimate the cost incurred for the NIP in the district. Out of 31 immunization clinics in these four MOH divisions, 15 were selected, using a simple random technique, to provide a sample for estimations of immunization costs.

Data collection

Data, including immunization performance (immunization coverage, vaccine use and wastage, use and wastage of injection-safety supplies), salaries and payments to staff, and the costs of cold-chain equipment, buildings, vehicles, maintenance and utilities (electricity, water), were collected over 3 months. Both national and district levels are actively involved in vaccine logistics, hence the costs incurred at these levels for NIP service were also included in the study, and related data were collected.

Pretested check-lists were used to collect data and the first author, with two trained medical pre-interns, carried out the data collection. Information was abstracted from immunization clinic and MOH office registers, returns, records, invoices, diaries and other relevant documents. Financial records of the costs of vaccine and cold-chain equipment were collected from the central Epidemiology Unit, Ministry of Health. Information was collected on both input (capital and recurrent costs) and output (number immunized) components of the NIP programme. In the study period, this was as follows: all children during their first year of life should be immunized with BCG, oral polio vaccine (OPV), diphtheria–tetanus–pertussis (DTP), Hep B, *Haemophilus influenzae* type B (Hib), Japanese encephalitis (JE) and measles–mumps–rubella (MMR), to complete the primary series of vaccination before reaching the age of one year. DTP (booster) and OPV (booster) should be administered at 18 months. At 3 years, the MMR (booster) should be given. At school entry aged 5 years, the fifth OPV dose should be given, as well as one dose of DT for those children who have completed the primary course of DTP.[2]

Most of the information on capital costs of MOH divisions was collected from the office of the regional director of health services in Kalutara, as this is the district administrative centre.

Data analysis

Data were coded and entered into Statistical Package for Social Sciences (SPSS) version 17.0. Data were collected on, and categorized as: (i) direct capital costs; (ii) direct recurrent costs; and (iii) costs of vaccines and injection-safety items.

Direct capital costs include costs for cold-chain equipment, buildings and vehicles. Items of cold-chain equipment are mainly procured at national level. However, cost estimates for cold-chain items at all levels were separately calculated. Since the values of buildings and equipment depreciate over time, it was assumed that over a given lifespan for each item, equal usage would correlate linearly with the depreciations in values.

Direct recurrent costs include staff salaries, based on the proportion of time spent on NIP activities, administrative costs, utilities (water and electricity payments) and consumables. Maintenance costs include the costs for cold-chain equipment, buildings, vehicles and waste disposal. Training costs allocated by national and provincial government, and costs incurred for adverse events following immunization, were not included. These activities are a part of the country's overall training and disease-surveillance activities and thus the costs are non-specific. The study population was around 5% of the country's population of children aged under 5 years and therefore inclusion of estimates for these non-specific costs would be unlikely to influence the study findings.

Vaccines and injection-safety items (auto-disable and reconstitution syringes and safety boxes) are procured at national level. Data on vaccine usage for a 3-month period in the study areas were collected for estimation of vaccine costs. Vaccine wastage was also considered separately for each antigen in these estimates.

First the cost per each input item was estimated – for capital (cold-chain equipment, buildings, vehicles) and recurrent

items (salaries, utilities, maintenance and administrative costs). The costs of vaccines and injection-safety items were also estimated separately. This was followed by estimation of the output items, i.e. number of immunized children aged under 5 years, for the given time period. Finally, the mean cost incurred by each item per immunized child aged under 5 years was estimated, using following formula:

> cost per child aged under 5 years for a given item = cost of the given input item for the 3-month study period/total number of children aged under 5 years immunized for the 3-month study period

Ethical clearance

Ethical clearance was received from the ethical review committee of the Faculty of Medicine, University of Kelaniya. Written informed consent was obtained from each study participant.

RESULTS

The study estimated the cost of immunization service at three levels: divisional (immunization clinic and MOH office), district and national levels. Most of the data derived from divisional level, as it is the primary level of immunization service delivery in the country. The immunization data for this study were based on 16 946 children aged less than 5 years and registered in four selected MOH areas, during the study period of 3 months. With the exception of vaccines and injection-safety supplies, the capital and recurrent costs were based on costs incurred at 15 immunization clinics, 4 MOH offices and the district cold stores in Kalutara district.

The cost estimates were made separately for direct capital costs and direct recurrent costs. All these costs were estimated for children aged under 5 years and are presented in both Sri Lankan rupees (SL Rs) and United States dollars (US$).

The cost of vaccines under the national immunization schedule for infants was 1361.84 SL Rs (US$ 10.32). For children under 5 years of age, the total vaccine cost was 1535.64 SL Rs (US$ 11.63) (see Table 1). When the costs of injection-safety supplies and the direct capital and recurrent costs at the national, district and divisional level were added, the total cost of a fully vaccinated child under 5 years of age was 1821.62 SL Rs (US$ 13.80) (see Table 2). The highest proportion of the cost is therefore borne at the national level, for the supply of vaccines and injection-safety items. Costs borne at the district level are largely for administration, and for the district medical-supply division, where vaccines are stored. At divisional level, costs for immunization service delivery include both capital (cold-chain equipment, buildings, vehicles) and recurrent (largely salary, maintenance, utility) costs.

The capital cost was only 6.6%, of which cold-chain equipment (5.3%) was the main costing component. The capital cost for buildings and vehicles was only 1.3%, as these costs are shared with other public health-care services. Vaccines (84.3%) and staff salaries (6.4%) were the main components of recurrent costs (see Fig. 1).

Table 1. Vaccine costs[a] by antigens per fully immunized infant and per child under 5 years of age, according to the schedule of the National Immunization Programme, Sri Lanka

	Cost per infant		Cost per child under 5 years of age	
Vaccine	SL Rs	US$[b]	SL Rs	US$[b]
BCG	6.84	0.05	6.84	0.05
OPV 1st, 2nd, 3rd doses	60.00	0.45	60.00	0.45
OPV boosters 4th, 5th doses	NR	NR	40.00	0.30
Pentavalent vaccine,[c] 1st, 2nd, 3rd doses	1095.00	8.30	1095.00	8.30
JE	100.00	0.76	100.00	0.76
MMR 1st dose	100.00	0.76	100.00	0.76
MMR booster – 2nd dose	NR	NR	100.00	0.76
DTP booster	NR	NR	21.80	0.17
DT	NR	NR	12.00	0.09
Total	1361.84	10.32	1535.64	11.63

BCG: bacille Calmette–Guérin; DT: diphtheria–tetanus; DTP: diphtheria–tetanus–pertussis; JE: Japanese encephalitis; MMR: measles–mumps–rubella; NR: not relevant; OPV: oral polio vaccine; SL Rs: Sri Lankan rupees; US$: United States dollars.

[a]Vaccine costs include two components – absolute cost per dose (from national procurement invoices) and vaccine wastage (calculated based on usage rate for each vaccine separately). While the vaccine cost per dose is actual, wastage is an estimated mean.

[b]1 US$ = 132 SL Rs (in 2012).

[c]Pentavalent vaccine: diphtheria, tetanus, pertussis, *Haemophilus influenzae* type B, hepatitis B.

Table 2. Cost per fully vaccinated child under 5 years of age, by National Immunization Programme costing levels

National Immunization Programme costing levels	Cost per child under 5 years of age[a]	
	SL Rs	US$[b]
National level		
Vaccines	1535.64	11.63
Injection-safety supplies[c]	42.88	0.32
Direct (capital and recurrent)[d]	17.40	0.13
District level		
Direct (capital and recurrent)[d]	73.29	0.56
Divisional (MOH) level		
Direct (capital and recurrent)[d]	152.41	1.15
Total cost	1821.62	13.80

MOH: medical officer of health; SL Rs: Sri Lankan rupees; US$: United States dollars.

[a]All values presented are means except absolute dose/unit costs of vaccines and injection-safety costs incurred by the National Immunization Programme. Cold-chain costs, building costs and salaries were calculated at national, district and divisional levels and then extrapolated as a mean value to the target population of immunized children in the four MOH areas. Since these are pooled costs of absolute values and estimated means, standard errors are not presented.

[b]1 US$ = 132 SL Rs (in 2012).

[c]Auto-disable and reconstitution syringes, safety boxes.

[d]Capital costs include cold-chain equipment, vehicles, buildings; recurrent costs include salaries, maintenance, administration and utility costs, such as electricity and water.

