MONGOLIA'S AIR POLLUTION CRISIS:

A call to action to protect children's health

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FOREWORD

Air pollution has become a child health crisis in Ulaanbaatar, putting every child and pregnancy at risk. The risks include but are not limited to stillbirth, preterm birth, lower birth weight, pneumonia, bronchitis, asthma and death. There is also emerging evidence that air pollution is linked to impaired cognitive development, already occurring during pregnancy and a child's early years. Furthermore, these children will be at higher risk from chronic health problems later in life.

The National Center for Public Health and UNICEF are deeply concerned about the situation.

With approximately half of the Mongolian population living in Ulaanbaatar, this is not only a major concern to individual children and their families, but to the country as a whole. The air pollution crisis poses a threat to Mongolia's human capital.

Children and pregnant women residing in the Ger districts are at highest risk. They are exposed to the highest levels of air pollution levels because most of the pollution stems from using raw coal and other solid fuels in the Ger districts to stay warm. Their overall health condition is often relatively low, making them more vulnerable to air pollution. Their access to good and affordable health care is often limited.

The National Center for Public Health and UNICEF Mongolia are calling for a more holistic approach to tackle this child health crisis, urging stakeholders to invest not only in cleaner energy solutions, but also in immediate measures to reduce the impacts of air pollution on the health of children and pregnant women. Measures to reduce the air pollution and measures to protect the health of the most vulnerable need to go hand in hand. Doing whatever is possible to protect our children's health now is not an option - it is our duty.

This report evaluates how much the public health system is currently spending on air pollution related diseases amongst children, makes projections on the health costs if no action is taken, discusses potential interventions to reduce the burden of air pollution on child health, and assesses the budgetary space for investments in such interventions.

We would like to thank the Swiss Agency for Development Cooperation for funding this report and its commitment to continue to support Mongolia with addressing this child health crisis.

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EXECUTIVE SUMMARY

During the long cold season, air pollution levels in Ulaanbaatar, Mongolia, are among the highest in the world. Data collected by the Government of Mongolia (GoM) reported on 30 January, 2018, at 05:00, air pollution levels of 3,320 µg/m³ (at Baruun 4 zam) - this is 133 times the recommended daily average concentration[1]. Exposure to air pollution of such a magnitude has very serious health consequences, particularly for children[2]. These include risks of pneumonia and bronchitis, as well as chronic respiratory conditions that can affect them later in life, such as reduced lung function. It has also been shown to have serious effects on unborn children, including lower birth weight, preterm birth, and stillbirth. Emerging evidence is pointing to potential impacts on brain and cognitive development, especially during pregnancy and the early years of life[3]. Unfortunately, there are indications that many children who are affected by air pollution in Ulaanbaatar do not receive the necessary services they require. Given the considerable negative impact of air pollution, greater efforts are needed to prevent and treat the health impacts of air pollution, and to ensure that services reach all children.

If no immediate action is taken to reduce the levels of air pollution, the direct financial cost of treating air pollution attributable diseases in children is expected to increase considerably. Based on the estimates made by the authors of this report, inaction would lead to an increase in the costs of treating air pollution-induced diseases in children of 33% between 2017 and 2025, costing health providers at least Mongolian Tugrik (MNT) 4.8 billion extra per annum by 2025. This means that the costs of not reducing air pollution levels to the National Programme for Reducing Air and Environmental Pollution (NPRAEP) target levels would amount to a total of MNT 24.5 billion over the 2017–2025 period to the Ulaanbaatar City health system alone. In non-monetary terms, inaction against air pollution translates into an additional burden to the health sector of an estimated 1.2 million hospital days and 145,000 outpatient consultations among children alone over the period 2017–2025 – all for air pollution-attributable diseases and impaired development. When indirect costs are considered, estimates escalate significantly. In addition to estimating direct costs, this study also estimates the value of lost productivity of parents caring for sick children. When taking this variable into account, the estimated projected cost of inaction increases to MNT 46.6 billion for the period 2017–2025.

Reducing air pollution levels in Ulaanbaatar is the only long term sustainable solution to protect children's health. However, based on the Government's current plans and the realities on the ground, it will likely take a significant number of years before the air quality in Ulaanbaatar during the winter will be of acceptable levels. Until then, thousands of children will continue to suffer from air pollution the coming years. As per UNICEF's global messages on air pollution and in line with the Convention on the Rights of the Child (Article 24 on children's health, which includes specific reference to environmental pollution), it is thus essential that stakeholders will not only invest in measures to reduce air pollution levels, but also in reducing children's exposure, in treating children with air pollution related diseases, and in measures that strengthen their overall health to reduce their vulnerability to air pollution.

Potential interventions include, for example, roll-out of the Pneumococcal Vaccine, improving indoor air quality in the public facilities for children, providing guidance to the public on the use and access to good quality face masks and a sustained public outreach campaign. These actions would likely provide immediate, shortterm relief to some of the most vulnerable and severely affected children.

There is a need to mobilise resources to finance the adoption of these and other potential interventions in a sustainable fashion. As this study shows, given the current macroeconomic climate in Mongolia, there is limited budgetary space in relevant ministries, departments and agencies (MDAs) to finance additional interventions aimed at mitigating health impact of air pollution. That said, there are unexplored sources of financing available across the Mongolian public financial system which could be utilised without causing disruptions to the delivery of other basic social services.

In terms of immediate child health measures to consider, the report recommends the following in summary:

- Develop and implement a multi-year public outreach campaign to raise awareness of the dangers of exposure to air pollution (with a focus on pregnant women and young children) and measures people can take to protect their health and reduce air pollution. This should also include further strengthening the evidence base around child health, pregnancy results and air pollution.

- Vaccinate all new-born children in Ulaanbaatar with 13-valent PCV and include the vaccine in the national immunization schedule of Mongolia and the relevant budget for the National Immunisation Programme budget of the Ministry of Health.

- Develop and implement a comprehensive indoor air quality management approach for kindergartens, schools and hospitals through a combination of technical and behavior change interventions.

- Develop an advisory note on measures people can take to reduce exposure to air pollution outside, including the proper use of good quality and well-fitted masks; consider the provision of such masks free of charge to the most vulnerable in the communities that are faced with the highest levels of air pollution. A review of the effectiveness of face masks is also urgently needed.

The study also recommends:

- Undertake a feasibility study to identify, cost and promote a package of interventions to reduce exposure of pregnant women and neonates living in the 'ger' districts to air pollution.

- Analyse and further pilot the provision of affordable and good-quality medicine to treat acute respiratory infections and chronic lung diseases among children of poor families.

- Assess and strengthen the capacity of the health care facilities to provide adequate and affordable care to children affected by air pollution. For example, this should include developing a list of essential equipment and supplies for family health care centres, training of staff, have surge capacity to accommodate the sharp seasonal increase in demand for treatment of respiratory and other air pollution-induced diseases, and continued and systematic improvement of clinical guidelines and their use.

- Recognising the increased need for a centralized procurement system for medicine and strengthening a centralised procurement process for medicines to ensure access to good-quality and affordable medication.

With regard to mobilizing the necessary funds for measures to protect children from air pollution health impacts:

- Classify the negative health impacts of air pollution as an emergency situation, at least during the winter months when morbidity is at its highest. This would allow the use of governors' emergency reserve funds to finance potential measures aimed at mitigating the negative impacts of air pollution on the health and wellbeing of Mongolian citizens. District and provincial governors and the Ulaanbaatar City Governor all have emergency funds, which, if used wisely, can significantly improve the situation of children in Ulaanbaatar during the winter months.

- Identify alternative external financing sources of funding in order to (co-)finance potential interventions to mitigate the impact of air pollution on children's health.

- Overall health sector budget strengthening by harmonising fund disbursement methodology between the different sources of health sector funding. The existing budget disbursement methodologies used by the SHIF and the State Budget cause disruptions in the smooth functioning of the health facilities in Mongolia. State Budget contributions are made on an input basis, whereas the SHIF provides output-based financing. This hampers health facility managers' ability to plan spending in advance in a rigorous fashion.

- A continued and strengthened prioritisation of budget allocations to primary healthcare services to foster a preventative healthcare system aimed at minimising the number of patients requiring specialised care.

- An increased budget allocation to FHCs and improved financial management capacity of the FHCs, which can be achieved by strengthening of checks and payroll controls for FHCs.

- Prioritise budget releases by MoF to health facilities in Ulaanbaatar during the winter months to ensure service delivery that meets increased demand from patients.

- Given the level of urgency and the long-term impacts of the air pollution crisis on child health and wellbeing, development partners should also be requested to (co-)finance measures.

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LIST OF ABBREVIATIONS

ADB	Asian Development Bank
COPD	Chronic obstructive pulmonary disease
DRG	Diagnosis-related group
FHC	Family Health Centre
FSL	Fiscal Stability Law
GFMIS	Government Financial Management Information System
GGHE	General government health expenditure
GoM	Government of Mongolia
GPA	Government Procurement Agency
HEPA	High-efficiency particulate air
IBL	Integrated Budget Law of Mongolia
IHD	Ischaemic heart disease
IMF	International Monetary Fund
LMIC	Lower middle-income country
LRI	Lower respiratory infection
LSA	Law on State Audit
MDA	Ministries, departments and agencies
MNAO	Mongolian National Audit Office
MoCUD	Ministry of Construction and Urban Development
MoECSS	Ministry of Education, Culture, Science and Sports
MoET	Ministry of Environment and Tourism
MoF	Ministry of Finance
MoH	Ministry of Health
MTFF	Medium-term fiscal framework
NDA	National Development Agency
NPRAEP	National Programme for Reduction of Air and Environmental Pollution
PAF	Population-attributable fraction
PCV	13-valent Pneumococcal Vaccine
PFM	Public financial management
PM2.5	Particulate Matter 2.5
PPLM	Public Procurement Law of Mongolia
PSMFL	Public Sector Management and Finance Law
SDGs	Sustainable Development Goals
SHIF	Social Health Insurance Fund
SIGO	Social Insurance General Office
WHO	World Health Organization

1. Introduction

1.1 Air Pollution and Child Health

Children are particularly vulnerable to the health complications associated with exposure to air pollution[4]. Outdoor air pollution is the most significant environmental risk faced by children in Ulaanbaatar. Mongolia's capital hosts about half of the country's total population and its air pollution is among the highest in the world during the winter. The vast majority of that pollution is caused by the burning of coal for heating of homes. The pollution is significantly linked to acute respiratory infections, such as pneumonia. On January 30, 2018, at 05:00 am, air pollution levels of 3,320 µg/m³ (at Baruun 4 zam) were reported - this is 133 times the WHO guideline for the 24-hour mean concentration which is set at 25 µg/m3[5]. Air pollution is linked to reduced foetal growth, preterm birth, low birth weight, impaired cognitive intra-uterine development, impaired cognitive development, and even spontaneous abortion. It is also linked to diseases that can be highly debilitating for children, such as bronchitis and asthma, causing children to miss school and other important learning and development opportunities. It can affect children's growth and development, with long-term consequences, including reduced lung function and recurring or chronic respiratory conditions that can last a lifetime. Barriers to be addressed are multiple and require a holistic approach from exposure protection to treatment. These barriers include (but are not limited to) low awareness among communities about the impacts of air pollution on child health and how to respond, lack of access to finance and technology for clean heating solutions, and insufficient capacity and unreliable quality antibiotics and other medicine to treat children with pneumonia and other air pollution-related diseases.

Starting in 1990, Mongolia underwent a profound social and economic transformation. Over the past 27 years, Mongolia has abandoned economic central planning in favour of a market-based economy and has adopted a democratic political system. It also ratified a new constitution in 1992 which enshrines new civil rights and liberties, such as the lifting of restrictions on the movement of people domestically – Article 16.18. This new political economy setting, combined with an increased recurrence of dzuds (severe winters, often preceded by excessively dry summers)[6], accelerated the rural exodus which has transformed the country over the past decades. As thousands of families lost their livestock and saw their crops

destroyed, they moved to the capital in search of alternative livelihoods and improved living conditions. In 2015, 45.7% of Mongolia's population lived in Ulaanbaatar[7]. This rapid and unplanned urbanisation has led to the expansion of 'ger districts' in the suburbs of Ulaanbaatar. These large informal areas, where more than 60% of the city's population live, experience a variety of public health and environmental challenges. The rapid growth of these areas increases pressures on the environment, leading to a sharp upsurge in air pollution. It should be noted that the impacts of climate change and land degradation will continue to increase the risk of more frequent and extreme dzud conditions. This will further undermine rural livelihoods in the coming years and decades, and could thus lead to an upsurge in migration from the rural areas to the urban centres.

In 2016 Ulaanbaatar surpassed both New Delhi and Beijing as the capital with the highest levels of air pollution in the world. The level of fine particle concentration is often used as a proxy for measuring air pollution and its impact on health[8]. PM2.5 can penetrate deep into the lungs and has been found to have strong links to a variety of health problems. The current WHO guideline for PM2.5 is set at 10 µg/m3 for the annual mean

concentration. In Ulaanbaatar, the average concentration of PM2.5 in 2016 was 256 µg/m3, more than 25 times the WHO guideline for the annual mean concentration[9]. The average fine PM2.5 detected in the ger districts is considerably higher[10]. Furthermore, there is a large seasonal element to air pollution in Ulaanbaatar, with high concentrations between the months of November and March. This spike in air pollution is mainly due to increased combustion of coal and biomass, as well as the usage of heat-only boilers in the ger districts. The city's location (in a valley surrounded by mountains) and the lack of air movement during the winter further aggravates the situation[11].

Children are the most vulnerable to adverse health effects of air pollution from the day they are conceived. In Mongolia, a 3.5-fold increase in foetal deaths has been documented between winter and summer[12]. Initial analysis showed that in the last 10 years, the incidence of respiratory diseases in Mongolia increased alarmingly, including a 2.7-fold increase in respiratory infections per 10 000 population[13]. Pneumonia is now the second leading cause of under-five child mortality in the country[14]. In 2015, up to 435 children under the age of five in Ulaanbaatar died from pneumonia[15]. Children living in a highly polluted district of central Ulaanbaatar were found to have 40% lower lung function than children living in a rural area[16].

The persistently high levels of air pollution in Ulaanbaatar, the negative impacts on the health and wellbeing of its citizens, especially its children, and the fact that Ulaanbaatar is hosting nearly half of the Mongolian population, make this an emergency situation. As mentioned in previous paragraphs and further analysed in this report, the current levels of air pollution in Ulaanbaatar are already causing very significant damage to the health of the city's citizens.

If no structural and large-scale measures are adopted, levels of air pollution are likely to continue rising. In the meantime, children in Ulaanbaatar are witnessing a dramatic increase in morbidity and fatality rates due to exposure to air pollution, particularly during the winter months. It is critical that this situation be treated as an emergency and that all necessary actions available to policymakers and the GoM overall are taken immediately.