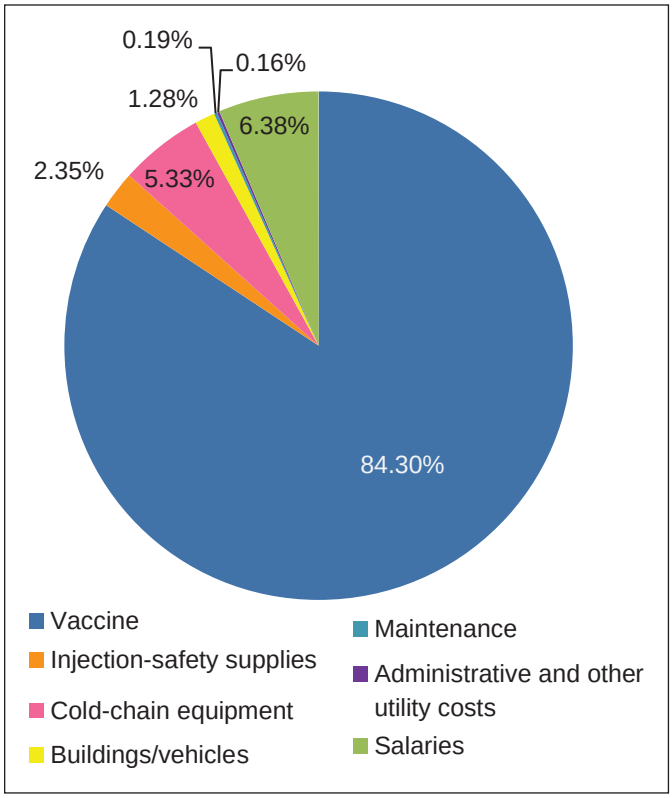

Fig. 1. Total programme cost by items for a fully vaccinated child under 5 years of age

DISCUSSION

This study estimated that the cost for full vaccination of a child by the age of 5 years was 1821.62 SL Rs (US$ 13.8). Previously, only one study was available in Sri Lanka for the cost of the NIP for infant immunization; this was carried out in Badulla district.[5] According to this study, the cost for full immunization of an infant for six antigens (BCG, DTP, OPV and measles vaccines) ranged from 61.47 SL Rs to 369.15 SL Rs (US$ 1.48 to US$ 8.89). However, this study was done nearly 25 years ago, hence cost comparison needs to be done with caution. Studies done in many other low- and middle-income countries have reported a wide range of costs for full immunization of a child, from the lowest of US$ 4.81 in Viet Nam,[6] to the highest of US$ 332.3 in Moldava.[7] Bangladesh has also reported a low average cost per fully vaccinated child, at US$ 6.91.[8] The costs of full immunization of a child reported for Cameroon (US$ 12.73)[9] and Peru (US$ 17.42)[10] are closer to the estimates of the present study. The cost of fully immunizing a child also varies within a region; for example, in Africa, the cost in Ghana has been estimated as US$ 60.30, which is almost five times higher than that for Cameroon.[9,11] Studies in Ghana and Moldova showed a cost for fully vaccinating a child in a middle-income country that was much higher than for many other middle-income countries.[7,11] However, these estimates should be compared with caution, as the cost can vary according to the number and type of vaccines in a country's EPI schedule, and also depends on the timing of the study performed, and its assumptions and methodology. The majority of these studies were focused on children in the first year of life; therefore, the

term "fully immunized child" refers to infants. However, since most vaccines are given in the first 12 months, the costs of fully immunized infants and fully immunized children at 5 years can validly be compared. Furthermore, the determinants of routine immunization costing vary by country. For example, the total number of doses administered in routine immunization was accounted as the main cost component in both Ghana and Benin.[12] In Ghana, the time spent on immunization, the cost for cold-chain items and staff costs were positively associated with total costs. In a pooled sample, facilities in capital cities had higher costs.[12]

In this study, the cost of vaccines overwhelmingly accounted for the highest proportion of the total cost (84.3%), at 1535.64 SL Rs (US$ 11.63) for full immunization of one child. Of this vaccine cost, the highest amount of 1095.00 SL Rs (US$ 8.29) was spent on three doses of pentavalent vaccine, followed by MMR vaccine, at 200 SL Rs (US$ 1.52) for two doses. This highlights that the newly introduced vaccines are costly and one of the main contributing factors for the increased cost of immunization in Sri Lanka. A study done in Ethiopia following introduction of pentavalent vaccine revealed that a cost estimation for the country of including this vaccine increased the total cost by US$ 2.5 million annually.[13]

Many studies have shown that a high proportion of immunization cost is contributed by the labour or salary components. In 1991, salary was the leading cost component in the Sri Lanka EPI (46%) and vaccines accounted for only 21.9% of total costs.[5] Similar findings were reported from Moldova (labour cost 65%, vaccines 9%),[7] Ghana (salary 61%, vaccines 17%),[11] Honduras (labour cost 54%, vaccines 23%)[14] and Uganda (salaries 38%, vaccines 7%).[15] In the present study, the findings were different; vaccines were the lead component, largely due to the cost of newer vaccines. The salary component accounted for the second highest proportion of total costs in the present study, but it was low at only 6.4%. Provision of an immunization service is one part of the responsibilities of public health service providers. Hence, their salary and time spent on EPI was hypothetically assumed. This may also partially explain the differences of EPI costings by components in the different studies.

In 2006, a WHO summary of the estimated costs of achieving the WHO-UNICEF Global Immunization Vision and Strategy, 2006–2015[16] noted :[17]

> The estimated total price tag for immunization activities in 2006–2015 in the 72 poorest countries is US$ 35 billion. One third of this amount will be spent on vaccines, rising from about US$ 350 million in 2005 to nearly US$ 1.5 billion per year by 2015, as vaccination coverage is expanded with underused vaccines, and new vaccines are introduced. Two thirds will be spent on immunization delivery systems, including shared costs for the strengthening of overall health systems, a key factor in increasing immunization coverage. US$ 2.2 billion will go towards immunization campaigns, such as those for measles, tetanus, yellow fever, and polio.

Direct capital and direct recurrent costs are the major components for estimating the cost of a programme to provide services.[18] The present study revealed that direct recurrent cost was the major contributor to the cost of the NIP programme in Kalutara district, at 93.4%. The capital cost for cold-chain equipment, buildings and vehicles was only 6.6%. Of note, the assumptions on depreciations in the values of both buildings and equipment were also based on the subjective opinions of respondents. Nevertheless, similar findings were reported in the study from a rural setting in northern Viet Nam, where the capital cost constituted 6.6% and recurrent cost made up 93.4% of the total immunization cost in 2005.[6] Out of the recurrent costs in Viet Nam, vaccines and supplies were the largest category (33% of the total), followed by staffing costs at 30.2%. In the United States of America, the 2009 birth cohort was analysed to estimate the direct and societal cost for infant immunization; the ratio for the two was reported to be 3.0:10.1.[19]

This study highlights the financial burden of the introduction of costly new vaccines into the country's NIP. Similar trends have also been observed in other countries. Since the incidence of vaccine-preventable disease is becoming low and less visible, there could be challenges in obtaining the necessary funds and logistics in the future, as many donors are interested in other competing priorities, such as noncommunicable disease, vector-borne disease and public health issues associated with climate change. All these competing priorities have created challenges to health authorities' planning and allocation of the limited financial resources available.

Despite the above-mentioned limitations, this study has highlighted the basic cost components of the NIP in a selected district in Sri Lanka. In the authors' opinion, a more robust nationwide study on immunization costing and financing of the NIP in the country is a timely need, and national immunization programmes in other low- and middle-income countries would also benefit from such studies.

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Policy opportunities and limitations of evidence-based planning for immunization: lessons learnt from a field trial in Bangladesh

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ABSTRACT

Despite success in scaling up immunization, the national immunization programme in Bangladesh remains challenged by persisting inequities in health access related to geographic location and social factors, including income and education status. In order to tackle these inequities in access, the national immunization programme has conducted a field trial of the evidence-based planning model in Bangladesh between 2011 and 2013, in 11 low-performing districts and 3 city corporations. The main elements of this intervention included bottleneck analysis in local areas, action planning and budgeting to correct the bottlenecks, and establishment of a monitoring system to track progress. Coverage improved in 8 out of 14 districts post intervention. The main success factors associated with the intervention included more analytic approaches to situation assessment and taking action on health inequities at the local level, as well as more considered use of local data to track immunization drop-outs. The main factors associated with coverage declines in trial areas (6 districts) included poor financial resourcing and supervisory support, and gaps and turnover in human resources. In order to sustain and improve coverage, it will be necessary in future to link pro-equity approaches to subdistrict planning to higher-level health-system-strengthening strategy and planning systems. This will ensure that local area planners have the required resources, comprehensive operational plans and political support to sustain implementation of corrective actions to address identified system bottlenecks and inequities in health access at the local level.

Key words: Bangladesh, bottleneck analysis, evidence-based planning, immunization

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BACKGROUND

Immunization in Bangladesh

Immunization has been recognized internationally as one of the development success stories of Bangladesh, and has been seen as being responsible, in part, for the sharp reduction in childhood mortality since 1990. The immunization programme was introduced in 1979, with vaccines to protect against six vaccine-preventable diseases. Since that time, the country has introduced a number of new vaccines and technologies, and achieved significant targets for disease elimination and eradication for tetanus and polio respectively. In the 24-year period between 1979 and 2003, coverage had increased to 72% for the triple diphtheria–tetanus–pertussis (DTP3) vaccination, after which Bangladesh entered a new vaccination era with the addition of four new antigens – hepatitis, *Haemophilus influenzae* type B, rubella and pneumococcal vaccines.[1]

Much of this success in immunization scale-up has derived from the development of an extensive primary health-care system in rural areas, networked by systems of district health services, with systematic and comprehensive approaches to health-outreach services within the catchment areas of upazila health complexes (with population catchments of 300 000, after which there are additional administrative subdivisions of unions and wards). Within each ward, there is a "sub-block" that has an Expanded Programme on Immunization (EPI)[2] outreach site, where routine EPI services are provided monthly for catchment populations of approximately 1000.[3] The

Government of Bangladesh, in collaboration with development partners, is currently further extending systems of community clinics in rural areas and satellite clinics in urban areas, in order to enhance the population accessibility of primary care services.[4]

Gaps in immunization in Bangladesh

Despite this public health success story, concerns have been identified in recent coverage surveys regarding pockets of low immunization coverage, particularly for disadvantaged subpopulation groups.[5] Urban migrant populations are one concern. A total of 33% of the population of Bangladesh now resides in urban locations, and numbers are expected to grow from the current level of 53 million people to 79.5 million in 2028.[6] The lack of an urban health infrastructure is a major concern in reaching urban migrant populations, with nongovernmental organizations, hospitals and the private sector working with the public sector to cover the population for immunization and related public health services.

This concern is reflected in recent results of coverage surveys and research, which demonstrate that there was a 7.6% drop-out rate for immunization services, with the most common reasons stated by respondents as lack of awareness of the importance of vaccination, distance of the service from home, migration, and lack of information about services.[5] Earlier coverage studies in Dhaka demonstrated that there was a drop-out rate of 36% for bacille Calmette–Guérin (BCG)–measles vaccination in Dhaka's Zone 8, which was attributed by the researchers to parents' lack of knowledge about the vaccination schedule, fear of side-effects, and health workers' reluctance to vaccinate during illness.[7] An additional immunization challenge is the high rate of administration of invalid doses of vaccines (incidence of invalid doses 4.2% nationally and 11% in Dhaka),[5] illustrating both health-worker and community lack of knowledge of immunization schedules. There is also a significant gap in the supply of health workers at vaccination sites, with the most recent multi-year plan for immunization indicating that there were about 6000–7000 vacant health assistant (vaccinator) posts in 64 districts across the country, accounting for 10–12% of all posts.[3]

Despite the strong rural health-care system in Bangladesh and maintenance of high coverage rates, coverage surveys also indicate pockets of low coverage. One study in 128 remote villages in 2011 established that a household's relative poverty status, as reflected by wealth quintiles, was a major determinant in health-seeking behaviour.[8] Mothers in the highest wealth quintile were significantly more likely to use modern trained providers for antenatal care, birth attendance, postnatal care and child health care than those in the poorest quintile, which is linked to socioeconomic disadvantage. Another study in 2010, of access to immunization in rural Bangladesh, found that a full vaccination rate was strongly correlated with a higher wealth index, living a short distance from a health facility, lower parity, mothers' age being of 20–34 years, higher education level of mothers, and child male sex.[9] Multivariate analysis of determinants of utilization in one recent study found that the child of a woman with no education was almost 80% less likely to be fully immunized than a child of a woman with secondary education. Children in the poorest economic quintile are less than half as likely to be fully immunized as children in the wealthiest quintile.[10]

In terms of geographic access, the country's strategic plan for immunization noted that 13 out of 64 (20%) districts have DTP3 coverage below 80%.[3] Finally, the most recent demographic and health survey findings indicate that, although coverage remains high at the national level, more in-depth analysis of immunization coverage according to social variables, including socioeconomic status, education level and sex, suggest some trends in coverage linked to social disadvantage.[4] These demographic and health survey data illustrate a gap of 20.8% between the highest (97.2%) and lowest (76.4%) education levels, and a gap of 9.2% between the highest (86.0%) and lowest wealth quintiles (76.8%) for the percentage of children who are fully immunized.[4]

These studies and surveys therefore point towards a complex set of supply-side and demand-side determinants of access to vaccination services in specific local urban and rural areas, in what is a rapidly changing social and economic context.

National and global initiatives for improving coverage using micro-planning

The development objective of the Government of Bangladesh is to "improve access to and utilization of essential health, population and nutrition services, particularly by the poor".[11] Particular challenges noted by the national health programme for 2011–2016 that were of significance to the immunization programme included high rates of neonatal death, limited effectiveness of urban primary health-care service delivery, the requirement for more gender-sensitive and equity-based service-delivery models, inadequacies in human resources, weak legal frameworks, and low utilization of public health facilities by the poor.[3] Strategies implemented to date in Bangladesh include the "Reaching Every District" strategy,[12] which involves implementation of a mix of strategies, including supportive supervision, mapping of lower-performing districts and areas, and preparation of micro-plans to reach every women and child.[3] Interventions in urban areas have also focused on such micro-level strategies, such as extending the hours of community clinics in local areas, training of vaccinators, screening for drop-out, and establishment of community volunteer groups.[13] Such interventions have demonstrated success nationally and internationally, with implementation of "Reaching Every District" strategies in Asia[14] and Africa[12,15] demonstrating the potential to raise coverage of DTP3 vaccination for disadvantaged groups within a reasonable time frame.

Evidence-based planning is a complementary strategy to "Reaching Every District". Whereas the "Reaching Every District" strategy focuses principally on the use of data to analyse the status of the immunization programme and modify activity plans as necessary,[12] evidence-based planning takes a

more in-depth analytic approach to analysis of coverage across five domains of availability, accessibility, utilization and adequate and effective coverage (see next section on analytic frameworks).

The persistence of immunization inequities in Bangladesh, and the complex range of demand-side and supply-side determinants driving these inequities, has resulted in a renewed effort by immunization managers and development partners to tackle the bottlenecks to immunization performance in local settings. This paper describes the concept, process and impact of evidence-based planning, and outlines and analyses its implementation in the Bangladeshi context. It then considers the policy opportunities and limitations of the approach for application in both national and international settings.

Analytic frameworks and the evidence-based planning intervention

In 1978, Tanahashi proposed a model to both measure health-service coverage and identify bottlenecks in implementation.[16] The Tanahashi model categorizes coverage into five domains of availability, accessibility, utilization and adequate and effective coverage.[17] Effective coverage is defined as the end result that provides the desired public health impact (which in the case of immunization is the "fully immunized child"). In reaching coverage, the model identifies two demand-side and three supply-side determinants of coverage (in addition to quality, which covers both sides). The determinants are physical access, first use, continuous use, supplies, human resources, and quality.[17]

Using these coverage concepts, the method uses a selected set of interventions (of which one is immunization coverage) to identify the main bottlenecks to health-system performance, and, on the basis of this analysis, designs the strategies, specifies the indicators and identifies the costs required to achieve effective coverage. A "traffic light system" then monitors implementation, by identifying the extent to which the proposed interventions have been implemented to reduce bottlenecks. The process is conducted according to the steps listed next.

1. The first step in the process is developing a "coverage-deficit chart" according to each determinant of coverage.
2. The second step involves entering data, validating them, and creating a bar chart named the "coverage-deficit chart". This enables a forum for the planning team to discuss health-system issues by focusing on specific determinants of low coverage.
3. The third step is an identification of programme bottlenecks through interactive in-depth discussion by each subdistrict.
4. The fourth step is development of a "bottleneck action plan" (including budget) and monitoring system.

Together, these steps constitute the "evidence-based planning" approach, the methods of which are outlined in more detail in the analytic frameworks and findings sections of this paper.[16]

APPROACH

Sources of information

A case-study approach utilizing both qualitative and quantitative methods has been used to build a up a picture of the effectiveness of the evidence-based planning approach in improving analysis of the immunization situation in selected local areas. Implementation of the initiative commenced in 11 districts and 3 city corporations in 2011. A smaller sample of 20 upazilas (at least one from each district) and a zone in each city corporation were included in the assessment (including Barisal City Corporation and two city corporations in Dhaka City). There was a total target population of 831 170 children aged less than 1 year in the 11 districts and 3 city corporations. Each of these sample upazilas was visited at least once between October 2013 and April 2014, in order to collect and analyse data for this assessment.

In-depth interviews were undertaken in 2013 and 2014 with district and upazila managers and concerned personnel involved in the micro-planning trial. These interviews were carried out by United Nations Children's Fund (UNICEF) zonal officers and a supporting UNICEF consultant with relevant health staff, including the civil surgeon, the upazila health staff and family planning officer, the district EPI superintendent, the officer in charge of immunization and the vaccinators (health assistants). These participants represented the planning group. In city corporations, the planning group also included NGO managers, supervisors and medical officers. The individuals interviewed ($n=58$) represented approximately 22% of planning participants across the 11 districts and 3 city corporations. No structured interview format was utilized.

Consultation meetings ($n=4$) were undertaken to document the barriers to improved vaccination coverage through removing bottlenecks and implementing corrective actions (as described in the previous section), with the same participants described above. These consultation meetings were undertaken after micro-planning meetings with district and upazila health officials of Rangpur, Jhalokati, Barisal City Corporation and Bagerhat districts. Analysis of the coverage-deficit chart and causes of low performance were discussed in the consultation meeting. Observations were made during participation in the micro-planning meeting, as well as through verification of documents related to corrective action and its implementation. Records were kept for bottleneck analysis and the coverage-deficit chart. Observations were carried out while collecting and validating documents, as well as participating in micro-planning meetings. A checklist, notebook and audiorecorder were used to record information, with proper approval from the authority concerned. Immunization data included data from the bottleneck-analysis exercise (as described above), coverage-survey data, and the information provided by planners through the corrective-action exercise.