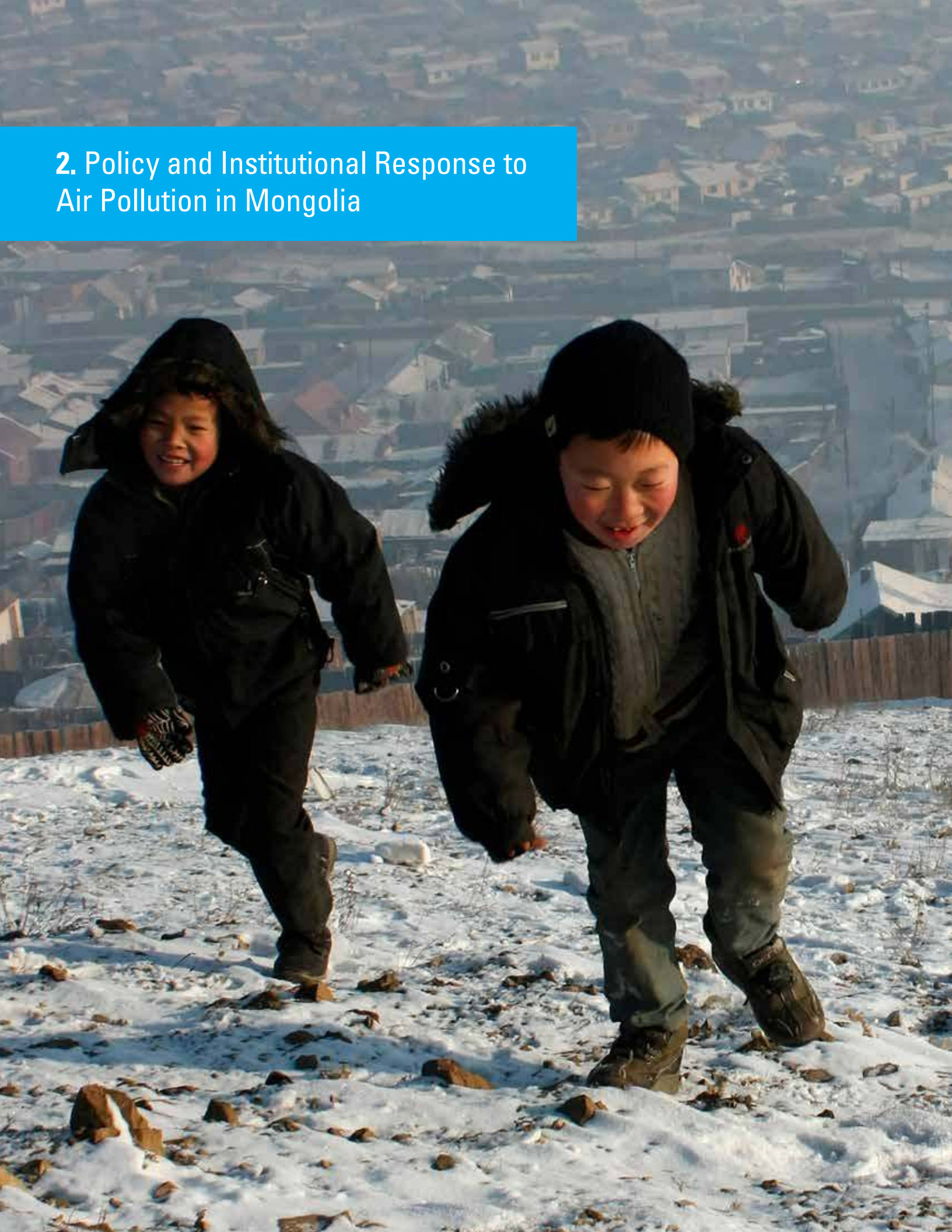
1.2 Research Purpose and Structure of the Report

This analysis estimates how much it costs and how much it will cost health providers to treat air pollution-induced diseases in Ulaanbaatar provided the GoM does not take immediate action to minimise the current levels of air pollution. The report then assesses ongoing commitments to mitigate air pollution and discusses potential interventions to minimise the impact of air pollution on child health while broader plans to reduce levels of air pollution are implemented. Recommendations related to these interventions can provide ground for further cost effectiveness analyses and costing to facilitate the adoption of these measures by the GoM. Furthermore, this study also includes a budgetary space analysis that aims to assess the GoM's ability to finance any of such interventions based on recent public expenditure trends. Finally, this report provides concrete policy and research recommendations to the GoM and other stakeholders.

The overall purpose of the analysis is to collect evidence which supports actionable recommendations aimed at reducing the consequences of air pollution-induced diseases in children in Ulaanbaatar. The recommendations analyzed here are not meant to be exhaustive, nor are they meant to be implemented in absence of other fundamental programmes to reduce air pollution and protect children. Addressing the full effects and causes of air pollution in Ulaanbaatar will require a holistic and comprehensive response that covers short, medium and long term interventions.

> *Protecting children from air pollution is not only in their best interests; it is also in the best interests of their societies – a benefit realized in reduced health costs … in increased productivity … in a cleaner, safer environment … and thus, in more sustainable development.*
>
> *We can make the air safer for children. And because we can, we must.*
>
> **Anthony Lake** (2016)
> *Former UNICEF Executive Director*

2. Policy and Institutional Response to Air Pollution in Mongolia



Across the political spectrum, there is a recognition that action must be taken to address air pollution. The GoM has responded to this imperative and is committed to addressing the impacts air and environmental pollution have on the country. The GoM's response is informed by its current institutional and policy framework on the issue of pollution, which include existing strategic documents, frameworks, and sector plans.

Mongolia's Sustainable Development Vision 2030, approved in 2016 and firmly anchored in the Sustainable Development Goals (SDGs), envisions significant efforts aimed at tackling air pollution and its impact on public health. One goal is the elimination of air pollution in Ulaanbaatar City, specified under Phase I of Objective 2 for Ecosystem balance: '... and have no air pollution in Ulaanbaatar City'. This ambitious goal is complemented by a variety of other objectives aimed at 'reducing factors affecting preventable maternal and child mortality'[17].

Mongolia has also adopted a variety of specific policies, laws, action plans, and strategies aimed at reducing air pollution and its impact on the health of Mongolian citizens. These vary in terms of their mandate, level of prioritisation, competence, as well as area of focus. Table 1 provides an overview of the main laws, policies, programmes, and strategies which have focused on minimising air pollution over the past few years.

Adding to the laws, policies, programmes, and strategies identified in Table 1, there are additional initiatives undertaken by the GoM that aim to mitigate air pollution and its impact on children's health, specifically, as outlined in Table 2.

Furthermore, this section of the report describes the recently approved NPRAEP, which was created to overcome the shortcomings of previous strategies aimed at reducing air pollution in Mongolia over the past years. The NPRAEP Implementation Plan helps identify the main areas of concern of the GoM, as well as where its efforts will be focusing over the coming eight years.

Table 1. Laws, Policies, Programs and Strategies on Air Pollution Reduction

- Green Development Policy (2014).
- Mongolia's Contribution to Mitigating Climate Change (2015).
- Government of Mongolia Action Plan for 2016 – 2020.
- Clause 4.1.11 and Provision 10.4 of the Mongolian Law on Development Policy and Planning.
- Clean Air Fund (abolished in 2014).
- Provision 14.1 of the Law on Environmental Protection.
- Clause 6.1.1 of the Law on Air (2012), incorporated with Law on Reducing City Air Pollution.
- Recommendation 03703 of the National Security Council.
- Law on Environmental Impact Assessment.
- Law on Air Quality (2012).
- State Great Khural's New Development 'Smoke Free Ulaanbaatar'.
- Strategy for Reducing Climate Change, Adapting to Climate Change, and Protecting Public Health (passed by order no. 404, Minister of Health, December 2011).
- National Air Quality Standards of Mongolia were approved by Resolution 67, December 2007.
- National Program on Environmental Health (2005, Govt Resolution 245).
- State Policy on Ecology (1997).

Table 2. Additional initiatives on air pollution

- Provision of free electricity to poor households in the ger areas during night time in the winter months
- Distribution of clean stoves and face-masks to poor households.
- Distribution of air-purifiers to schools and hospitals
- Subsidies for parent carers during period of sickness of their child to avoid overcrowding of hospital facilities (introduced for winter of 2016/17).
- Pilot program on introducing 15,000 pneumococcal vaccines for children in two districts (2016).
- Free provision of some medicines during winter months (2016/2017)

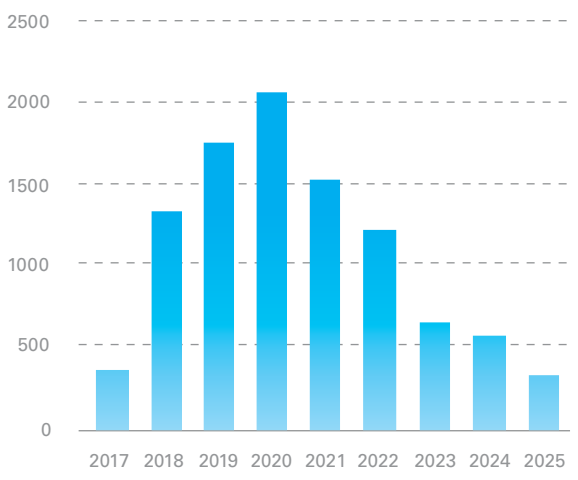
NPRAEP

Recognising that 'earlier efforts to reduce environmental pollution did not reach the desired results'[18,19], the GoM recently launched the NPRAEP (2025). This programme is a comprehensive strategy which integrates policies aimed at reducing air and environmental pollution with 'concrete implementation actions and inter-sectoral coordination using all available technical, financial and human resources[20]'. The programme is, to a large degree, a successor to the MNT 18.8 billion New Medium-Term Development Programme 2016, which also sought to address air and environment pollution but could not be fully implemented due to lack of secured funding. The NPRAEP, in contrast, is more comprehensive than its predecessor and has thus far managed to garner more political capital. The programme is being led by the Prime Minister within a social context of increased awareness of the problems associated with health pollution, which increases the urgency to act upon this problem.

The NPRAEP was originally costed at MNT 4.9 trillion. However, the recently published implementation plan shows that cost estimations rise to MNT 9.8 trillion over the eight-year implementation period, as listed in Figure 1 below:

FIGURE 1

NPRAEP Implementation Plan Cost 2017-2025 (MNT billion)



The NPRAEP has five main objectives aimed at providing medium- to long-term strategies to address air pollution within Mongolia. The recently published implementation plan for the programme provides an estimation of the budget requirements to address the programme's objectives, as outlined in Table 3 below.

As can be seen in Table 3, nearly 80% of the estimated cost of implementing the NPRAEP are expected to be spent on Objective 2 (79.1%) – activities aimed at reducing pollution sources by introducing environmentally friendly and advanced technologies. While these activities are crucial to reduce the cost of air pollution, they focus almost exclusively on the energy sector and how to make it more environmentally friendly[21].

Potential financing sources[22] identified by the GoM for the implementation of the NPRAEP include but are not limited to:

- national and local government budgets;
- revenues generated from Air Pollution Fees;
- revenues generated from Water Pollution Fees;
- loans and aid from international organisations and donors; and
- private sector financing.

While potential sources of financing have already been identified, only 4.5% of the total estimated cost for the entire eight-year period has been secured (Figure 2). An estimated 2.0% – MNT 200 billion – is expected to be financed by the State Budget. Another 2.5% – MNT 240 billion – will be financed by revenues collected via an Air Pollution Tax[23].

FIGURE 2

Financing Sources for NPRAEP

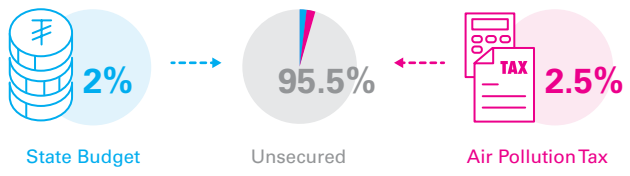


Table 3 - Breakdown Costing of NPRAEP

NPRAEP Objectives	Estimated Costing MNT (billions)	Share of Total Costing
Objective 1: To implement an effective policy for urban planning, construction and infrastructure development and to improve the quality of air and environment in urban areas through the development of the community.	1811	18.5%
Objective 2. Reduce pollution sources by introducing environmentally friendly and advanced technologies, reducing raw coal consumption and reducing pollution substances	7765	79.1%
Objective 3: Take a comprehensive approach to reduce the amount of pollutants emitted from vehicles	107	1.1%
Objective 4: To define the management, coordination and financing of air and environmental pollution mitigation activities and to create a system to reward air and environment pollution activities	98	1.0%
Objective 5: To increase citizen participation and accountability in reducing environmental pollution, to establish healthy living practices, and to strengthen environmental quality monitoring and analysis	31	0.3%
Total	**9,811**	**100%**

The NPRAEP focuses extensively on medium- and long-term outcomes which require significant investment, such as refurbishing the ger districts or transforming the energy sector by adopting less polluting alternatives for energy generation. This is an ambitious programme which is being launched amidst an austere economic context marked by increasing debt levels and an International Monetary Fund (IMF) programme which demands the adoption of fiscal austerity measures to reduce public spending. As a result, implementation of the NPRAEP will most likely be a challenging undertaking and will require the involvement of a wide range of stakeholders, including local authorities, MDAs, bilateral and multilateral donors, the private sector, and civil society. The vast majority of MDAs have some responsibility in regard to the implementation of the NPRAEP.

This report identified six key government stakeholders involved in mitigating the impact of air pollution on children's health, directly and indirectly. These are the Ministry of Construction and Urban Development (MoCUD), which is responsible for guiding the conversion of existing homes in the ger districts to 'green homes' through the provision of affordable loans; the Ministry of Environment and Tourism (MoET), which is responsible for monitoring the implementation of the NPRAEP and which hosts the Secretariat Committee of the NPRAEP; MoECSS, which has an important role to play in reducing children's exposure to air pollution by ensuring that schools are a safe environment for children and in delivering public outreach campaigns targeting minors; MoH, which is responsible for taking the necessary measures to ensure that health facilities of all types can deliver services which mitigate the health

implications of air pollution; the Social Insurance General Office (SIGO), which is responsible for ensuring that all Mongolian nationals have access to healthcare; and the Capital City Governor's Office, which can channel some of its resources and human capacity towards mitigating the effects of air pollution on the health of children living in Ulaanbaatar. A more detailed description of the responsibilities of each of these institutions can be found in Annex D and a detailed description of the financing needs of each of them under the NPRAEP Implementation Plan can be found in Annex E.

This report builds on the NPRAEP and estimates the economic losses that will be incurred by the GoM in the provision of healthcare services to children if it does not implement the NPRAEP. The assumptions and estimates guiding the models used by the authors were derived from the NPRAEP.

LOVE
LOVE

3. Cost of Air Pollution in Ulaanbaatar

High levels of air pollution entail significant costs to society, the economy, and the environment. A fully comprehensive estimate of all of the costs associated with high levels of air pollution would have to take into account the effects of air pollution across different economic sectors, such as tourism and agriculture, and would also have to monetise the effects of air pollution on social and environmental welfare. However, such a comprehensive study is not possible with the limited data available. There is a similar trade-off between robustness and comprehensiveness to be faced by studies estimating the cost of air pollution on health in Mongolia.

Previous studies[24] have tried to cost the overall economic burden deriving from exposure to air pollution in Mongolia. A World Bank report (2011) estimated an average annual value of health costs associated with air pollution of USD 463 million (range USD 177 million–USD 727 million), equivalent to 18.8% of Ulaanbaatar's gross domestic product (GDP) (2008 data)[25]. The calculations were informed by a Value of Statistical Life of MNT 319 million (USD 168,000), derived from a local survey conducted in the winter of 2010 which estimated the willingness to pay for mortality risk reductions typically resulting from air pollution control policy. Similarly, a joint World Bank and Institute of Health Metrics and Evaluation report (2016) estimated that in the whole of Mongolia 2,424 lives (children and adults) were lost due to air pollution in 2013[26], amounting to MNT 4.1 trillion (USD 2.1 billion) in welfare losses (6.9% of the country's GDP). The country-specific Value of Statistical Life for this study was computed based on a base Value of Statistical Life of MNT 7.5 billion (USD 3.83 million) in Organisation for Economic Co-operation and Development countries adjusted by LMIC's GDP per capita and income elasticity of 1.2. Studies such as the ones mentioned are crucial in that they provide the GoM with an indication of the overall magnitude of the problem.

This report adopts a conservative yet pragmatic methodology and builds on available data. It ensures that the results and estimates are useful for policymakers to decide on affordable and cost-effective measures to address the problem. Accordingly, although there is a wide variety of diseases that are linked with exposure to air pollution, this analysis focuses on nine[27] specific diseases[28] which have well established and robust population-attributable fractions (PAFs)[29]. Similarly, a strong focus is placed on direct costs[30] of air pollution for health providers. This means that, to a large extent, the focus of this report is on actual funds being spent by health providers in Ulaanbaatar in the treatment of air pollution-induced diseases. That said, one particular kind of indirect cost is considered: lost productivity of carer parents. This indirect cost is measured in recognition of its importance in helping define the magnitude of the problem.

3.1 Direct costs of air pollution

The analysis in this subsection focuses deliberately on the direct costs associated with air pollution in Ulaanbaatar, on the understanding that such information would be most useful to the authorities to determine affordable and cost-effective measure to address the problem. Adopting a full economic approach similar to those adopted in studies conducted by the World Bank discussed above could see the total cost be up to eight to nine times higher than the direct cost estimated in this analysis. However, it can be argued that such information specific to Mongolia and Ulaanbaatar is already available and would be of less relevance to MDAs for budget planning purposes than the direct costs. Furthermore, some of the children considered in the base case analysis (ages 0–18 years) were born before air pollution levels in Ulaanbaatar rose to their current levels. Their morbidity profile, particularly as regards long-term complications and disease exacerbations, is likely to be milder than that of children who were exposed to high air pollution levels since birth. Given the chosen time horizon of the analysis (eight years), one can appreciate that this assumption would not significantly affect the magnitude of the estimates.

Current direct cost of air pollution

In 2016, air pollution-related diseases in children (0–18) cost public health services in Ulaanbaatar MNT 10.4 billion (USD 4.8 million). When including adults, the costs rise to MNT 18.4 billion (USD 8.5 million) in the same year. These public health costs are borne primarily by the MoH and the Social Health Insurance Fund (SHIF) in Mongolia. These values amount to 1.6% of the total executed budget of the MoH, or 4.6% of the total executed budget of healthcare facilities in Ulaanbaatar.

While the proportion of the health budget spent on treating these diseases may appear relatively small given the gravity of the situation, it is important to keep in mind that these only reflect the direct costs of treatment provided by public health providers in Ulaanbaatar, excluding indirect costs associated with morbidity. It is also important to note that

this value is considered insufficient by health providers, who often mentioned the need for increased budget allocations in order for them to be able to provide adequate assistance to all those who require medical care.

From Table 4 below one can also note that the costs associated with public healthcare provision to patients with air pollution-related diseases has increased significantly over the past five years in Ulaanbaatar. For children, this value has nearly doubled – shedding light on the increased vulnerability of children to the health impact of exposure to air pollution. It should also be noted that such figures exclude children who did not access public health services, or who utilised private health institutions, indicating that figures could be considerably higher.

In the following paragraphs, calculations are presented estimating the costs for the Government to provide public care to an increasing number of patients affected by air pollution related diseases if the level of air pollution in Ulaanbaatar does not decline.

Direct cost of inaction

If the GoM does not take immediate action to address air pollution, the economic burden of air pollution on Ulaanbaatar's health services related to children aged 0–18 years is expected to total MNT 24.8 billion (USD 9.8 million) by 2025. This means that if current trends continue into the future (e.g. air quality levels, demography, structure of health service provision etc.), the costs of treating all air pollution-attributable disease cases occurring in children between 2017 and 2025 will be approximately MNT 24.8 billion (USD 9.8 million) higher than if effective interventions against air pollution are implemented today. This is because effective interventions would gradually decrease the number of cases of air pollution-attributable disease, with correspondingly less pressure on the health system. On a similar note, effectively reducing air pollution levels as stipulated in the NPRAEP would decrease direct costs to Ulaanbaatar's public health system by a total of approximately MNT 24.8 billion (USD 9.8 million) over 2017–2025.

The annual direct cost of treating air pollution-attributable disease is not constant, as it increases gradually over the considered time horizon, from MNT 11.3 billion (USD 4.5 million) in 2017 to MNT 15 billion (USD 4.8 million) by 2025 (Figure 3). If, however, average air pollution levels are reduced in line with the NPRAEP, the annual cost to Ulaanbaatar health services of treating air pollution-attributable disease cases would decline from MNT 11.3 billion (USD 4.5 million) in 2017 to MNT 10.3 billion (USD 3.3 million) in 2025. From 2021 onwards, inaction would translate into an annual cost of inaction for the public health sector of approximately MNT 4.8 billion (USD 1.6 million) (Figure 3). This means that if air quality is brought down to and maintained at NPRAEP 2021 target levels, disease caused by air pollution alone would cost Ulaanbaatar public health services approximately MNT 4.8 billion (USD 1.6 million) less each year compared to a case where no effective interventions against air pollution are implemented today.

When considering the entire population of Ulaanbaatar, including adults, the annual cost of inaction against air pollution is about MNT 7.2 billion (USD 2.4 million) on average from 2021 onwards (Figure 4). It is important to note that children (ages 0–18 years) represent about 30% of the total population of Ulaanbaatar, but they currently concentrate more than 40% of the cost of inaction in the total population of the capital city, and this share is likely to increase. By 2025, approximately two-thirds of the cost of inaction against air pollution in the entire Ulaanbaatar population will be related to children.

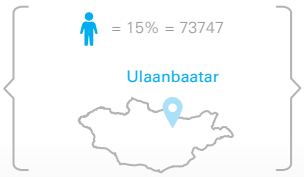
The largest proportion of the cost of inaction burden for 0-18-year-olds would fall on the in-patient departments in district hospitals (Figure 5). If nothing is done to address rising levels of air pollution, air pollution-attributable cases

Table 4 - Cost of Air Pollution

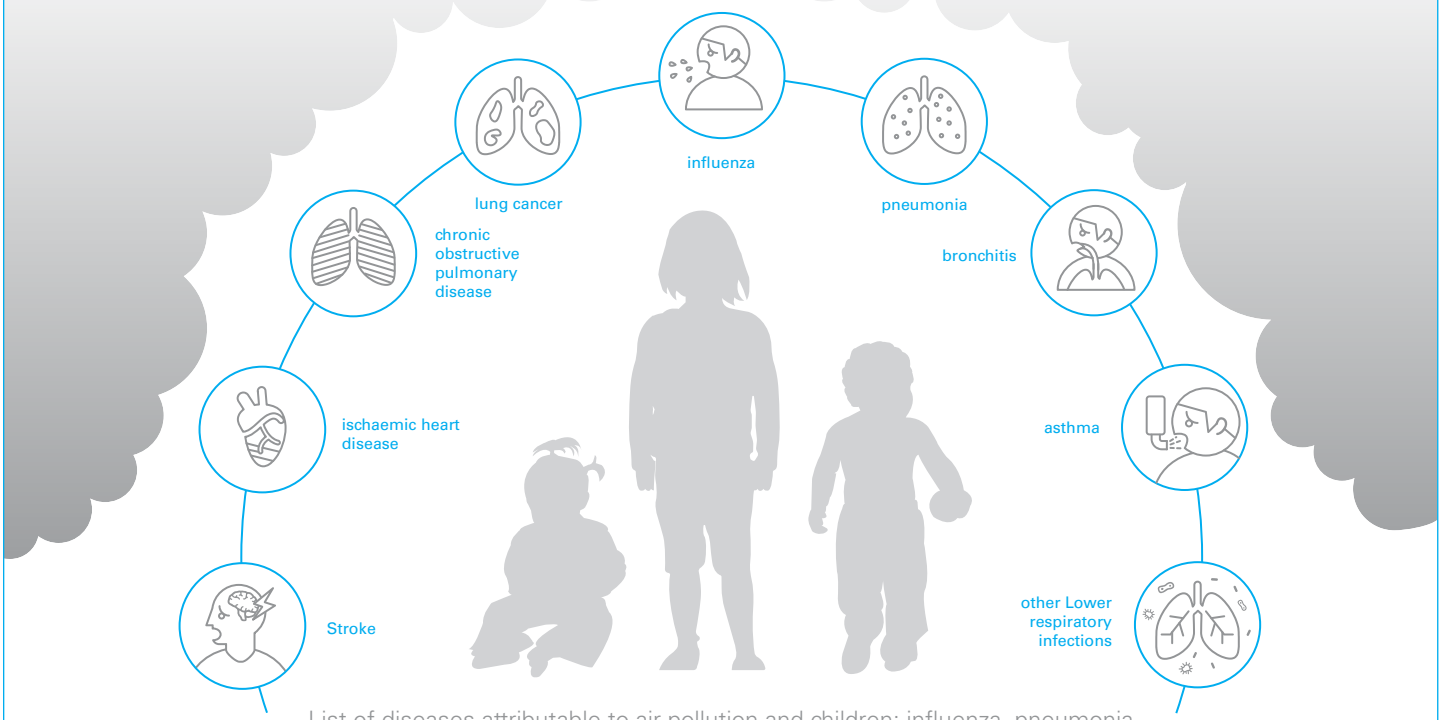
Cost MNT ('000)	2012	2013	2014	2015	2016
Total Pop.	12,710,537	12,923,606	15,737,691	12,306,503	18,442,278
0-18 year olds	6,043,414	5,984,436	8,435,229	6,018,945	10,456,721

In 2016, air pollution-related in children (0–18) cost public health services in Ulaanbaatar **MNT 10.4 billion (USD 4.8 million)**.

73747: 15% of children in Ulaanbaatar are involved

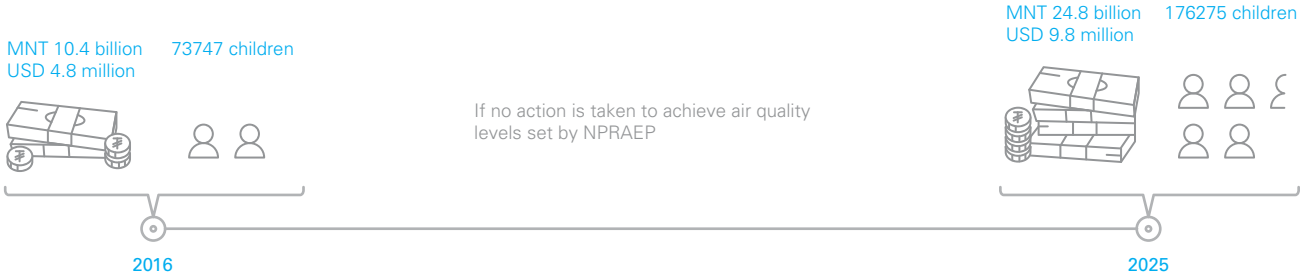


amount spent
USD 4.8 million



List of diseases attributable to air pollution and children: influenza, pneumonia, bronchitis, asthma, other Lower respiratory infections.

Cost of Inaction: The economic burden of air pollution on Ulaanbaatar's health services related to children aged 0–18 years is expected to reach **MNT 24.8 billion (USD 9.8 million)** by 2025.



would place an additional burden worth about MNT 3.9 billion (USD1.3 million) on these facilities from 2021 onwards, compared to a scenario where effective measures are taken against air pollution. Over the same period, in-patient departments of tertiary hospitals would incur an annual additional cost of approximately MNT 700 million (USD 227,927). By contrast, the additional burden put on outpatient services (including Family Health Centres (FHCs)) is of a much smaller magnitude.

FIGURE 3

Air pollution-attributable economic burden to Ulaanbaatar health services, population 0–18 years.