A review of literature listed in PubMed was conducted in January 2015, using the search term "bottleneck analysis" in the title and abstract fields. The search was not limited by date.

Sixteen articles were retrieved but none was relevant to subnational planning in low- or middle-income country settings. A repeat of the search using the term "evidence-based planning" retrieved 46 articles, of which only six were assessed to be of some relevance to this field trial; most of these are cited in this paper (see Discussion). The literature review was conducted after the trial, in order to compare and contrast the results with findings from similar settings in other countries.

Data analysis

For qualitative data, after entering field notes from interviews, consultations and observations, the main themes were organized into coherent categories in the form of problems and barriers to immunization that prevent improvement in immunization coverage and management performance. These categories are discussed in the section "Process findings". The main approach to analysis is described in relation to the methods of bottleneck analysis, including the method for the coverage-deficit chart described in the previous section, and the analytic framework.

Ethical considerations

As this operational assessment was undertaken as part of an internal evaluation of an existing programme initiative, no specific consent was sought from an institutional ethics body. Prior approval from the EPI headquarters at the Ministry of Health and Family Welfare was sought before starting data collection, and verbal consent was received from the respondents prior to conducting interviews.

OUTCOMES

Process findings

The process findings are described next, according to the three main areas of coverage-deficit charting, bottleneck analysis and monitoring systems. In all cases, the processes were performed by members of the immunization micro-planning group for each upazila (20 in rural areas) or zone (3 in urban areas).

Coverage-deficit charting

Before undertaking the assessment of the coverage-deficit chart (the first step in the bottleneck-analysis approach), participants were requested to reach consensus on the definition of the determinants of coverage in the context of immunization services. This is described in Box 1.

Following this step, participants were requested to identify or formulate measurable indicators with the administrative data of their catchment area and then reach consensus on the coverage data. The planning groups then created the coverage-deficit chart. The bar chart denotes the coverage according to coverage type (see Fig. 1). The planning group could then concentrate on each specific low-coverage determinant and start bottleneck analysis through active discussion (see following section).

Almost all of the upazila health officers, family planning officers and EPI staff were found to be aware of the coverage-deficit charts, which were displayed at the facilities. All of

Box 1. Definitions of coverage determinants in the context of immunization services

Availability coverage

Availability of essential commodities and human resources: assess the availability of critical health-system inputs such as drugs, vaccines and supplies

Accessibility coverage

Assess beneficiaries' geographic access to health services, including the number of villages regularly served by outreach services (for population-oriented outreach services) and the time taken or distances to reach a facility

Utilization coverage

Assess the first use of multi-contact health services, for example, the first in a series of childhood vaccinations

Adequate coverage

Timely continuous utilization: assess utilization with respect to the number of recommended contacts for care; for example, the percentage of children fully immunized (estimated by coverage of three-dose series of pentavalent [diphtheria, tetanus, pertussis, *Haemophilus influenzae* type B, hepatitis B] vaccine)

Effective coverage

Assess the percentage of children who have received all the doses of all antigens within 1 year following the exact time and interval specified in the immunization schedule (referred to as valid coverage)

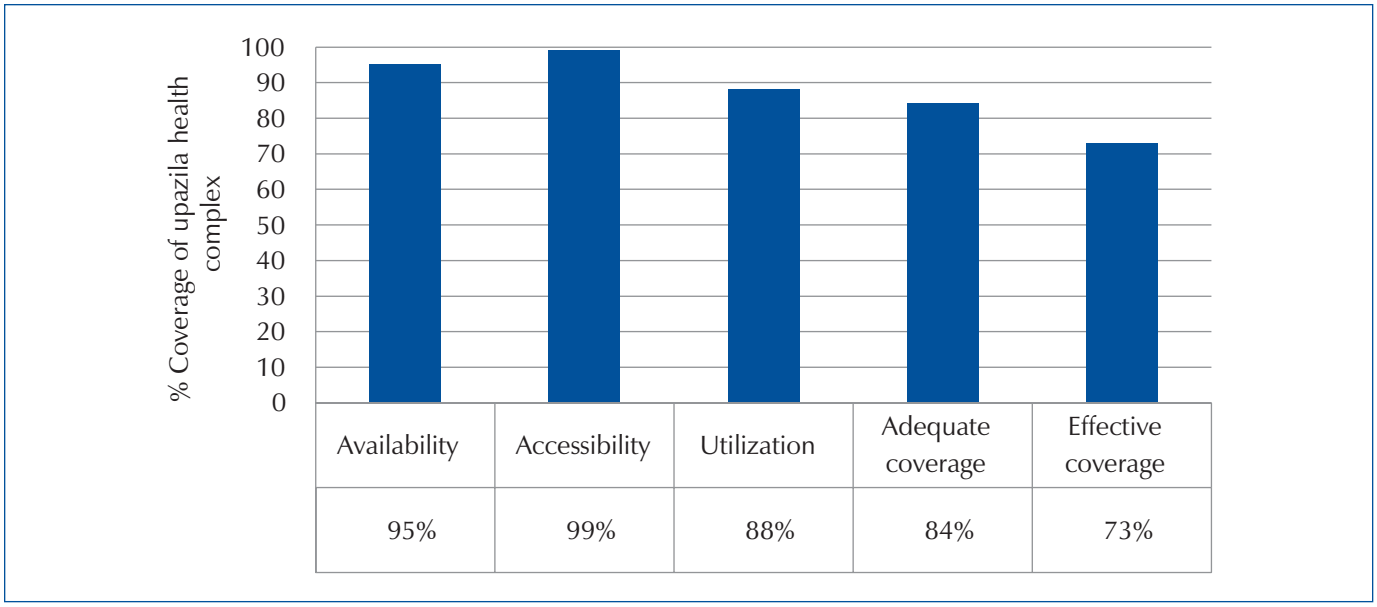

Fig. 1. Example of a coverage-deficit chart, Bangladesh evidence-based planning

Source: Micro-planning meeting, Bangladesh evidence-based planning, 2012.

the upazilas were found to have the required information for creating the coverage-deficit chart, such as the target population, situation of existing manpower and other logistics, a list of hard-to-reach areas, and the achievements of the previous year.

Bottleneck analysis

The planning participants analysed the coverage-deficit chart across the four domains (or determinants of coverage) of enabling environment (social norms, legislation, policy, budget, management), supply (availability of essential inputs, access to adequately staffed services, facilities and information), demand (financial access, cultural practices and beliefs, continuity of use) and quality (adherence to quality standards). In this way, bottlenecks to performance could be related to both the *determinants of coverage* (enabling environment and supply, demand and quality factors) and the *types of coverage* (availability, accessibility, utilization, and adequate and effective coverage).

Table 1 provides an example of how participants in one case cross-referenced analysis of determinants of coverage with analyses of types of coverage (and coverage gaps) from the coverage-deficit chart.

Through group discussion, participants identified bottlenecks as supply-side or demand-side, or as related to the enabling environment. These were then critically analysed to assess the differences in coverage patterns across the coverage-deficit chart. In the process of undertaking this analysis, participants were able to graphically visualize the difference between availability and accessibility, accessibility and utilization, utilization and adequate coverage, and adequate and effective coverage. This helped them focus on the differences and accurately identify causes and the major bottlenecks obstructing higher immunization coverage. On the basis of this analysis, participants then were able to develop a plan to address bottlenecks, using a planning table to enter data into fields labelled as "bottlenecks", "corrective actions", "monitoring", "means of verification", "frequency timeframe" and "budget required". This was referred to as a "bottleneck-analysis action plan", which commenced implementation in 2011.

Monitoring systems

As part of the evidence-based planning system, participants were guided by facilitators to develop a "monitoring results for equity systems" (Mores) table, which indicated the status for implementation of the bottleneck-analysis action plan. The Mores table refers to the use of "traffic light" symbols to indicate the level of implementation of corrective action. The red zone denotes no action done; yellow that action is in progress and green that action is completed or about to be completed.

Results of evidence-based planning

The impacts of evidence-based planning are outlined next, in terms of impacts on coverage and the status of actions to reduce barriers to performance.

Impacts on coverage

Fig. 2 provides data on effective coverage (proportion of fully immunized children) for 14 districts before and after the

Table 1. Analysis of bottlenecks, evidence-based planning Bangladesh

Difference between coverage types	Analysis by determinants of coverage	Analysis of bottlenecks
Accessibility coverage and utilization coverage: 11.0%	Supply: access to adequate human resources	Lack of human resources: in 2011, out of six sanctioned health assistant posts, the union had three staff working. The situation improved when a fourth person was recruited. However, human resources are still a major impediment to carrying out vaccination in a timely manner and two additional members of staff could contribute to increasing the rate of immunization.
	Supply: access to adequate service and information	Access is a problem during the rainy season in July to August. During the non-rainy season, 10% of the mothers had to walk for 40 min or more to the immunization sites, whereas in the rainy season, mothers do not feel comfortable bringing their children during rain and walking longer distances.
	Demand: continuous coverage	Demand is low. As a baby gets older, his or her mother will get involved in day labour, which might be far away from her house and so, owing to business, she does not bring her child for vaccination. Caregivers, often grandparents, are frequently ignorant of the importance of timely child vaccination.
Adequate coverage and effective coverage: 10.6%	Enabling environment (management) and coordination	There is irregular monitoring and poor quality of supportive supervision by first- and second-line supervisors for the work of health assistants and female health welfare assistants.
	Supply: access to adequate service and information	Children travelling with parents are missing their scheduled doses of vaccines.
	Demand: social and cultural practices and beliefs	Among some parents, there is poor knowledge, or complete absence of knowledge, related to the importance of fully immunizing children.
	Quality	Existing EPI administrative data at all levels (union, upazila, district and national) do not provide information for EPI managers on the number of fully vaccinated children.