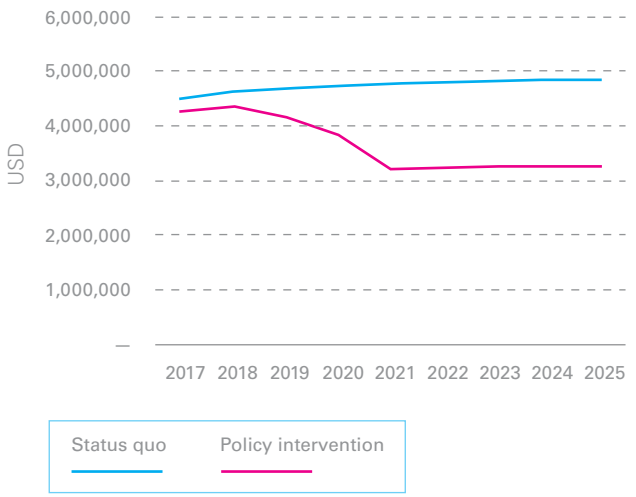


FIGURE 4

Cost of inaction against air pollution in Ulaanbaatar, by population group (Ulaanbaatar health system costs only)

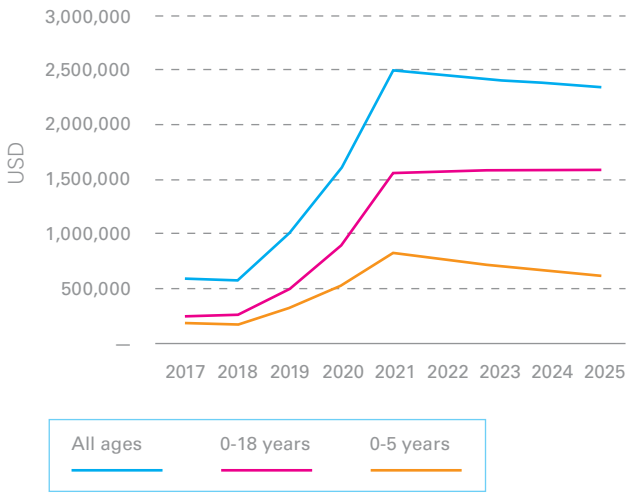
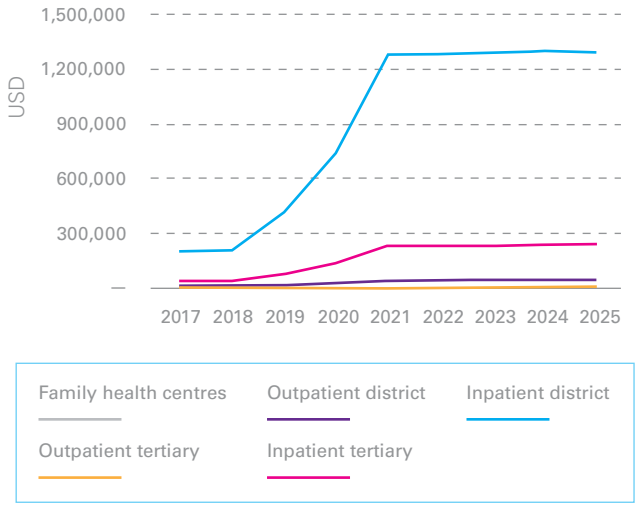


FIGURE 5

Cost of inaction against air pollution in Ulaanbaatar by service delivery level, population 0–18 years.



3.2 Accounting for value of lost productivity of carers

Despite the focus on direct costs, in this report we appreciate the value of some indirect costs which can be robustly measured. Of particular relevance to this study is the cost associated with the value of lost productivity of parents or carers looking after sick children. When taking this indirect cost of air pollution exposure into account, our cost estimates escalate dramatically – both for current as well as future costs. As can be seen in Table 5 below, when including indirect costs associated with loss of productivity of carer parents, the total cost of air pollution-induced diseases increases to MNT 19.6 billion (USD 9 million) in 2016 – equivalent to 2.9% of the MoH total executed budget for that year and 8.7% of all funds spent by health facilities in Ulaanbaatar.

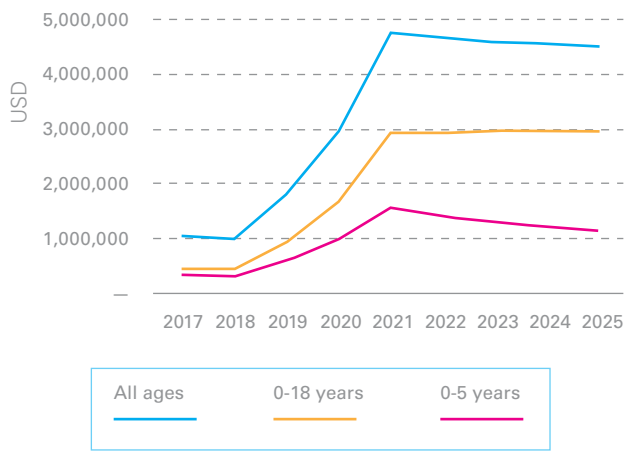
When accounting for the value of lost productivity of carers, the total cost of inaction over the 2017–2025 interval becomes MNT 46.6 billion (USD 18.4 million) for the 0–18-year-olds – nearly double the estimated direct costs. On an annual basis, the total (direct and indirect) cost of inaction for this population group would be approximately MNT 9 billion (USD 3 million) from 2021 onwards, representing more than half of the total economic burden calculated for the entire Ulaanbaatar population (Figure 6).

Table 5 - Total Costs of Air Pollution Induced Diseases on Children 0-18 (Direct and Indirect)

MNT ('000)	2012	2013	2014	2015	2016
Total Costs	11,361,618	11,250,740	15,858,231	11,315,617	19,658,635

FIGURE 6

Total cost of inaction against air pollution in Ulaanbaatar (direct and indirect costs)



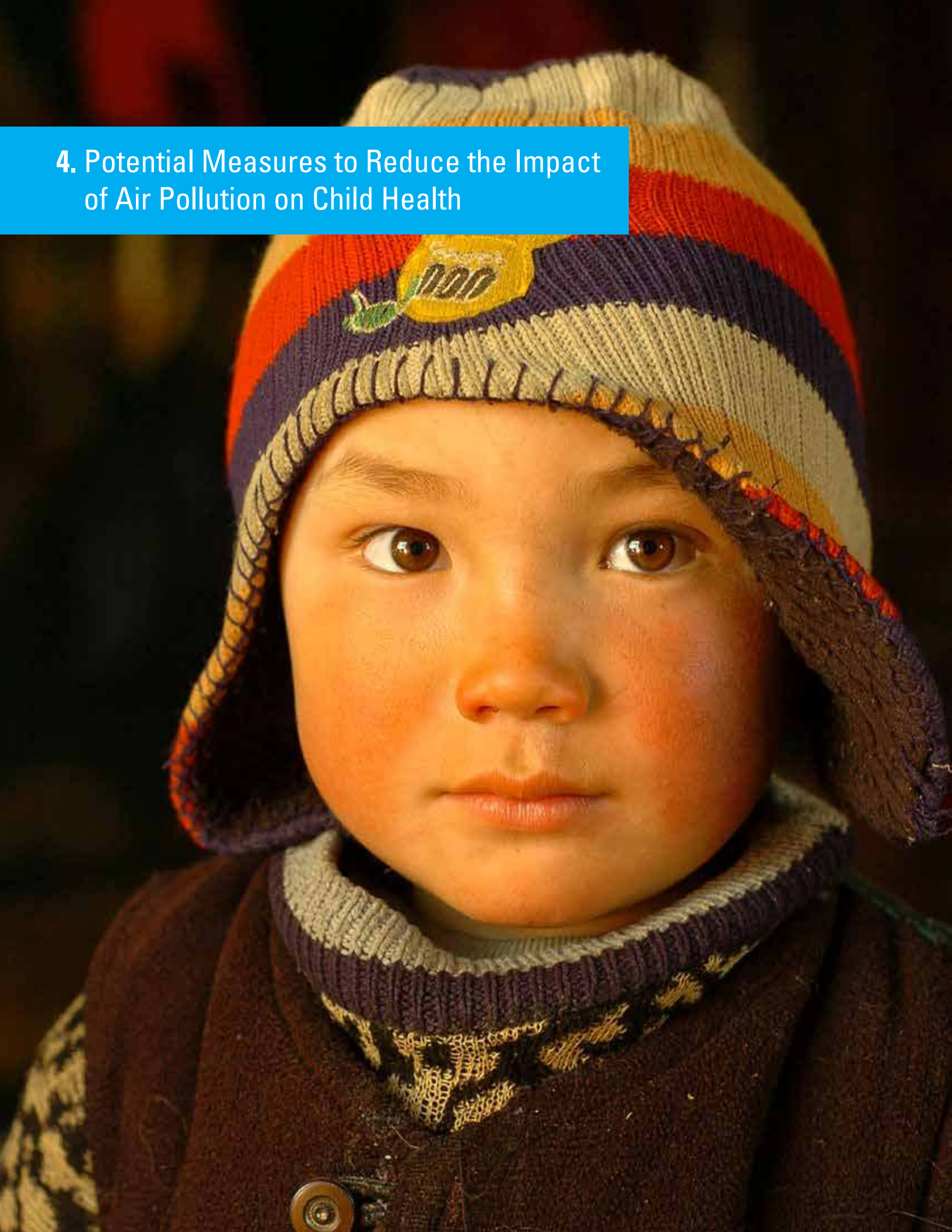
3.3 Other indirect costs

Despite this conservative and pragmatic approach to health cost measurement, there is something to be said about the indirect costs brought about by missed school days. There is ample literature estimating the economic returns of schooling. For example, Montenegro and Patrinos (2014)[31] conducted a global analysis of economic returns to schooling based on more than 800 surveys and produced estimates for 139 economies. For Mongolia, they estimated that, on average, an additional year of schooling is associated with a 9.1% increase in future income. The respective returns of completing primary, secondary and tertiary education were 13.4%, 4.2% and 10.1%, respectively, all close to averages for the East Asia region. There is also evidence, most of it from high-income countries, that chronic school absenteeism (defined as missing more than 10% of school days in an academic year) increases the chances of school dropout, consequently affecting future individual earnings[32]. Establishing a link between the number of school days missed, the probability of failing to complete a school year/ an educational cycle, and future earnings in Mongolia would in theory allow an estimation of the future indirect cost of missed schooling in Ulaanbaatar. However, this analysis examines a mid-term interval of only eight years, in line with the horizon of the air pollution reduction plan, and it is unlikely that one would be able to meaningfully capture the magnitude of such effects. Furthermore, we could not identify Mongolian-specific data linking the number of missed school days with the probability of academic failure.

While this is a limitation of the analysis, similar analyses examining the economic burden of air pollution or respiratory disease (beyond those ones that are particular to Mongolia) have also restricted indirect costs to quantifying the value of lost productivity. For example, the report of the Royal College of Physicians (2016),[33] which evaluated the long-term impacts of air pollution in the UK, included as indirect costs 'lost working days', 'restricted activity days' and 'asthma symptom days in children'.

Finally, it is important to acknowledge that it is beyond the scope of this study to conduct a normative costing exercise estimating the gap between the current economic burden of air pollution-related diseases in Ulaanbaatar and the economic burden in a scenario where both air pollution drops and quality of care in public health facilities improves. While several areas of potential improvement in the organisation and delivery of health services were identified by the team during the field visits and the desk review, estimating the cost of implementing such improvements, and their likely health impacts, would take up much more resources than were available for this exercise.

4. Potential Measures to Reduce the Impact of Air Pollution on Child Health



Based on the existing plans and programmes to reduce air pollution in Ulaanbaatar as articulated in the NPRAEP, it is clear that only in the medium term a significant improvement in air quality can be expected[34]. Meanwhile, every year thousands of children and pregnancies will continue to be at high risk. It is thus essential that government and other stakeholders also urgently increase actions to protect children's health and pregnancies to the extent reasonably possible.

In this chapter, a number of potential interventions will be discussed that may alleviate the impact of air pollution on child health in the short run, while the NPRAEP is being implemented. The potential interventions for discussion have been selected based on a literature review and stakeholder consultations.

4.1 Public outreach campaign

Whilst there is increasing concern from the public about the health implications of air pollution, there is still much to do to further inform the public about the health risks and possible measures they can take to reduce these risks. It is thus recommended to develop and implement a comprehensive and multi-year public outreach campaign. Messages would need to cover, at a minimum, the following:

- Explaining the impacts of air pollution on health, with a focus on children and pregnancy;
- Information about protective measures such as air purifiers and face masks;
- The use of cleaner technology and fuels for heating, combined with better insulation;
- The importance of vaccinating children with the pneumococcal vaccine;
- Guidance to parents and care givers about early recognition of respiratory problems among young children;
- The importance of exclusive breastfeeding for infants and healthy food habits for children to strengthen their overall health;
- Explaining the importance of monitoring foetal growth and avoiding exposure to air pollution during pregnancy.

To underpin the campaign, it will be important to continue to strengthen the evidence base around child health, pregnancy results and air pollution.

The target group for this campaign would be children aged 5–18, parents of children below the age of five, and pregnant women. The total number of people to be targeted (including one parent per child under the age of five and an average of 31,000 pregnant women in Ulaanbaatar every winter) would therefore equate to about 440,000 individuals in Ulaanbaatar.

4.2 Roll-out of the Pneumococcal Vaccine in Ulaanbaatar

Rolling out the 13-valent pneumococcal vaccine (PCV13) would have an immediate effect on the health of children exposed to air pollution as it protects against invasive pneumococcal disease, pneumonia and inflammation of the middle-ear (acute otitis media) from S. pneumoniae[35]. In line with WHO recommendations, the GoM has committed to including this vaccine in its Expanded Program on Immunisation in a 2+1 schedule (three primary doses at two, four and nine[36] months of age, without a booster dose). Recently, the GoM has included the roll-out of the PCV13 in its 2018 budget proposal as part of its actions to address air pollution. However, the PCV13 is not yet part of the National Immunisation Programme's budget. It is recommended that the MoH includes the PCV13 in its national mandatory immunisation schedule for children and, as a result, that it includes it in the Immunisation Programme's budget. This would ensure continuity of roll-out of the vaccine in subsequent years.

4.3 Improving indoor air quality in public kindergartens, schools and hospitals

Children spend a considerable amount of time in public facilities like kindergartens, schools and hospitals. Considering the high levels of ambient air pollution in the city, it is no surprise that high levels of indoor air pollution in such facilities have been reported as well.[37] There is thus an urgent need to develop and pilot a holistic approach to improve the indoor air quality in these facilities. Doing so will likely significantly reduce children's exposure to air pollution and ultimately can reduce the health problems associated with such exposure[38].

Common air pollution related problems with public facilities, especially with the older buildings include but are not necessarily limited to:

- The building envelope is poorly sealed;
- The heating system cannot be regulated well: when it

gets too hot inside, people open the windows;

- As a result, during the cold season this can result in large volumes of polluted air entering the building. It is questionable whether any air purifiers would be able to still keep the indoor air quality acceptable as per Mongolian standards;
- Oftentimes older buildings are poorly insulated. Especially when these rely on their own boilers or stoves for heating, this is directly contributing to excessive use of coal and thus air pollution on the premises and neighbourhood;
- Overcrowding of facilities contributes to poor indoor air quality as well.

Recommendations:

- Undertake a rapid assessment of indoor air pollution levels in kindergartens, schools and hospitals;
- Design and pilot a comprehensive indoor air quality management approach for existing and to be built kindergartens, schools and hospitals;
- Monitor the performance of the pilots, both in terms of indoor air quality and child related parameters such as school attendance;
- Subject to good performance of the piloting phase, the costing of introducing and managing a comprehensive indoor air quality management approach for kindergartens, schools and hospitals should be considered, prioritizing facilities that are located in the areas most affected by air pollution. This should also include costing of capacity development for government staff and facility users.
- When government plans to establish new kindergartens, schools and hospitals, it should consider including costs for insulation and a comprehensive indoor air quality management approach in the total capital budget allocation.

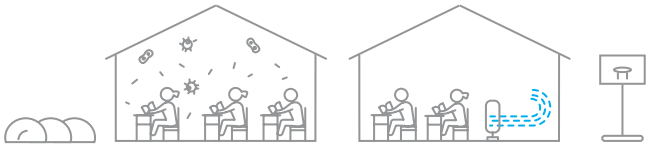
Kindergartens:

There are **216** public kindergartens in Ulaanbaatar, catering to **76,982** children.

Out of a total of **1714** classrooms, about **1000** are said to have an air purifier but it is unknown whether this has resulted in a significant improvement in air quality in these classrooms.

Schools:

There are **131** public schools in Ulaanbaatar, catering to **208,281** Children.



Out of a total of **6070** classrooms, it is unknown how many have an air purifier.

Public hospitals:

In Ulaanbaatar, there are **13** tertiary hospitals, **12** district hospitals, **3** maternity hospitals and **137** family healthcare centres.

Stakeholder interviews indicated that during the winter months, hospitals are unable to cope with the increased number of in-patient children, resulting in children being accommodated in rooms not normally allocated to children and in hospital corridors. Since clean air is not only of importance to hospitalized children but also many other patients, it is advised to consider promoting a comprehensive indoor air quality management approach in all hospitals, for all patients.

4.4 The use of face-masks during the cold season

The Ulaanbaatar City Governor's Office has already started an initiative to distribute HEPA face masks among the residents of Ulaanbaatar. Also, concerned citizens who can afford it are purchasing face masks to reduce their exposure to PM2.5 when they are outside.

It should be noted that there are uncertainties about the effectiveness of HEPA face-masks. Recent studies identify benefits in the usage of face-masks but also challenges and limitations. According to a recent study, certified N95/N99 masks are the only face-masks that actually protect against PM2.5, if properly used[39]. Furthermore, all these masks exclusively filter airborne particles. In other words, they do not filter all toxic gases[40].

It is unclear to what extent these masks effectively reduce exposure to ultrafine particles (PM < 0.1), which may be among the most harmful because these can enter the bloodstream and pass the placental barrier. In addition to these arguments, Peltier adds that using face-masks could actually have a counterproductive effect as 'users do not avoid high concentration environments because they assume they are protected from these contaminants'[41]. While the debate on the effectiveness of these masks is still unfolding, the one issue that all researchers agree is that if face-masks are to have any protective effect, they need to fit and be worn properly, ensuring that all air inhaled goes through the filters.

Recommendations:

- Develop an advisory note on measures people can take to reduce exposure to air pollution outside, including the proper use of good quality and well-fitted masks;
- Consider the provision of such masks free of charge to the most vulnerable in the communities that are faced with the highest levels of air pollution;
- A review of the effectiveness of face masks is also urgently needed.

4.5 Other possible interventions to be assessed

During interviews taking place in 2017, various stakeholders suggested various other possible measures as well:

Introduction of a pregnancy package

According to recent scientific literature[42] the developing foetus and young child are particularly vulnerable to the many adverse effects of toxic air pollutants. In fact, exposure to air pollution during the pregnancy is associated with 'low or reduced birth weight, small size for gestational age, preterm and stillbirth'[43]. Research suggests that prenatal exposure to high levels of air pollution affects childhood mental health. This can increase the risk of such conditions as attention deficit hyperactivity disorder, symptoms of anxiety, depression and inattention, and behavioural disorders. Studies show that these conditions inhibit the development of a child's self-regulating behaviours and social competency[44]. Levels of air pollution in Ulaanbaatar are likely to be causing significant health complications for pregnant mothers and, especially, children in the prenatal and neonatal stages. Consideration should thus be given to introducing a pregnancy package for pregnant mothers in Ulaanbaatar that live in the poorest households containing an HEPA filter, air quality monitoring device, adequate face-masks, as well as a manual with recommendations on how they can best avoid exposure during these critical phases of the development of their child. It is thus recommended that a thorough analysis will be undertaken regarding the feasibility, sustainability and likely positive impact of such an intervention.

Continued provision of free medicines

During the winter months of 2016/2017 the GoM provided free medicines for children suffering from respiratory diseases. While this initiative was appreciated by interviewed stakeholders, there were also concerns regarding the sustainability and suitability of this measure. The intervention suffered from some shortcomings, which hampered its success. Concerns were voiced surrounding the timing and duration, the sustainability of the intervention, the suitability and quality of the medicines selected, equitable access to the free medicines included in the package, and control over the number of prescriptions provided to patients. As a result, the stakeholders interviewed would welcome the repetition of this measure provided there is an improvement in the design and delivery mechanisms for this intervention. The list of medicines which was provided for free needs revision to ensure their quality and suitability; the number of dispensaries which provide such medicines for free need to be expanded; and there needs to be more control over who has access to these medicines. It is recommended that further analysis

will be conducted on the cost-effectiveness of this intervention, and what can be done to overcome the challenges faced in 2016/2017. This intervention can serve as a beneficial complement to the roll-out of the PCV as it may lead to a reduction in hospital admissions provided the medicines given are of good-quality and follow WHO standards, as per the Integrated Management of Childhood Illnesses.

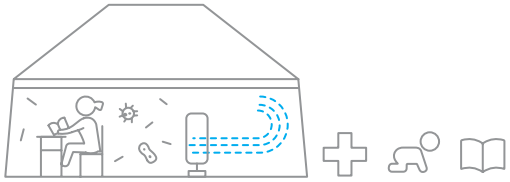
Systematic improvement of clinical guidelines

In interviews with stakeholders from both the MoH and health facilities, staff mentioned the need to improve clinical guidelines in a systematic fashion. While clinical guidelines are in place at the moment, they are not being enforced. As a result, for example, the prescription of antibiotics in cases where such medicines are not required is on the rise, which may lead to a decrease in their effectiveness in the medium term. It is thus recommended to undertake a deeper analysis of the challenges with regard to the implementation of the clinical guidelines.

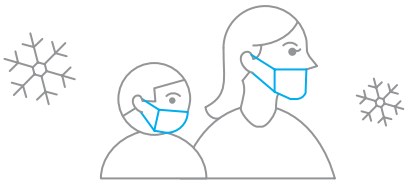
Finally, it is recommended that the capacity of the healthcare facilities to provide adequate and affordable care to children affected by air pollution be assessed and public health workers trained to provide proper antenatal, neonatal and postnatal child care in a context of high levels of air pollution.

Potential interventions to protect children from air pollution

Vaccination of all new-born children in Ulaanbaatar with 13-valent PCV and include PCV in the national immunisation schedule of Mongolia and the relevant budget for the National Immunisation Programme of the Ministry of Health (MoH).



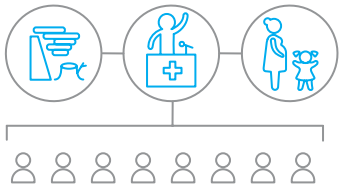
Develop and implement a comprehensive indoor air quality management approach for kindergartens, schools and hospitals through a combination of technical and behavior change interventions.



* Develop an advisory note on measures people can take to reduce exposure to air pollution outside, including the proper use of good quality and well-fitted masks;

* Consider the provision of such masks free of charge to the most vulnerable in the communities that are faced with the highest levels of air pollution.

* Review the effectiveness of face masks.



Public outreach campaign to raise awareness of the dangers of exposure to air pollution (with a focus on pregnant women and young children) and measures people can take to protect their health and reduce air pollution.

5. Funding Public Expenditure on Interventions

The above sections clearly demonstrate the need for immediate action to address the impact of air pollution on child health. It is thus important to determine to what extent the GoM can afford to invest in measures to better protect children's health, based on its current available budgetary space.

5.1 Macro-fiscal context

Economic activity in Mongolia has been weak in recent years. GDP growth slowed from almost 8% in 2014 to 1% in 2016. Revenues from mining have declined significantly since its peak years, due to a global fall in commodity prices. Non-mining growth is largely led by the construction sector and fiscal spending, and has not yet achieved a sustainable level of growth. In turn, private consumption is weak and inflation reached a historical low in 2016, despite substantial depreciation of the Mongolian MNT in 2016.

The country's fiscal position is weak overall. The deficit reached 17% of GDP in 2016 – twice the level of 2015 - due to a sharp fall in revenues, higher interest payments, pre-election spending programmes, clearance of arrears on infrastructure spending, and a judicial settlement with a mining company. The large fiscal deficit and the depreciation of the currency pushed general debt up from 55% of GDP in 2015 to nearly 70% in 2016.

After decreasing significantly in the past years, exports recovered mildly due to improved commodity prices and a pickup in coal exports. At the same time, imports were weak, reflecting the weak economy, and the trade balance stayed in surplus. The overall current account, however, registered a deficit of around 4% of GDP in 2016 and the MNT is under substantial pressure, depreciating by more than 25% in the same year. Gross reserves were broadly stable at USD 1.3 million, supported by the issue of a USD 500 million sovereign bond, the contracting of a USD 250 million international syndicated loan, and drawings under the People's Bank of China swap line[45].

The medium-term outlook could improve provided the authorities maintain fiscal discipline. Continuation of the policies of the past years would lead to continued stagnation and an unsustainable build-up of debt. The ongoing IMF supported programme advocates strengthening of policies by the new authorities and fiscal consolidation. Under these conditions, the GoM's public spending will have to be contained to a minimum until public finances are stabilised.

5.2 Challenges in budgeting

Although the MoF has implemented a number of important reforms over the last year, some ministries still experience challenges in their budgeting processes. As the GoM will be undertaking strict measures to maintain fiscal discipline, addressing these challenges throughout the budget cycle can result in more efficient utilisation of available funds. Some of these challenges are outlined in the figure below.

These systemic challenges are faced by the MoH specifically and the GoM more broadly. They impact on the GoM's ability to deliver services effectively. Where applicable, we will try to recommend changes to help overcome such challenges. A more efficient PFM system could help reduce transaction costs and potentially increase the budgetary space available to the MoH.

FIGURE 7

Challenges faced by Mongolia's public financial management (PFM) system

Planning

- Annual and multi-annual planning documents are not aligned with the Medium-Term Fiscal Framework.
- As a result, sector plans (such as the health sector plan) are not informed by the fiscal constraints, undermining the credibility of such plans.

Budget Preparation

- Ministries do not strictly follow the budget circular developed by the MoF and they fail to abide by the budget ceilings.
- As ministries expect, on average, a cut of 20% to their budget, they submit budget proposals that are inflated by about 20%.
- Such actions undermine the use of budget celings in order to have clearly defined spending priorities.

Budget Implementation

- Due to a challenging economic environment, cash management is largely based on expenditure controls and cash rationing, resulting in budgets being executed based on a monthly allotment budget schedule that established expenditure limits as means of internal controls.
- This practice undermines predictability in the flow of funds to ministries and impacts on service delivery and contributes to arrears.
- FHCs have few payroll checks and controls to ensure consistency. As payroll is calculated based on budgeted positions and not actual positions, this results in inconsistencies between payroll and personnel records.
- Health facilities are increasingly reporting an increase in arrears that are accumulated until a threshold is reached, before being resolved by the MoF.

Monitoring, Reporting and Auditing

- Due to inconsistencies between the Chart of Accounts used for budget planning and budget execution, the quality of monitoring reports could be improved.
- A fixed schedule for internal audit reporting would improve ministries' ability to utilise such reports for in-year decision making.
- The lack of a comprehensive quality of service delivery review, in for example the health sector, undermines the assessment of whether financial resources are sufficient to deliver quality services.

5.3 Expenditure review

Any interventions planned to address the impact of air pollution on child health must be seen within the context of both the GoM's capacity to spend allocated funds and the wider public expenditure environment and its priorities. This becomes particularly critical within Mongolia's current constrained fiscal environment, as highlighted in the previous section and as evidenced by the signing of an agreement between the GoM and the IMF requiring the adoption of fiscal austerity measures to reduce public spending. This section therefore analyses trends in nominal and real budget allocations for the whole of government and for the MoH in more detail.

The main question to be answered is: based on current government budget allocation and execution, can the GoM afford to introduce interventions to reduce the impacts of air pollution on children's health? The public expenditure review section is informed by the costing of action/inaction that was conducted. The previous section therefore provides a framework within which to analyse the recurrent and development expenditure that is currently undertaken by the relevant stakeholders and to inform thinking of future budget allocations that will be needed.

In the following subsections, budgetary analyses are provided focusing on under-executing expenditure items within the development and recurrent budgets to illustrate if there is budgetary space available to fund potential interventions to reduce the exposure of children to air pollution and thus the health impacts on children.

5.4 Underspending MDAs

In general, execution rates for expenditure are high for the GoM as a whole. However, some MDAs have a higher level of underspent recurrent funds than others. According to total budget execution data from 2012–2016, the Cabinet Secretariat Office and the National Statistics Office have consistently underspent their budget allocations.

As listed in Table 7, the value of combined underspent funds by these MDAs is relatively small to cover costs of potential interventions.

Recurrent expenditure

Although the combined value of underspent recurrent funds by all MDAs in 2016 is relatively high at MNT 181.3 billion, no single MDA has demonstrated consistent under-execution of their recurrent budget over the past years. This means it would be difficult for the GoM to identify one single MDA for recurrent budget reprioritisation based on its previous execution rate. This suggests that if the GoM launched a government-wide effort to fund interventions aimed at reducing the impacts of air pollution exposure on children using under-executed recurrent expenditure, it would have to reallocate recurrent budgets from all MDAs based on criteria other than execution rates alone. That said, initiatives that require such a high degree of inter-ministerial coordination are often complex and difficult to achieve. An alternative to this is to look at capital budget expenditure across MDAs.

Capital expenditure

In contrast to the recurrent budget, the capital budget across all MDAs has been overspent by MNT 14.9 billion in 2016. This means that, overall, the GoM executed more than its allocated budget for capital expenditure in 2016. When reviewing trends in capital budget execution by MDA, however, analysis shows that three ministries are consistently underspending their capital budgets, namely the MoECSS, the MoF, and the MoET.

The combined value of underspent capital budget funds by these ministries in 2016 amounted to MNT 64.4 billion. Reallocating funds from the capital budgets of these ministries, however, would require an extensive analysis to determine whether such funds are underspent, or in fact are due to project delays on ongoing projects. Furthermore, reallocating funds from these MDAs would require considerable political will across government. In the following sections, this report sets out to examine whether there is sufficient budgetary space within MDAs whose mandate is directly related to air pollution and its impact on child health.

Table 6 - Execution rate of selected budgetary entities

Execution rate (%)	2012	2013	2014	2015	2016
Cabinet Secretariat Office	88%	84%	92%	81%	77%
National Statistics Office	127%	80%	76%	-	84%
Combined underspent funds (MNT million)	4,259	6,023	4,172	2,838	4,948

Table 7 - Capital budget execution rates of selected MDAs and combined underspent funds

Execution rate (%)	2012	2013	2014	2015	2016
MoECSS	68%	53%	66%	73%	87%
MoF	48%	51%	96%	70%	45%
MoET	64%	91%	79%	33%	48%
Combined underspent capital funds (MNT million)	76,886	77,328	96,359	46,040	64,412

5.5 Under-expenditure by relevant sector MDAs

As identified in the Background section of this report, the ministries most directly involved with reducing air pollution and its impacts on child health are the MoH, MoECSS, MoCUD, and MoET.