EPI: Extended Programme on Immunization.[2]

Source: Micro-planning meeting, Bangladesh evidence-based planning, 2014.

evidence-based planning intervention. The figure demonstrates that mixed results were achieved. Of the 14 districts, 8 showed improvement in coverage and 6 districts declined. In 6 of the 8 improving districts, the coverage improvements ranged from 4% to 13%. Of the 6 districts that declined, the decline was in the range 1–4%.

Barriers to performance and performance success factors

During consultations, the main reasons for the districts having a lower than expected national coverage was identified by planning participants. The reasons were a mix of technical and managerial factors. In terms of technical factors, common presenting problems included administration of invalid doses, lack of registration of pregnant mothers, incomplete registration books, lack of birth registration, inadequate emphasis on communication with parents, and poor reporting.

In addition to these technical barriers to performance, the findings from micro-planning meetings also indicate that there were major unresolved managerial and resourcing barriers to performance. Participants in planning sessions identified lack of quantity and quality of supervision as a major gap. Delayed or irregular supervision, as well as poor communication with communities on the timing of immunization sessions, was reported by health staff to contribute to lack of logistical support for immunization sessions.

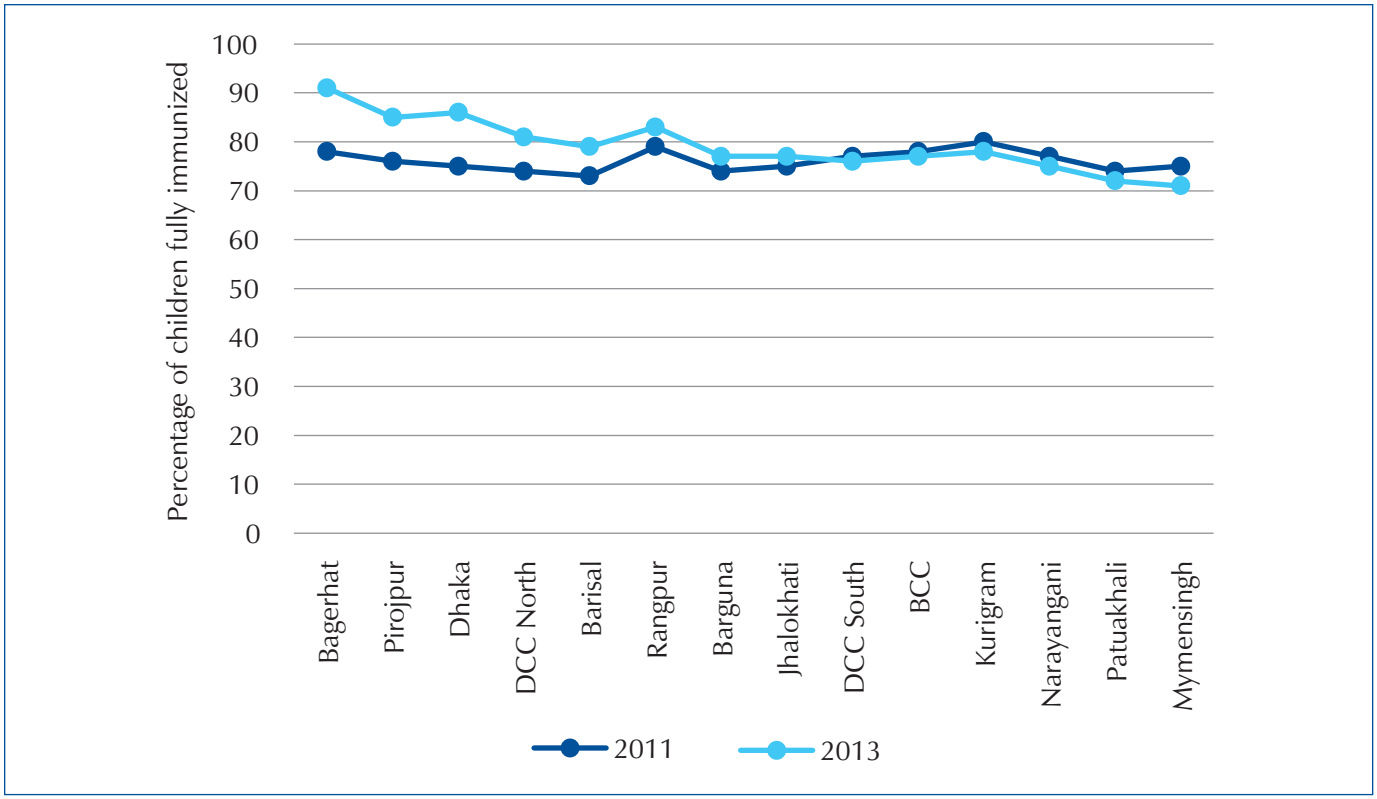

Fig. 2. Effective coverage (fully immunized children) before and after the evidence-based planning intervention in Bangladesh

BCC: Barisal City Corporation; DCC North: Dhaka North City Corporation; DCC South: Dhaka South City Corporation.
Source: administrative data, Ministry of Health and Family Welfare, 2013.

Other managerial and resource constraints included lack of basic immunization supplies, under-financing of basic health-services operations, uncertainty of funding and high turnover and shortages of staff. In some cases, rapid turnover of staff, in conjunction with lack of investment in orientation programmes for new staff, meant that the practices of evidence-based planning could not be sustained. Owing to the constraints of these enabling determinants of coverage, fewer EPI sites were located in some instances, which may have impacted on accessibility coverage. In some cases, the decline in coverage was attributed to lack of implementation of the bottleneck corrective action plan, or lack of supervision. In one district where coverage dropped from 93% to 86%, implementation funds were not received in the previous year.

There were also some management and service-delivery practices that were associated with positive coverage outcomes. This was particularly the case in upazilas that implemented active searching for unimmunized individuals. In one upazila, staff identified drop-out cases and invalid doses through sample survey, as well as during household visits. This practice enabled them to take corrective actions accordingly. Similarly, Dhaka City Corporation North and South were found to keep records of mobile numbers in order to ensure follow-up of drop-out cases. The main success factor, however, was the ability of the planners, through the evidence-based planning approach, to identify bottlenecks and plan corrective actions. The other advantage of the evidence-based planning approach that was observed was the increased analytic capacity of planners to distinguish types of coverage, and the significance of this for planning actions.

DISCUSSION

Summary of main findings

This field trial in evidence-based planning has demonstrated that district and subdistrict planners have the capacity to conceptualize the enabling, supply-side and demand-side determinants of coverage. They have also been able to conceptualize these determinants in terms of types of coverage, and then apply this to action planning and monitoring. This evaluation has also confirmed that monitoring activities were carried out to specify the gaps in system performance, as well as to implement and monitor the status of corrective actions. It was found that in almost all upazilas studied, immunization and health staff were aware of the evidence-based planning approach. It was found that almost all the monitored upazilas adopted corrective action plans to address each bottleneck.

As well as providing evidence of the capacity of district and subdistrict (i.e. upazila) planners for development, implementation and monitoring of the evidence-based planning approach, there is also some indication that the intervention (see Fig. 2) had some impact on coverage, with 8 out of 14 low-performing districts demonstrating improvements to effective coverage (fully immunized children) post intervention. Key elements in the success of the intervention have been the bottleneck-analysis approach itself, which has enhanced the capacity of planners to analyse the immunization situation, as well as to develop and monitor action plans to reduce inequities in coverage. The other main success factor identified in the intervention was the enhanced capacity of planners to undertake active search and follow-up of immunization drop-out cases.

Nevertheless, the fact that six districts declined in coverage post intervention, with others receiving only modest gains, suggests that the intervention itself, in the absence of broader system-strengthening initiatives, is likely to have limited impact. This is borne out by the fact that weak supervision, high turnover in human resources, and lack of basic investments in health-system material and financial resources in some districts, all point to limited impact of a subdistrict planning initiative in the absence of higher-level managerial, policy and system-strengthening strategy.

The strategy is also limited in terms of the difficulty of validating coverage, owing to over-reliance on administrative coverage reporting to assess impacts. Although successive surveys of data on coverage in Bangladesh have demonstrated reasonable quality of data, it is also expected that, owing to reporting difficulties and high levels of inward and outward migration from urban areas, it is likely that planners will be confronted by issues of data quality in these lower-performing districts. This assessment of the evidence-based planning methodology was also limited by the fact that other health-system-strengthening initiatives and investments (including maternal, neonatal and child health programme planning) were concurrently taking place in the field-trial districts, making it difficult to attribute coverage improvements solely to the intervention under study.