Altogether, these ministries received 29% of the GoM's budget in 2016. The majority of the 29% was allocated to the MoECSS and the MoH, receiving 22% and 9% of the total integrated budget, respectively.

Overall, budget allocation to these ministries as a share of the total integrated budget has been on a downward trend since 2013. The MoET in particular, which is responsible for most activities related to reducing air pollution, has seen its budget shrink significantly throughout this period, from 1.2% of the total integrated budget in 2013 to 0.6% in 2016. The MoCUD witnessed a significant reduction to its allocated budget in 2015, with a reduction of 76% of its budget allocation. If the NPRAEP is to be successfully implemented, such trends would need to be reversed and result in increases in budget allocation towards the MoET.

Partly due to the downward trend in budget allocations for these ministries, execution rates have been increasing significantly as ministries attempt to increase the efficiency of their spending. In 2016, the total execution rates of these four ministries were above 90%. The MoET, which typically had lower execution rates in past years, managed to implement 91% of its allocated budget in 2016. While the execution rate of the capital budget of the MoET remained low – at 49% – all other capital and recurrent budgets presented execution rates above 85% in 2016. This suggests

Table 8 - Budget allocation to relevant MDAs

	2013	2014	2015	2016
MoH	463,890	612,282	616,389	672,290
MoET	76,262	70,664	67,742	54,114
MoCUD	160,461	240,733	57,842	65,894
MoECSS	1,040,707	1,307,416	1,100,891	1,338,660
Total integrated budget (MNT million)	6,629,851	7,312,400	7,837,420	9,519,906

that there is limited budgetary space within these ministries to finance additional interventions aimed at reducing the impacts of air pollution exposure on children's health.

Unlike in previous sections which looked at the overall budget across all MDAs, this analysis demonstrates that when the scope of MDAs is reduced to include only those whose mandate is directly linked with air pollution and its impact on child health, there is not sufficient budgetary space to finance potential interventions. In the following sectors, the expenditure trends of the MoH will be examined in greater detail.

Table 9 - Execution rates of selected ministries

		2014	2015	2016
MoH	Total	95%	94%	99%
	Recurrent	97%	103%	99%
	Capital	82%	43%	97%
MoET	Total	84%	75%	91%
	Recurrent	88%	87%	98%
	Capital	57%	33%	49%
MoCUD	Total	92%	116%	100%
	Recurrent	128%	98%	92%
	Capital	81%	100%	103%
MoECSS	Total	92%	93%	93%
	Recurrent	97%	96%	88%
	Capital	72%	74%	97%

5.6 MoH

The MoH is the central agency responsible for budgeting and expenditure management in the health sector. On the basis of instructions from the MoF[46], the MoH provides budget preparation guidelines to all public healthcare providers. In 2016, the MoH budget received 7% of the total State Budget. However, this value is still below the average spent by neighbouring countries and other LMICs in 2016[47]. Furthermore, the MoH budget as a share of GDP is still only 2.8%, below the WHO benchmark of 5% of GDP[48].

Overview

The overall budget of the MoH presents a very high execution rate, reaching 98% in 2016, even after a 9% increase in the approved budget compared to 2015. Absorptive capacity has been significantly higher for the recurrent budget when compared to the capital budget. That said, in 2016 both recurrent and capital budgets had very high execution rates. The execution rate of recurrent expenditure has averaged at around 99% throughout the period 2012–2016, reaching 103% in 2015. For the capital budget, the execution rate has averaged 66% in the period 2012–2016, reaching 97% in 2016. The increase in execution rate for the capital budget is explained by the drastic reduction in the number of capital development projects financed by the MoH in 2016. Although the capital budget increased by 22% in 2016, it has been concentrated on a limited number of projects with high absorption capacity. As a result, while it is fair to say that there was significant

FIGURE 8

Approved and executed budget – MoH

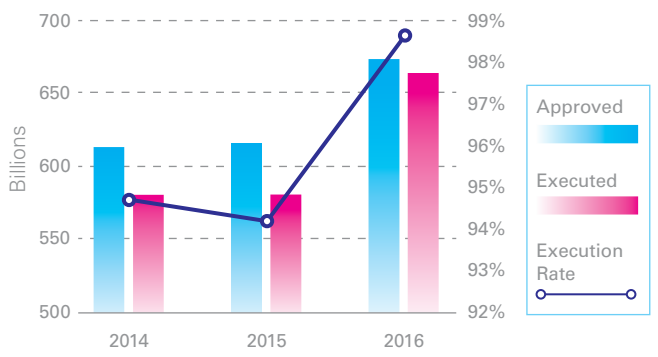


Table 10 - Approved and executed recurrent and capital budget – MoH

	2012	2013	2014	2015	2016
Recurrent budget – MoH					
Approved	365,554	402,936	351,235	526,113	562,162
Executed	350,963	394,120	342,109	541,803	556,201
Execution rate	96%	98%	97%	103%	99%
Budget growth	-	10%	-13%	50%	7%
Capital budget MoH					
Approved	90,041	60,954	132,513	90,276	110,127
Executed	56,881	22,181	116,570	38,877	106,786
Execution rate	63%	36%	88%	43%	97%
Budget growth	-	-32%	117%	117%	22%

budgetary space in capital expenditure within the MoH, this is no longer the case. The GoM's decision to stop the approval of new capital projects will help maintain a high execution rate for capital budget in the upcoming years.

Recurrent budget

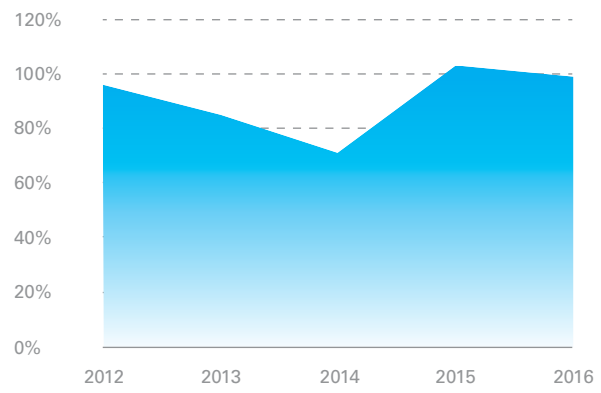
As is evident from the table above, there are weak linkages between the spending capacity of the MoH and the budget allocation it receives annually. This suggests that the MoF does not take spending capacity into consideration when considering budget proposals. This appears to hold true for both recurrent and capital budgets. For instance, in 2014, the recurrent budget allocation to the MoH decreased by 13%, despite its high execution rate of 98% the year before. For the capital budget this tendency is even more marked. In 2014, after having only executed 36% of its allocated funds the year before, the MoH received a 117% increase in its capital budget.

Expenditure on salaries and wages is the largest single item of expenditure in the MoH budget. Salaries and wages accounted for 32% of total spending by the MoH in 2016 – equivalent to 50% of all recurrent expenditure. This number is even higher for health facilities in Ulaanbaatar. Tertiary hospitals in the capital city spent 47% of their total expenditure on salaries and wages in 2016, while districts hospitals in the capital city spent as much as 71% of their total executed expenditure on salaries and wages in 2015, and 67% in 2016.

Despite constituting the largest single expenditure item in the MoH budget, salaries and wages paid to workers are modest. Health workers interviewed during our visit to Mongolia frequently mentioned the low pay associated with working in the health sector. One district hospital manager who was interviewed even mentioned that facilities rely on the use of medical students – at no pay – during winter months when hospitals get crowded[49]. Current salaries and wages are low by Mongolian standards. Even then, the MoH does not have sufficient resources to staff hospitals with the number of staff needed to provide quality healthcare to patients. Both payroll and personnel need to increase for the Mongolian health sector to provide better quality healthcare to its citizens. Adding to this problem, the GoM has decided to freeze public sector workers' salaries for the coming three years, effectively leading to a real reduction in salaries and wages. This has become a particularly contentious issue within the health sector, generating widespread discontent among health sector workers[50]. This combination of factors means that should new funds be available for the MoH, an increase in the salaries and wages of health workers is likely to take priority over other forms of recurrent expenditure. This is particularly important in the context of this report. Capital investments need to be accompanied by a proportional increase in recurrent expenditure to account for maintenance costs associated with the introduction of new equipment. If capital projects are introduced without a proportionate increase in recurrent expenditure, then the added value of these investments declines significantly. The introduction of indoor air quality measures, for instance, necessitates increased spending on goods and services – to account for maintenance, repairsas well as staff hours.

FIGURE 9

Execution rate recurrent expenditure – MoH



The overall execution of recurrent expenditure of the MoH has been consistently high in the period 2012–2016. In 2016, the total value of underspent recurrent funds across the entire recurrent budget amounted to MNT 6 billion. While the overall execution rate of the recurrent budget of the MoH is very high, some line items have exhibited execution rates which average below 85% in the period of 2012–2016. Table 12 below identifies categories of spending within the MoH which a) have execution rates of 85% or below for three or more years between 2012 and 2016, and b) have not witnessed a significant decrease in budget allocation in 2016.

Table 11 - Approved and executed budget of line items

MNT (billion)	2014		2015		2016	
	App.	Exe.	App.	Exe.	App.	Exe.
Bonus	1,628	1,725	16,959	14,374	16,917	14,124
Contractual pay	-	-	1,377	1,353	334	283
Benefit insurance	-	-	1,666	-	1,698	-
Occupational insurance	-	-	2,266	-	2,375	-
Unemployment insurance	-	-	417	-	425	-
Health insurance	-	-	4,170	-	4,246	-
Health and safety items	309	178	279	192	297	246
Guest welcoming expenses	31	17	40	19	-	-
Other common payments	2,487	726	-	-	7,791	3,957
Audit, credit rating and certification fee	163	109	125	65	109	92
Vehicle tax	30	23	54	38	52	43
Vehicle inspection	14	10	16	10	14	11
IT service	445	320	577	383	287	277
Land fee	177	119	147	87	123	111
Bank and financial institution's service fee	77	36	59	14	32	24

As noted above, the total value of total under-executed funds has been modest throughout the past three years. In 2016, this value amounted to roughly MNT 6.8 billion[51]. The value of underspending by the identified line items has been also consistently low. Furthermore, there are various items within the MoH with execution rates well above 100%. Although this is not accounted for in the Integrated Budget Law[52], the execution report of the MoH seems to suggest that funds are being reallocated from under-executed items towards overexecuted items. This narrows the already limited budgetary space available within the MoH's recurrent budget.

While some budgetary space could be created by reprioritising recurrent expenditure from consistently under-executed items towards financing some of the potential interventions, this would unlikely be sufficient to cover cost of significant actions aimed at reducing the child health impact of air pollution. Reallocation of the recurrent budget seems to be already taking place within the MoH, which further reduces the availability of underspent resources.

Capital budget

Execution rates for the capital budget of the MoH have been volatile over the past five years. However, in 2016 the execution rate of capital spending by the MoH was 97%, and is likely to remain high given restrictions on the introduction of new capital projects by the GoM. Overall, the MoH underspent MNT 3.8 billion of its capital budget in 2016. Similarly to the previous paragraph, which analysed underexecution of the MoH's recurrent budget, specific projects were identified which have execution rates below 85% to assess how much budgetary space there is for fund reallocation within the capital budget.

As can be seen in Table 12, the value of underspent funds within the MoH's capital budget decreased significantly in 2016. If the current trend in high execution of capital projects continues, which is likely, the amount of annually underspent funds will decrease even further. This will make it more difficult to use reallocation of funds from the MoH's capital budget to finance potential interventions.

As execution rates are used as a proxy for identifying projects/line items which could have their funds reallocated, the focus should be on multi-annual projects[53]. However, capital projects carried out by the MoH have short life-spans, with the vast majority of them lasting no more than two years. As can be seen in Table 13, there were however only five multi-annual capital projects with execution rates below 85% in 2016.

Assuming this trend continues, the value of under-executed funds within the MoH's capital budget which could be reallocated is likely to become insignificant. It is fair to assume that, at this stage and in the upcoming years, it is highly unlikely that there will be sufficient budgetary space within the MoH's capital budget for reallocation towards potential interventions aimed at reducing the impact of air pollution on children's health.

Table 12 - Projects with underspent capital budgets, MoH

MNT (million)	Number of projects below 85%	Value of underspent funds
2012	19	8,283.4
2013	39	21,549.1
2014	27	27,376.9
2015	41	15,815.1
2016	5	3,770.3

Table 13 - Execution rate and underspent funds by capital project

MNT (billion)	2014		2015		2016	
Name of project	Execution rate	Underspent funds	Execution rate	Underspent funds	Execution rate	Underspent funds
Maternity Hospital I	83%	867.5	48%	1,012.7		
Maternity Hospital II	0%	75.1	67%	165.6		
Soum Health Centre I	0%	580	66%	182.6		
Soum Health Centre II	0%	600	0%	262.7		
Capital Repair of Ulaan-baatar Health Organisations	81%	584.3	36%	271.56		
District Sports Complex	0%	1080	56%	478.9		
Infectious Diseases			7%	1,275	70%	106
Equipment for the National Centre for Traumatology			74%	726.4	54%	244
Child medical equipment			0%	1,200	38%	1,359
National Centre for Pathology			0%	304,8	80%	61
National Diagnostic and Treatment Centre	-	-	-	-	0%	2,000
Total		3786.9		5880.22		3,770

Funding potential measures

As is apparent from these paragraphs, while there is sufficient budgetary space overall within the MoH, the viability of reallocating funds from the capital budget is questionable. After identifying budgetary line items and capital projects that have had execution rates below 85% regularly over the past years, and which have not experienced significant budget decreases, the total amount of funds under-executed by the MoH in 2016[54] amounts to MNT 10.6 billion. The GoM can therefore not rely exclusively on reallocation of funds within the MoH to finance some additional interventions. Instead, it would have to rely on unspent budgets from other MDAs or funds made available for the implementation of the NPRAEP, or external financing from donors.

The value of consistently underperforming recurrent budget line items in the MoH in 2016 amounted to 6.8 billion, which could be used to implement some air pollution interventions to protect children's health if adequately prioritized. Assuming recurrent under-expenditure does not decrease dramatically in the coming years, the MoH could finance some low cost interventions from its own recurrent budget.

Although the GoM is already funding the roll-out of the PCV in 2018, the vaccine is not yet included in the National Immunisation Schedule. It is crucial that the roll-out of the PCV vaccine is not done as an ad hoc intervention but is continued in the coming years as air pollution levels worsen. For this to happen, the MoH has to make sure it includes the PCV in its national immunisation schedule.

Health facilities in Ulaanbaatar

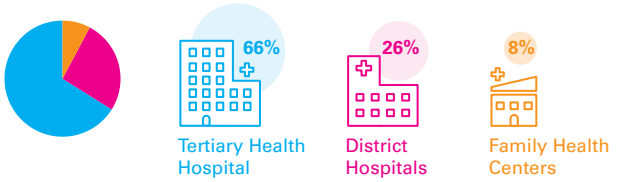
Spending by facility per capita expenditure in healthcare facilities in Ulaanbaatar is MNT 161,916 (USD 64.8) – the highest in the country. Out of all health facilities in Ulaanbaatar, tertiary hospitals receive the largest share of general government health expenditure (GGHE)[55]. In 2016, tertiary health facilities received 66% of all public health spending, compared with 26% for district hospitals and 8% for FHCs (Figure 10). FHCs also received the smallest increase in budget allocation between 2015 and 2016, when compared to other health facility types – 5%, compared with 20% for tertiary health facilities and 13% for district health facilities. That said, the percentage of annual budget increases for FHCs in Ulaanbaatar has grown significantly since 2012 – with the exception of 2015. FHCs in Ulaanbaatar saw their budget increase by 14% in 2013 and by 28% in 2014, suggesting increased investment in primary healthcare by the MoH. Increased allocations, and spending on FHCs and district hospitals in particular, will facilitate addressing the impact of air pollution on child health, as these are the first points of contact for children affected by air pollution-induced illnesses. Investing in FHCs' ability to treat air pollution-induced diseases minimises the chances of disease progression to serious levels which require specialised care. The GoM is committed to a gradual increase in budget allocations towards primary care as a percentage of the total GGHE. It is crucial that this trend is accelerated to strengthen the emergence of a preventative healthcare system. A continued and strengthened prioritisation of budget allocations to primary healthcare services to foster a preventative healthcare system would ultimately reduce the number of patients requiring specialised care, leading to a reduction in GGHE, as well as improved welfare of patients.

Sources of financing

Health facilities in Ulaanbaatar have three main sources of financing, namely: the State Budget, Social Health Insurance and own revenue. The major provider of funds towards all health facilities in Ulaanbaatar is the State Budget, which finances 52% of all expenses incurred by health facilities in the city in 2016. The Social Health Insurance financed 42% of all operations and own revenue generated by secondary and tertiary health facilities contributed towards 6% of all expenses incurred by health facilities. Different sources of financing use different methods for funds disbursement, which causes disruptions in the smooth functioning of the health facilities in Ulaanbaatar. State Budget contributions

FIGURE 10

Public Health Expenditure by Health Facility Type



are made on an input basis, whereas the SHIF provides output-based financing. This hampers health facility managers' ability to plan spending in advance in a rigorous fashion. Alignment of the fund disbursement methodology between the different sources would significantly improve the ability of health facilities to deliver according to a pre-established plan. The distribution of funds is also not even across health facility types. In 2016, tertiary health facilities in Ulaanbaatar received 49% of their funding from the Social Health Insurance, followed by 43% from the State Budget and 8% from own revenue. District health facilities, in turn, received 52% of their funding from the SHIF, followed by the State Budget – at 46% – and the remaining 2% was financed by own revenue. Compared to the previous year, there has been a marked increase in SHIF contributions towards expenditure of tertiary health facilities – from 36% in 2015 to 43% in 2016.

Predictability in flow of funds to hospital facilities

Although the MoH suffers from occasional delays in the transfer of monthly allotments from the MoF, according to the Public Expenditure and Financial Accountability Assessment 2016 health facilities in Ulaanbaatar receive their allotments in a timely fashion. This suggests that the MoH prioritises timely transfer of funds to health facilities over other expenditure items. That said, during an interview with a health worker in Ulaanbaatar, delays in the transfer of funds to health facilities was flagged as a concern. This could mean that since the economic crisis in Mongolia, the MoH may be facing added difficulties in transferring the funds to health facilities in a timely fashion. At the moment, health facilities are accumulating arrears, which, according to an interviewed stakeholder, will be resolved by the MoF when their cumulative value reaches a certain threshold. Delayed transfers during winter months can significantly worsen the situation of children affected by air pollution-induced diseases who are not able to get the healthcare they need. It is, therefore, crucial that the MoF prioritises budget releases

to health facilities in Ulaanbaatar during the winter months to ensure service delivery that meets increased demand from patients.

Accountability and autonomy of health facilities

At the forefront of service delivery, health facilities are expected to be accountable for timely delivery of quality services. An autonomous facility can manage available resources diligently and seek additional resources proactively, instead of waiting for support passively. However, Mongolia's healthcare system is still very centralised. Health facilities have very limited managerial autonomy and do not play a significant role in the formulation of the annual budget. Instead, budget planning is done centrally by the MoH and funds are channelled to health facilities, with guidance on a line item basis, providing very little margin for transfer of funds across expenditure items. Granting increased managerial responsibilities to health facilities has the potential to improve these facilities' ability to deal with the upsurge in demand for healthcare witnessed during winter months. However, this is a process that has to be done gradually and under strict supervision of the MoH.

Service provision

Healthcare facilities in Ulaanbaatar receive a significant share of total public health expenditure in Mongolia. One-third of the MoH's entire annual budget in both 2015 and 2016 was spent in tertiary, district and primary health facilities in Ulaanbaatar alone, which incur no capital expenses. These facilities face serious financial constraints, which hamper their ability to deliver quality services to their patients[56]. This is particularly true during winter months, when FHCs and district hospitals in Ulaanbaatar are filled beyond their capacity. The impact of air pollution on health is well noted by health workers across all levels of healthcare facilities, which record an increasing number of visits due to respiratory diseases during the winter months. At one district hospital for children in the ger area – Songinokharikhan District Hospital – where an interview was carried out, stakeholders indicated that during winter months 90% of visitors to the hospital have respiratory diseases, but they are only able to admit 30% of these. 70% of those 30% are diagnosed with pneumonia. Despite having only 165 beds, during winter months this hospital takes in as many as 300 children, which requires the use of undesignated spaces and folding beds to accommodate them[57].

Under-executed budgets

The volume of underspent funds across healthcare facilities in Ulaanbaatar is negligible. The total value of underspent funds by tertiary, district and FHC health facilities in 2016 was MNT 10 billion. Tertiary hospitals, in part due to their significantly larger budgets, have the highest share of under-executed funds but they still demonstrate a high absorptive capacity, with 94% execution rate in both 2015 and 2016. District hospitals in Ulaanbaatar have an execution rate of 98% and FHCs exceed 99%. As a result, there is very little budgetary space within recurrent expenditure of healthcare facilities in Ulaanbaatar to reallocate funds towards interventions to mitigate child health consequences of air pollution. That said, the paragraph below provides more details regarding the expenditure items of healthcare facilities in Ulaanbaatar which have underspent consistently throughout 2015 and 2016.

Expenditure on 'Bonus' had execution rates of 80% and 85% in 2015 and 2016, respectively, across tertiary hospitals – where it constituted 3.15% of total approved spending in 2016. For district hospitals, the values for the same period are 87% and 85% – constituting 3.1% of total approved spending. Spending on 'domestic trip expenses' had an execution rate of 49% in 2015 and 88% in 2016 for district hospitals. For tertiary hospitals, the values for the same period were 57% and 86%. The share of total approved expenditure in 2016 for 'domestic travelling' for tertiary hospitals was 0.03%. 'Heating' had an execution rate of 83 and 85% in district hospitals, where it represents 1.5% of the total approved budget[58]. The budget category 'Work, service fee performed by others', which comprises auditing services, insurance expenses, vehicle tax, and vehicle inspections fees, constituted 0.99% of approved expenditure for tertiary hospitals in 2016. The equivalent for district hospitals was 1.1%. This represents a significant share of total approved expenditure but its execution rate in tertiary facilities was 84% in 2015 and 57% in 2016. For district hospitals during the same period the execution rate was 74%[59].

6. Conclusions and Recommendations

Recognising the irreversible and life-threatening impact of air pollution on child health, it is critical that government will consider to take urgent measures to better protect children's health from exposure to air pollution. Whilst the authors recognize that the only sustainable solution is to actually reduce the air pollution to acceptable levels, it is clear that that will take a significant number of years before. Meanwhile, each year thousands of children and pregnancies are at high risk which has significant implications. As this report shows, unless action is taken now to protect children, it is foreseen that child health impacts and associated costs will continue to rise the coming years. In terms of immediate child health measures to consider, the report recommends the following:

- Develop and implement a multi-year public outreach campaign to raise awareness of the dangers of exposure to air pollution (with a focus on pregnant women and young children) and measures people can take to protect their health and reduce air pollution. This should also include further strengthening the evidence base around child health, pregnancy results and air pollution.

- Vaccinate all new-born children in Ulaanbaatar with 13-valent PCV and include the vaccine in the national immunization schedule of Mongolia and the relevant budget for the National Immunisation Programme budget of the Ministry of Health.

- Develop and implement a comprehensive indoor air quality management approach for kindergartens, schools and hospitals through a combination of technical and behavior change interventions.

- Develop an advisory note on measures people can take to reduce exposure to air pollution outside, including the proper use of good quality and well-fitted masks; consider the provision of such masks free of charge to the most vulnerable in the communities that are faced with the highest levels of air pollution. A review of the effectiveness of face masks is also urgently needed.

The study also recommends:

- Undertake a feasibility study to identify, cost and promote a package of interventions to reduce exposure of pregnant women and neonates living in the 'ger' districts to air pollution.

- Analyse and further pilot the provision of affordable and good-quality medicine to treat acute respiratory infections and chronic lung diseases among children of poor families.

- Assess and strengthen the capacity of the health care facilities to provide adequate and affordable care to children affected by air pollution. For example, this should include developing a list of essential equipment and supplies for family health care centres, training of staff, have surge capacity to accommodate the sharp seasonal increase in demand for treatment of respiratory and other air pollution-induced diseases, and continued and systematic improvement of clinical guidelines and their use.

- Recognising the increased need for a centralized procurement system for medicine and strengthening a centralised procurement process for medicines to ensure access to good-quality and affordable medication.

With regard to mobilizing funds for such measures to protect children from air pollution health impacts:

- Classify the negative health impacts of air pollution as an emergency situation, at least during the winter months when morbidity is at its highest. This would allow the use of governors' emergency reserve funds to finance potential measures aimed at mitigating the negative impacts of air pollution on the health and wellbeing of Mongolian citizens. District and provincial governors and the Ulaanbaatar City Governor all have emergency funds, which, if used wisely, can significantly improve the situation of children in Ulaanbaatar during the winter months.

- Identify alternative external financing sources of funding in order to (co-)finance potential interventions to mitigate the impact of air pollution on children's health.

- Overall health sector budget strengthening by harmonising fund disbursement methodology between the different sources of health sector funding. The existing budget disbursement methodologies used by the SHIF and the State Budget cause disruptions in the smooth functioning of the health facilities in Mongolia. State Budget contributions are made on an input basis, whereas the SHIF provides output-based financing.

This hampers health facility managers' ability to plan spending in advance in a rigorous fashion.

- A continued and strengthened prioritisation of budget allocations to primary healthcare services to foster a preventative healthcare system aimed at minimising the number of patients requiring specialised care.

- An increased budget allocation to FHCs and improved financial management capacity of the FHCs, which can be achieved by strengthening of checks and payroll controls for FHCs.

- Prioritise budget releases by MoF to health facilities in Ulaanbaatar during the winter months to ensure service delivery that meets increased demand from patients.

- Given the level of urgency and the long-term impacts of the air pollution crisis on child health and wellbeing, development partners should also be requested to (co-) finance measures.

Annex

Annex A: Legal framework for PFM in Mongolia

The Fiscal Stability Law (FSL, 2010): The FSL introduces four fiscal rules to deal with mineral price volatility and Dutch disease effects. First, it mandates that structural or long-term mineral prices be used to calculate structural budget revenues. Second, the annual structural budget deficit (expenditure minus structural revenues) should be below 2% of GDP. Third, the annual growth of government expenditure must not exceed non-mineral GDP growth, as another safeguard measure to curb excessive spending growth. Fourth, to maintain long-term fiscal solvency, the public debt-to-GDP ratio will be maintained at below 40% from 2014. All revenues more than structural revenues are saved in the Fiscal Stability Fund, which must be not less than 5% of GDP in any given year. The law went into effect in January 2013.

The Budget Law (IBL, 2011): The integrated Budget Law of Mongolia (IBL), which went into effect in January 2012, is the primary budget legislation for the country, replacing the Public Sector Management and Finance Law (PSMFL) and the General Budget Law of 1992. The main objectives of the IBL are to: (i) strengthen the medium-term fiscal framework (MTFF) and ensure fiscal stability; (ii) improve the comprehensiveness of the budget; (iii) strengthen the public investment planning and capital budgeting process; (iv) ensure efficient financial management; (v) significantly increase the authorities and financial resources of local governments; and (vi) strengthen accountability through participatory budgeting.

The law states that the budget consists of the State (central government) Budget, local government budget, the Human Development Fund, and the SHIF. The budget should list projects to be executed through concession contracts and includes information on government guarantees and contingent liabilities, thereby improving the budget's comprehensiveness. The budget calendar is laid out in detail, with the process commencing with the approval of the MTFF by the Parliament by June 1, together with the Socio-economic Guidelines, which forms the basis for the budget ceilings of line ministries. Budget proposals from line ministries and the National Development and Innovation Committee (currently the MoF) for large projects, as discussed below, are meant to comply within the limits imposed by these ceilings. This provision should significantly improve the credibility of the budget process.

The IBL is intended to significantly strengthen public investment planning and capital budgeting process, thereby redressing a major weakness in the PSMFL. It mandates that only projects that have gone through a proper appraisal process will be considered for financing from the budget. The IBL also introduces the concept of a four-year rolling Public Investment Programme for large projects and mandates that the recurrent cost implications of capital projects be included in budget proposals.

The authorities of local governments have been significantly enhanced, with the capital city and Aimag governments responsible for basic education, primary healthcare, urban planning and construction, social welfare services, water supply and sewerage, public transport, urban roads and bridges, and municipal services, such as street lighting and garbage removal. These functions will be financed through local taxes and fiscal transfers (an equalisation grant) from shared taxes from the central government, with the transfer formula based on the size of population, population density, remoteness and the size of the local government, and the level of local development. There is also a conditional performance element to the transfers that are linked to local tax efforts. Only the capital city government is allowed, with the approval of the MoF, to borrow from capital markets to finance public investment projects, with their debt size limited to the previous year's revenue and debt service limited to 15% of the previous year's revenue.