Policy and strategy implications

In more recent studies, there is now an increasing focus on subdistrict inequities through a "reaching every community" approach, which lends itself very well to the evidence-based planning approach (using bottleneck analysis).[18,19] By addressing those determinants of coverage affecting the last 20% of children that are not vaccinated, then the strategy can go some way to addressing the so-called "inverse inequity hypothesis", whereby progress in immunization can often benefit the least vulnerable and least hard-to-reach children first.[20] This planning method, by firstly increasing the conceptual and analytic capability of planners to specify the determinants and types of coverage, and secondly focusing on the main constraints to lower coverage, has demonstrated the potential to support such reduction in inequity.

However, there are important policy and strategy implications from this field trial for pro-equity health planning in Bangladesh and elsewhere. In fact, the findings from this field trial are reflected in other recent international studies on evidence-based planning. In one recent evaluation of evidence-based planning in Philippines, although the evaluators found that the approach improved the use of local information to analyse the situation, they concluded that evidence is only one factor influencing investments in health. Other critical factors included political commitment in the local area to decentralization and the requirement for a "parallel process at a higher level of government" to resolve issues of financing and sector coordination. In the absence of such higher-level system interventions, it was considered by the evaluators that the evidence-based planning approach would have limited impact on service delivery.[21] Similarly, an investment case for scale-up of family planning in Asia, using an evidence-based planning approach, found that, although the approach is helpful in developing strategies that are contextualized to the local area, implementation can be affected by system bottlenecks upstream, including limitations in human-resource numbers, religious and cultural ideologies and legislation.[22] Similarly, two comprehensive literature reviews conducted to investigate why children are not reached by immunization services concluded that the main factors were a complex interplay of supply and access to services, parental knowledge and attitudes, and family attitudes and characteristics, leading analysts to conclude that "alternative approaches should be investigated beyond the immunisation programme within the broader health system".[23]

These findings, and related international findings, are therefore consistent in pointing towards a clearer future for evidence-based planning systems. Firstly, as a subdistrict analytic planning and monitoring tool, the capacity to sustain planning actions to reduce inequities (through reaching every community) will depend on the analysis and contextualization of local area strategies, as well as equitable investments in higher-level enabling and supply-side factors. This assumes a health-system-strengthening approach. In practical terms, evidence-based planning systems, and the related bottleneck-analysis approach, will need to be carefully linked to annual operational planning and budgeting systems that have the capacity to draw down budgets and allocate the required material and financial resources. Marginal budgeting in this way can be linked to overall sector budgeting, to ensure that the bottleneck-analysis approach links to overall sector planning and financing strategies, and hence can become less dependent on project financing in order to sustain pro-equity planning interventions.

Conclusion

This study concludes that evidence-based planning has the potential to improve coverage and reduce inequities through a more analytic and pro-equity approach to district and subdistrict health planning. In this field trial in Bangladesh, the system of evidence-based planning has been installed and implemented in all trial areas, with coverage improvement demonstrated in 8

out of 14 low-performing districts. The trial has demonstrated the potential to implement more analytic methods of health planning, and improve coverage when linked to system-strengthening investments and more careful use of local-area data for tracking of immunization drop-out cases. Despite these successes, more moderate coverage improvements and coverage declines in other districts highlight the limitations of the evidence-based planning method as an analytic tool rather than a system-strengthening strategy. In order to sustain and improve on coverage gains, it will be necessary in future to link such subdistrict analytic approaches to strategy and planning for higher-level health-system strengthening, in order that local area planners have the required resources, comprehensive operational plans and political support to take corrective actions on system bottlenecks and inequities in health access.

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Opportunities in oral health policy for Timor-Leste

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ABSTRACT

Timor-Leste faces an urgent set of challenges in oral health. The impact of oral diseases in terms of reduced quality of life and cost of treatment is considerable. This paper reviews progress on policy recommendations since the National Oral Health Survey in 2002, the first such national survey. Few proposals have been implemented to date, owing to (i) lack of local support for the recommendations, particularly on promotion of oral health; (ii) lack of financial and budgetary provisions for oral health; (iii) lack of focus on services, human resources and dental personnel; (iv) poor focus, design and implementation of policy and planning in oral health; and (v) lack of transport to facilitate health-care workers' access to remote areas. Based on this assessment, the present paper presents a reconfigured set of policies and recommendations for oral health that take into consideration the reasons for low uptake of previous guidance. Key priorities are promotion of oral health, legislative interventions, education of the oral-health workforce, dental outreach programmes, targeted dental treatment, dental infrastructure programmes, and research and evaluation. Interventions include promotion of oral health for schoolchildren, salt fluoridation, fluoride toothpaste and banning sweet stalls and use of tobacco and betel nut in, or near, schools. Timor-Leste should strengthen the availability and quality of outreach programmes for oral health. Dental therapists and dental nurses who can supply preventive and atraumatic restorative dental care should continue to be trained, and the planned dentistry school should be established. Ongoing research and evaluation is needed to ensure that the approach being used in Timor-Leste is leading to improved outcomes in oral health.

Key words: dental, developing economies, oral health, policy, prevention, Timor-Leste

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BACKGROUND

Oral health is an important component of general health and quality of life.[1] The fledgling nation of Timor-Leste faces an urgent set of challenges in oral health. Periodontal disease and oral cancer are associated with entrenched habits of smoking tobacco and chewing betel nut. There is also a heightened risk of dental caries associated with shifting dietary habits, limited fluoride exposure and inadequate provision of preventive dental treatment.[2]

By the time of independence in 1999, the administration in Timor-Leste had collapsed: over one third (35%) of all health facilities and 80% of schools were destroyed, the remaining infrastructure was severely damaged and there had been an exodus of doctors, dental professionals and skilled health-management staff.[3,4] This, coupled with a projected threefold increase in the population between 2005 and 2050,[5] gave an indication of the problems in health-service delivery faced by the new Government of Timor-Leste.

To obtain the profile of oral-health status of the people and to aid the subsequent development of a National Oral Health Strategy, the Australian Agency for International Development (AusAID) funded the National Oral Health Survey in 2002, the first such survey undertaken in Timor-Leste.[2] The study identified that the vast majority (>85%) of children and adults had never made a dental visit.[2] Fewer than half the adults who reported having done so had visited a dentist or dental nurse, with the remainder visiting traditional healers.[2] The burden of

dental caries was found to be low to moderate, probably linked to a subsistence farming diet, but the disease was usually untreated or treated by extractions.[2] The prevalence of smoking among male adults was above 70%, and more than one third (38.3%) of adults of both sexes chewed betel nut.[2]

The United Nations Transitional Administration ended when Timor-Leste became an independent nation on 20 May 2002.[3] At the end of 2002, there were two dentists and 39 dental nurses working in the country. By 2013, there were seven dentists and 40 dental nurses, with one dental nurse per 27 018 people.[6] As of 2016, there were 10 public- and private-sector dentists in Timor-Leste. The present paper reviews the policy and practice relevant to oral health in Timor-Leste from 2002 to the present, and proposes ways forward.

PREVIOUS POLICY RECOMMENDATIONS FOR ORAL HEALTH RELATED TO TIMOR-LESTE

National Oral Health Survey, Timor Leste, 2002

Recommendations on oral-health policy (see Box 1) from the 2002 National Oral Health Survey included the integration of oral-health promotion with general health promotion, and monitoring of the oral health of infants and children younger than school age, as a component of general health check-ups.[2] It recommended that non-acidic and low-sugar fluids should be promoted for consumption by young children, and for infants, bottle removal was encouraged after feeding. At the general population level, salt fluoridation and access to affordable toothbrushes and fluoride toothpaste was encouraged. The integration of traditional methods of tooth cleaning with fluoride toothpaste was further suggested. It was also recommended that a campaign for promotion of oral health should be delivered through schools, warning of the dangers of smoking tobacco and chewing betel nut, articulating the benefits of fluoride, and encouraging tooth brushing and the use of fluoride toothpaste. It was recommended that a programme for screening and fissure sealing could provide preventive dental care for older children and that personal dental care should be provided as both urgent oral treatment and atraumatic restorative treatment, while routine dental treatment should be integrated with the primary health service.[2]

Timor-Leste *National Oral Health Strategy*, 2004

The *National Oral Health Strategy*[7] was released in 2004 by the Ministry of Health (MoH) and largely accepted the oral-health policy recommendations of the National Oral Health Survey (see Box 1). It recommended salt fluoridation, affordable fluoride toothpaste, a school dental service and integration of oral health into general health promotion, and focused on preschool children, pregnant women and mothers of young children, schoolchildren and people who smoke or chew betel quid.

Box 1. Existing policy recommendations for improved oral health in Timor Leste

Australia–East Timor National Oral Health Survey, 2002[2]

Population oral health integrated with general health promotion

- Smoking cessation
- Betel-quid chewing
- Child dental caries:
  - Integrate oral health for infants and preschool children into general health measures
  - Promote non-acidic, non-sugary fluids and removal of bottle after feeding

Specific population oral-health promotion

- Salt fluoridation
- Affordable toothbrushes and toothpaste
- Continuation of traditional tooth-cleaning methods, but with fluoridated toothpaste
- School oral-health promotion campaign:
  - Anti-smoking
  - Anti-betel-quid chewing
  - Importance of fluoride
  - Use of toothbrushes and toothpaste
  - Screening and fissure-sealant programme

Provision of personal dental treatment

- Urgent oral treatment
- Atraumatic restorative treatment
- Routine dental care as part of personal dental treatment with a primary health-care service

Timor-Leste National Oral Health Strategy, 2004[8]

National oral-health protection, promotion and prevention programme

- Salt fluoridation
- Affordable fluoridated toothpaste
- School dental service

Oral health integrated with general health promotion

- Preschool children
- Pregnant women and mothers of young children
- Schoolchildren
- People who smoke or chew betel nut

Support for service delivery

- Appropriate and affordable oral-health service
- Improve coverage and quality of oral-health services

Personal dental care

- Blend between promotive and curative interventions
- Strengthening of the referral system

Research directions

- Use of processed and other salt quantities consumed
- Oral mucosal changes related to chewing betel quid and smoking tobacco

Human-resource development

- Multiskilling the workforce

Institutional approach

- Integration of all community services with planning undertaken at the district level

Strategic alliances

- External assistance
- Contracting out
- Private sector

Monitoring and evaluation

- Monthly reports from health facilities to guide district operational planning

***National Health Sector Strategic Plan 2011–2030*[10]**

Objective

- To improve the oral health of the Timorese people by establishing an appropriate and affordable oral-health service that is accessible to all

Strategies

- To ensure access to appropriate oral-health services by the whole population at all facility levels
- To reorient clinical service delivery from a curative model of care to a blend of promotive, preventive and curative interventions
- To promote community awareness and participation in priority target groups who are at risk of critical oral conditions

Formulating oral health strategy for South-East Asia, 2008

A report from the World Health Organization (WHO) South-East Asia Region recommended that WHO Member States should undertake a situational analysis, reflect oral health in their national health policies, have promotion and prevention plans for oral health, integrate oral health into other health programmes, adopt a multidisciplinary approach, strengthen the oral-health workforce and establish surveillance of oral health and regular monitoring of oral-health programmes.[8]

World Health Organization framework for oral health, 2010

The WHO framework for oral health, *Equity, social determinants and public health programmes*, published in 2010, gave an overview of international policy on oral health (see Box 2) and examined social determinants, entry points and interventions to address inequalities in oral health.[9] The framework recommended that policies aiming to influence oral health should take into account the socioeconomic context and position, with the associated differential exposure and vulnerability to risk of oral disease, and differential health-care outcomes and consequences.[9]

National Health Sector Strategic Plan 2011–2030, 2011

The *National Health Sector Strategic Plan 2011–2030* noted that oral health was a priority within a range of essential health interventions, and that the most common problem was dental caries, but that the treatment of the dental problems was "far beyond the capacity of the existing health workforce and the budget of the MoH".[10] It recommended ensuring access of the whole population to appropriate oral-health services, reorientation of clinical service delivery from a curative model of care to a blend of promotive, preventive and curative interventions, and promotion of community awareness and participation in priority target groups (see Box 1). Key indicators were: increased scholarships for oral health professionals, 75% of health centres implementing oral-health programmes, baseline data on periodontal diseases and oral cancer, and at least 35% of schools participating in oral-health promotion and education.

THE CURRENT SITUATION

In 2014, a follow-up oral survey of schoolchildren in Dili was done; comparative analysis of the 2002 and 2014 survey data for Dili schoolchildren identified that a marginally lower proportion of children in Dili reported brushing their teeth the previous day than did the Dili children in 2002, and twice as many (20% versus 40%) reported experiencing toothache in the previous 12 months (authors' observations). The experience and severity of dental caries, as measured by the mean number of decayed, missing and filled teeth, were greater in 2014 than in the earlier survey. Conversely, there was a lower prevalence and extent of gingival bleeding and calculus, and a greater proportion of children reported having seen a dentist in the preceding 12 months in the 2014 survey compared with the one in 2002. This indicated that access to treatment may have improved for children in Dili, but this inference cannot be generalized across Timor-Leste.

In a consultation exercise with stakeholders in oral-health policy in Timor-Leste, all noted that few recommendations from the National Oral Health Survey in 2002 had been introduced.[2] Little action had occurred in the area of integration of population oral health within general health promotion. Specific policies not introduced were salt fluoridation, affordable toothbrushes and toothpaste, and continuation of traditional tooth-cleaning methods with fluoridated toothpaste, and, while a school oral-health campaign was initiated, implementation was irregular, owing to funding limitations. Although personal dental treatment did supply urgent oral treatment, it did not provide preventive care, atraumatic restorative treatment, or routine dental care as part of personal dental treatment within a primary health-care service.

The consultation highlighted five common themes on what had hindered implementation of the recommendations. These encompassed: (i) lack of local support for the recommendations, particularly on promotion of oral health; (ii) lack of financial and budgetary provisions for oral health; (iii) lack of focus on services, human resources and dental personnel; (iv) poor focus, design and implementation of policy and planning in oral health; and (v) lack of transport to facilitate health-care workers' access to remote areas. Poverty posed a major challenge, alongside the pressure of competing priorities such as trade policies that are insensitive to public health (tobacco), a lack of information (disease burdens and economic impact), lack of awareness (limited health literacy), lack of advocacy, and a lack of resources (limited availability, affordability and access).

Box 2. Recommendations from the World Health Organization framework for oral health[10]

Socioeconomic context and position

- Legislate local production of quality, affordable oral-health products
- Remove taxes on oral-health products
- Place oral health within the primary health-care approach
- Fair and equitable policies
- Develop infrastructure for oral-health services and population-based interventions

Differential exposure to risk of oral disease

- Regulation on tobacco
- Better labelling
- Address excess use of alcohol
- Restrict advertising of unhealthy food
- Promote the use of mouthguards and safety helmets
- Encourage interventions that adopt a common risk-factor approach
- Support healthy physical and psychosocial environments
- Encourage optimal exposure to fluorides
- Promote oral health through "healthy-settings" initiatives and encourage them to be part of a larger network

Differential vulnerability to risk of oral disease

- Greater availability of sugar-free alternatives and medicines
- Support interventions and make tools available for breaking poverty and social inequalities
- Support measures that promote healthy eating and nutrition and reduce the amount of sugar, salt and fat in foods and drinks
- Reorient oral health services to improve access and availability
- Promote the availability of quality affordable oral-health products, healthy foods and drinks
- Regulate the sale of harmful or unhealthy products to certain high-risk groups in certain settings
- Promote oral health through chronic disease prevention, health promotion and health education
- Integrate oral health into community, local, national and international health programmes
- Work in collaboration across government departments and with local communities, other sectors, agencies and nongovernment and other organizations to promote oral health

Differential health-care outcomes

- Target resources that support disadvantaged or high-risk groups
- Improve early detection of oral cancer and noma with timely treatment and referrals
- Provide tobacco-cessation services in dental practices
- Include oral health in training of members of the primary health-care team

Differential health-care consequences

- Regulate the sale of harmful or unhealthy products to certain high-risk groups in certain settings
- Encourage healthy diets and moderate consumption of alcohol
- Outreach oral health care towards vulnerable and poor population groups
- Provide third-party payment systems reducing inequity in the use of oral health service

By contrast, several developments have been initiated in Timor-Leste that were not advocated in 2002. These are: (i) the establishment of a dental therapy school in August 2011; (ii) the creation of a Timor-Leste Dental Service in May 2002, though it is small relative to the population of Timor-Leste and largely supplies urgent oral treatment; (iii) the introduction of dental nurses (trained in Indonesia) during the early 1990s, and after independence in May 2002, who can deliver preventive dental care, extractions and simpler restorations; and (iv) plans to establish a school of dentistry in Dili in 2017. Although not advocated in 2002, these developments align with the strategic priorities for oral health in Timor-Leste, to deliver oral-health promotion and prevention, to deliver personal dental care and to develop human resources for oral health.[7]

REVISED POLICIES PROPOSED TO IMPROVE ORAL HEALTH IN TIMOR-LESTE

We propose an updated set of oral-health policies and recommendations for consideration by the government of Timor-Leste. Key priorities to improve the oral health of the population of Timor-Leste include promotion of oral health, legislative interventions, education of the oral-health workforce, dental outreach programmes, targeted dental treatment, dental infrastructure programmes and research and evaluation (see Box 3).

The proposals tackle the inadequate local support, shortfalls in financial and budgetary provisions for oral health, an inadequate focus on oral-health services and the lack of transport, by moving

Box 3. Proposed multistage recommendation for oral-health policy for Timor-Leste

Stage 1

1.1 Promotion of oral health

- Further develop the curriculum to cover chewing betel nut, smoking tobacco, diet, oral hygiene, and regular dental visiting
- Invite parents to the classes

1.2 Legislative interventions

- All imported salt to be fluoridated.
- All imported toothpaste to contain fluoride at 1000 parts per million
- Ban the use of tobacco and betel nut in schools
- Remove sweet stalls from schools

1.3 Education of the oral-health workforce

- Continue training dental therapists and dental nurses
- Establish a dentistry school for 15 students per year
- Train midwives, general nurses and health-promotion teachers in dental and oral cancer screening, oral health promotion, fluoride applications and use of fissure sealants

1.4 Dental outreach programme (Servisu Integradu da Saude Comunitaria: SISCa programme)

- Oral health screening, oral health promotion and fluoride applications
- Use existing portable dental chairs and equipment in community health centres
- Provide free toothbrushes and toothpaste to give away after screening

1.5 Targeted dental treatment

- Move the treatment philosophy from urgent oral treatment to prevention and atraumatic restorative techniques

1.6 Dental infrastructure programmes

- Improve the dental equipment, instruments and materials in community health centres
- Use existing portable dental chairs and equipment in community health centres for outreach services (SISCa programme)

1.7 Research and evaluation

- Redesign the monthly report on dental service to obtain better collection of data on oral health

Stage 2

2.1 Promotion of oral health

- Promote oral health through "healthy-settings" initiatives in schools and networks of health-promoting schools
- Include oral-health campaigns in general health campaigns
- Encourage the use of toothbrushes and fluoride toothpaste in adults, but where that is not practical, encourage traditional cleaning methods
- Create locally designed pamphlets on oral cancer for health workers

2.2 Legislative interventions

- Label tobacco packets
- Provide affordable toothpastes and toothbrushes by removing or reducing taxes on these products
- Tax all imported sugar to replace, or more than replace, any tax lost from removing the tax on toothpastes and toothbrushes
- Label food and drinks showing the amount of fat, sugar and salt
- Ban smoking and betel-quid chewing in public buildings
- Restrict advertising of alcohol, tobacco and unhealthy food

2.3 Education of the oral-health workforce

- Monitor the numbers and mix of the dental workforce, to ensure the most appropriate workforce
- Create a referral pathway for dental treatment for people found to have oral disease.
- Train dental clinicians in the importance of mouthguards for contact sports and how to make them, for a later campaign to the public
- Train oral-health professionals in smoking-cessation interventions
- Teach all dental workers how to do basic repairs on dental equipment and include such training as part of the dental undergraduate programmes
- Teach some local trades people, such as electricians, more advanced repair of dental equipment
- Provide scholarships for training in public health, oral and maxillofacial surgery, paedodontics, orthodontics and oral medicine

2.4 Targeted dental treatment

- Move to basic and then more elaborate restorative dentistry
- Ensure every community health centre has at least one dentist
- Improve collaborations with oral-health volunteer groups

2.5 Dental infrastructure programmes

- Have more than one dental room and dental chair per community health centre
- Have the same brands of dental equipment, instruments and materials in all dental surgeries, selecting dental equipment that does not often break down, and that is easy to repair when it does break down

2.6 Research and evaluation

- Routinely collect, report and share data on population health and access to care
- Ensure research is used to inform planning and service delivery
- Conduct regular evaluation external to Timor-Leste to determine whether recommendations on oral-health policy are being implemented
- Improve access to the Internet for all dental clinicians, possibly via mobile phones and portable computers

towards community-based prevention of oral diseases, with dental care based on a community-based hub-and-spokes model. The use of inexpensive legislative interventions and the move away from the medical model of dental care to a community-based preventive and minimally invasive one, with services often supplied by local health workers, will be more affordable in the developing economy of Timor-Leste, move the support and focus on oral health from central administration to the local communities, and reduce the need for transport. The proposals are also more likely to succeed than previous ones because circumstances have changed. During the time of the previous reports, the 2002 National Oral Health Survey[2] and the *National Oral Health Strategy*,[7] Timor-Leste was going through a time of great change. The country is now better organized, has more resources and has researchers able to assist in the local development of evidence-based health policies.

Promotion of oral health

The first stage in promotion of oral health should start with children, as Timor-Leste has a rapidly growing and young population. The census of 2010 identified that only 42.5% of children attended school;[11] despite this low attendance, the ready access to children in schools makes them the most suitable first recipients for promotion of oral health incorporated into general health promotion. At the same time, national efforts are required to improve access to education for those children currently missing out. Collaboration with education authorities, school administrators and teachers is required to further develop the school curriculum to cover chewing of betel nut, smoking tobacco, diet, oral hygiene (use of toothbrushes and fluoride toothpaste) and regular dental visiting. Parents should be invited to these classes to reinforce the messages at home.

Timor-Leste should progressively develop oral-health campaigns that encourage the use of toothbrushes and fluoride toothpaste in adults,[12] but where that is not practical, they should encourage traditional cleaning methods, e.g. datum, leaves and charcoal. Also needed are locally designed pamphlets on oral cancer for health workers that discuss the presentation of early-stage oral cancer, and the creation of a referral pathway for people suspected to have oral cancer.

Legislative interventions

The first stage in recommended legislative interventions should be to ensure that all salt is fluoridated,[13] and that all toothpaste contains fluoride at 1000 parts per million.[12] Water fluoridation[14] is not practical in Timor-Leste because the country does not have an extensive or clean reticulated water supply. However, Timor-Leste and the Asian Development Bank have recently announced plans to improve the water supply and sanitation for rural areas.[15] Salt and toothpaste are almost all imported into Timor-Leste and so arranging for them to contain fluoride can be done at little cost. At the same time, banning the use of tobacco[16,17] and betel nut,[18] as well as sweet stalls in schools,[19] could be implemented by the Department of Education with little difficulty.

At a later stage, the Government of Timor-Leste could investigate affordable toothpastes and toothbrushes, by removing or reducing taxes on these products and putting a tax on imported sugar to replace the revenue thereby lost. It could also label food and drinks, indicating the amount of fat, sugar and salt, ban smoking and betel-quid chewing in public buildings, and restrict the advertising of alcohol, tobacco and unhealthy food.

Education of the oral-health workforce

The Government of Timor-Leste should continue to train dental therapists and dental nurses to supply preventive and atraumatic restorative dental care.[20] Establishing a dentistry school will supply a workforce to attend to complicated treatments. A framework to monitor the numbers and mix of the dental workforce will enable better workforce strategies to support the needs of Timor-Leste.

The Timor-Leste dental service should train midwives, general nurses and health-promotion teachers in dental screening, using the "Lift the Lip" screening programme,[21] and screening for oral cancer, promotion of oral health, fluoride applications and glass ionomer sealants. It should also create a referral pathway for dental treatment for children with oral disease. Next, the Timor-Leste dental service should train dental clinicians in preventive practices such as mouthguards and smoking cessation.

Dental outreach programmes

Timor-Leste should focus on strengthening the availability and quality of oral-health services offered at the community health centres, health posts and via the outreach programme, Servisu Integradu da Saude Comunitaria (SISCa).[22] SISCa is an outreach programme designed to provide basic primary health-care services to communities and households at 602 posts all over the country.

Targeted dental treatment

Dental treatment should move from urgent oral treatment to prevention, with in-surgery oral and general health promotion,[23] fluoride applications,[24] fissure sealants[25] and atraumatic restorative techniques,[20] not only by dental practitioners, but by outreach health workers. At a later stage, as determined by the Timor-Leste Dental Service, these services could include basic and then more elaborate restorative dentistry. The policy should be that every community health centre has at least one dentist, so that a process can be established whereby outreach health workers can refer people with oral problems to a dentist.

Dental infrastructure programmes

Dental equipment, instruments and materials in community health centres need to be improved in a staged process, and the existing portable dental chairs and equipment in community

health centres should be used for the outreach SISCa programme. There needs to be more than one dental room and dental chair per centre, so that they can act as incoming referral centres from the sucos (villages) and aldeias (sub-villages). The same brands of dental equipment, instruments and materials are required in all dental surgeries. Quality equipment should be selected that does not regularly break down and is easy to maintain and repair.

Research and evaluation

Currently, the Timor-Leste Department of Health collects basic data on the productivity of dental practitioners, such as the number of patients seen and the treatments provided. For research and evaluation, the first step is to redesign the current monthly reporting systems of the Timor-Leste Dental Service, in order to obtain data on oral health, rather than solely focusing on staff productivity. The *National Health Sector Strategic Plan 2011–2030* proposed an improvement of the communication systems (including radio and Internet connections) to provide all health facilities with suitable systems for patient referral and the transfer of management data.[10] Linking the collection of data on oral health with such a communication system would be ideal.

Later stages should include supporting research that develops and evaluates models of oral health care and access, routinely collecting, reporting and sharing population data on health and access to care, to ensure research is used to inform planning and service delivery; conducting regular evaluation external to Timor-Leste, to determine whether recommendations for oral-health policy are being implemented; and improving communications access through wider use of mobile phones and portable computers, so dental clinicians can remain informed of current literature and international practice in oral health care.

Conclusion

Copying the medical model to improve oral health is not feasible in a developing economy with a rapidly growing population, as found in Timor-Leste. Hence, the approach should be preventive interventions: oral health promotion for schoolchildren, salt fluoridation, fluoride toothpaste and banning sweet stalls and use of tobacco and betel nut in schools. Timor-Leste should focus on strengthening the availability and quality of oral-health services offered outside of the larger cities, and train midwives, general nurses and health-promotion teachers in dental and oral-cancer screening, promotion of oral health, fluoride applications and glass ionomer sealants. Dental therapists and dental nurses who can supply preventive and atraumatic restorative dental care should continue to be trained, and Timor-Leste should continue to work towards establishment of a dentistry school to supply a workforce for more complex treatments. Ongoing research and evaluation is needed to ensure that the approach being used in Timor-Leste is leading to improved outcomes in oral health.

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