The Public Procurement Law of Mongolia (PPLM, 2011): The PPLM went into effect in January 2013. The law introduced radical changes in the system for public procurement in Mongolia. It brought the procurement responsibility from line ministries to a new Government Procurement Agency (GPA) for national-level projects and to local governments for local-level projects. The GPA became responsible for all procurements of large projects — such as inter-regional roads and power plants — as well as for establishing framework agreements for common use items (such as office supplies) that will be purchased by line ministries. Local governments will be responsible for all procurements of works, goods, and services to be financed from the local budget, as well as for local projects (e.g. schools and hospitals) financed from the national budget.

One of the most important aspects of the revised law is the new role for civil society organisations in both bid evaluation and contract monitoring. Monitoring of contracts by civil society organisations potentially covers both monitoring of the implementation of ongoing contracts as well as gauging end-users' satisfaction with completed contracts.

The General Taxation Law (2008): establishes the legal basis for the creation of new taxes, tax imposition, reporting, payment, inspection and collection; defines the rights, responsibilities and functions of the tax administration; and regulates their relations with around 18 other tax laws. More specifically, the General Taxation Law is the umbrella law which regulates the types of taxes, taxable items, tax rates, tax holidays and exemptions, rights and responsibilities of tax inspectors and taxpayers, tax administration units' services to taxpayers, structure and functions of the tax authority and tax inspectors, status and operation of the general database for tax information and recording, tax inspection process, and dispute resolution mechanisms.

Any changes to the tax legislation are initiated by a relevant government organisation in charge of tax policy and associated formal decisions are endorsed by Parliament. The GoM submits to the Parliament any amendments of the general tax law and other tax regulations, together with the annual budget proposal. Per the tax legislation, Mongolia has a flat 10% tax regime for major income taxes, such as personal income tax and VAT, and a two-stage tariff for corporate income tax: 10% for up to MNT 3 billion of income and 20% for above MNT 3 billion.

The Law on State Audit (LSA, 2003 with latest amendments made in 2013): Following the decentralisation of budget accountability to the local municipal authorities, as introduced by the IBL, the LSA of Mongolia was amended in 2013 to shift the country's supreme audit institution – the Mongolian National Audit Office (MNAO) – to a vertical organisational structure, which requires local state audit branches to report to the Auditor-General of Mongolia instead of reporting to the local municipal authorities, as previously mandated. By amending the LSA, state auditors are now responsible for reviewing not only the budget execution but also compliance with Parliament-approved legislation and implementation of recommendations provided by standing committees and other institutions in the Parliament structure. The vertical organisational structure will also allow the government auditors at all levels to receive their operational direction and guidance from the Auditor-General and report back to a central organisation. The law and the latest amendments to it have been in effect since 3 January 2003 and 7 November 2013, respectively.

Annex B: Institutional framework for PFM

The State Great Khural (Parliament): Parliament is responsible for approving all legislative acts and laws, including the MTFF, the medium-term and annual strategic plans, the annual budget, the audited budget execution reports, and tax laws, and for overseeing the spending and results of public funds. Parliament has the authority to amend the approved annual budget law, and to endorse any tax rate-related changes.

The MoF: The MoF is the main central government agency in charge of formulating fiscal policy, preparing, implementing, and reporting on the annual budget, ensuring timely financing of public funds, and the revenue generation process. The Fiscal Policy and Planning Department is responsible for drafting the annual budget, preparing the MTFF and implementing the annual budget law while Department of Financial Policy and Debt Management is in charge of management and reporting of the state debt. In terms of the fiscal revenue, the MoF is the institution that proposes any changes in tax rates, exemptions and tax holidays on behalf of the GoM. Tax revenue is collected through two main separate agencies – the General Department of Taxation and the General Department of Customs – under the MoF. Through its Treasury Department, the MoF handles expenditure transactions for the other central government line ministries, agencies, local governments and special government funds, such as SHIF and the Human Development Fund. Until September 2012, MoF was also responsible for public investment planning and the preparation of the capital budget; this function then shifted to the Ministry of Economic Development, which is now called the National Development Agency (NDA). The MoF continues to be responsible for capital expenditure transactions.

The NDA: The NDA is a government body located within the Prime Minister's Office that defines annual and medium-term socio-economic policy, exercises government's external

borrowing authority and develops planning of large-scale investment projects. The NDA plays an important role in overall public finance practice due to its external borrowing function and supervision of the Development Bank of Mongolia which has been the largest off-budget vehicle for investment financing since 2012. The NDA is in charge of negotiating and signing international borrowing agreements on behalf of the GoM, while the MoF takes care of the actual financing of the lending projects.

General Department of Taxation (GDT): The Mongolian taxation authority is the government execution agency in charge of tax revenue collection and it directly reports to the MoF according to the IBL and General Taxation Law. The GDNT has a vertical structure and therefore consists of the district and local tax offices according to the General Taxation Law. Tax revenues transferred to the GDNT account are reconciled on a daily basis and transferred to the Treasury Single Account at the MoF.

The Mongolian Customs Authority: The Customs Authority is another government executing agency in charge of trade facilitation and collecting customs tax and duties for imports and exports. The customs tax rates and fees are regulated by the relevant tax laws. The Customs Authority reports to the MoF.

The MNAO: The state audit board is the supreme audit institution that conducts audits for public financial operations, including the annual budget, the government financial statement, and the effectiveness and efficiency of using public funds for various stated purposes. According to the IBL, the annual government financial statement has to be audited and the audited statement has to be approved by Parliament.

Annex C: Methodology

The team developed a spreadsheet-based model to estimate individual-level costs. Ulaanbaatar demographic projections, by age group, are at the centre of the model. Morbidity data from 2012-2016 were used to calculate future incidence of air pollution related disease over the 2017-2025 time horizon. Future morbidity were combined with air pollution levels based on projections in the NPRAEP through disease-specific risk equations in order to arrive at air pollution attributable morbidity, expressed as number of cases attributable to air pollution per year. Direct and indirect medical costs were then estimated by multiplying the number of air pollution attributable cases for each disease with appropriate unit cost information.

Details on the data sources employed and assumptions made are presented below:

Population: demographic data for Ulaanbaatar city were obtained from the National Statistical Office. Population projections for 5-year intervals (2010, 2015, 2020 and 2025) were available by age group; these official projections were used and linear interpolation was used to estimate total population (by age group) in the years between projection years. For example, it was assumed that population would increase in equal increments between 2010 and 2015, between 2015 and 2020, and between 2020 and 2025 projected values, respectively. An adjustment was necessary to reconcile the age groups in demographic projections with age groups in morbidity data (see below): demographic projections would include the category 15-19 year olds, while morbidity data would categorise 6-18 year olds. Mongolia-wide official population projections until 2025 for every age in one year bands were used to compute the proportion of 0-19 year olds representing 0-18 year olds and applied this proportion to 0-19 year olds projected population in Ulaanbaatar to derive yearly estimates of the 0-18 year old population in UB.

Morbidity: a list of ICD-10 codes was agreed with UNICEF and Mongolian stakeholders for the diseases related to air pollution that would be included in the analysis. The MoH data on the number of annual cases in Ulaanbaatar for each ICD-10 code in the list for the interval 2012-2016, by age group (0-1 years, 1-5 years, 6-18 years and 18+ years) and by service delivery level (family health centres, outpatient district hospitals, inpatient district hospitals, outpatient tertiary hospitals and inpatient tertiary hospitals) was used. Linear regression models were estimated based on 2012-2016 data for each disease, each of the five service delivery levels and three age groups (0-5 years, 0-18 years and all ages), with total number of cases as the dependent variable and respective total populations in Ulaanbaatar as predictor. The estimated regression models were used to predict the number of future incident cases for each year of the 2017-2025 interval based on the projected Ulaanbaatar population.

Air pollution: the NPRAEP states an average PM 2.5 level of 256 ug/m3 in 2016, with the target to reduce it to 190 ug/m3 in 2017-2018 and to 70 ug/m3 after 2020. For the counterfactual scenario (effective policy intervention for air pollution reduction) the air pollution levels in the NPRAEP were used in their respective years, with linear interpolation reduction between 2018 and 2021 and constant 70 ug/m3 levels from 2021 to 2025. In the status quo (no change or ineffective action against air pollution) the 256 ug/m3 air pollution level was assumed constant and unchanged from 2017 to 2025 inclusive.

Air pollution attributable morbidity: the projected PM 2.5 levels were used to estimate relative risks for main disease categories, and relative risks were used in their turn to estimate population-attributable fractions of incident disease cases. This mirrors the approach used in the earlier study of Ochir et al (2014)[60]. Population-attributable fractions represent the proportion of incident cases that can be attributed to air pollution and it is proportional with PM 2.5 levels. For example, a PAF of 0.5 for pneumonia means that 50% of incident pneumonia cases are attributable to air pollution.

Cohen et al[61] re-estimated the risk equations used in the Ochir report based on more recent and comprehensive data. The authors were contacted and the necessary data was obtained from them to calculate relative risks, which were then used to calculate population-attributable fractions for low respiratory infections, lung cancer, COPD, stroke and ischemic heart disease (IHD). PAF for major diseases were projected for the interval 2017-2025 based on respective yearly average PM 2.5 levels and then multiplied with projected cases (above) in order to estimate the number of cases attributable to air pollution, at each level of service delivery and for each age group. The procedure was conducted both for the status quo scenario (no change in air pollution levels) and the counterfactual scenario (policy intervention to decrease air pollution). The risk equations for influenza, pneumonia and asthma[62] were assumed to be identical with that for low respiratory infections. For stroke and IHD the risk equations are age-specific in 5-year age bands. An age-specific PAF was calculated and a weighted average PAF was calculated based on the population age structure. The risk equation for TB was taken from the Ochir report as it was not re-estimated in the Cohen et al study.

Healthcare direct costs: the number of air pollution attributable cases in each scenario were multiplied by corresponding unit costs. In the absence of case intensity information, it was assumed that each incident case would incur either one visit/consultation or one inpatient episode, depending on the service level. The cost for an inpatient episode in district and tertiary hospitals was informed by the tariff currently used by the Health Insurance Fund, i.e. 300,000 MNT, multiplied by the corresponding cost weight. The cost for an outpatient consultation was also informed by the Health Insurance Fund, i.e. 15,000 MNT. The median cost of a family health centre visit was estimated to be 3,400 MNT, obtained by dividing the total expenditure budget for all FHC in Ulaanbaatar in 2016 by the total number of FHC visits in 2016, after adjusting for the fact that recorded disease-related visits represent on average 56.3% of all consultations, the remainder being preventive check-ups[63]. Future costs were discounted using the real discount factor projected by a NGRI-constructed macrofiscal model for Mongolia. The same model informed the future exchange rate MNT/USD.

Indirect costs: value of lost productivity in adults caring for sick children was estimated. The value of lost productivity in adults caring for sick children was calculated by multiplying the number of days off work by the average daily income of a working adult in Ulaanbaatar. The number of days off work was calculated by multiplying the number of inpatient/outpatient cases by their respective day length. The average length of stay (ALOS) by condition was calculated using MoH data. The following assumptions were made: all sick children are attended by one economically active adult; that one adult would take time off when a child is admitted to the hospital for the entire duration of the inpatient episode and would accompany the child to any outpatient visit (either at the family health centre or at the hospital); an outpatient visit takes about a third of the working day, leading to an adjustment factor of 0.3 days per visit. The average daily income per working adult was calculated using 2016 data for the average monthly income per household, number of households and number of economically active adults in Ulaanbaatar from the National Statistical Office of Mongolia.

Annex D: Projected model parameters

The population of Ulaanbaatar is expected to continue increasing up to 1.9 million by 2025, of which 0–18-year-olds will represent little over 600,000. PAFs for the diseases considered in the analysis are already over 0.5, with the exception of COPD. This means that more than 50% of cases of these diseases can already be attributed to high air pollution levels. If the NPRAEP's air pollution targets are met by 2025, the PAFs would decrease below the 0.5 mark; for example, the proportion of lower respiratory infections (LRIs) attributable to air pollution would decrease from nearly 65% (current) to about 40%. In the following table, the key figures were outlined focusing on the burden of air pollution on all children (ages 0-18 years).

Table 14 - Summary of projected model parameters

Parameter	2017	2018	2019	2020
Demographics				
Total Ulaanbaatar pop.	1,511,836	1,564,157	1,616,477	1,668,797
Pop. 0–18 yrs.	475,891	495,711	515,742	535,725
Status quo scenario				
PM 2.5 [ug/m3]	256	256	256	256
PAFs, status quo scenario				
Stroke	0.0898	0.0898	0.0898	0.0898
Lung cancer	0.5288	0.5288	0.5288	0.5288
COPD	0.5477	0.5477	0.5477	0.5477
Asthma	0.5581	0.5581	0.5581	0.5581
Influenza	0.5581	0.5581	0.5581	0.5581
Pneumonia	0.5581	0.5581	0.5581	0.5581
Other LRI	0.5581	0.5581	0.5581	0.5581
Tuberculosis	0.8485	0.8485	0.8485	0.8485
Ischaemic heart disease (IHD)	0.1017	0.1017	0.1017	0.1017
Policy intervention scenario				
PM 2.5 [ug/m3]	190	190	150	110
PAFs, policy intervention scenario				
Stroke	0.0798	0.0798	0.0724	0.0634
Lung cancer	0.4707	0.4707	0.4248	0.3662
COPD	0.4707	0.4707	0.4655	0.4173
Asthma	0.5278	0.5278	0.4982	0.4524
Influenza	0.5278	0.5278	0.4982	0.4524
Pneumonia	0.5278	0.5278	0.4982	0.4524
Other LRI	0.5278	0.5278	0.4982	0.4524
Tuberculosis	0.8046	0.8046	0.7629	0.6986
IHD	0.0936	0.0936	0.0875	0.0798
Costs				
Discount rate	0.9462	0.8763	0.8198	0.7757
USD/MNT	2,522	2,597	2,711	2,804

2021	2022	2023	2024	2025
1,715,748	1,762,700	1,809,651	1,856,603	1,903,554
552,793	569,388	585,313	600,487	614,980
256	256	256	256	256
0.0898	0.0898	0.0898	0.0898	0.0898
0.5288	0.5288	0.5288	0.5288	0.5288
0.5477	0.5477	0.5477	0.5477	0.5477
0.5581	0.5581	0.5581	0.5581	0.5581
0.5581	0.5581	0.5581	0.5581	0.5581
0.5581	0.5581	0.5581	0.5581	0.5581
0.5581	0.5581	0.5581	0.5581	0.5581
0.8485	0.8485	0.8485	0.8485	0.8485
0.1017	0.1017	0.1017	0.1017	0.1017
70	70	70	70	70
0.0518	0.0518	0.0518	0.0518	0.0518
0.2866	0.2866	0.2866	0.2866	0.2866
0.3490	0.3490	0.3490	0.3490	0.3490
0.3758	0.3758	0.3758	0.3758	0.3758
0.3758	0.3758	0.3758	0.3758	0.3758
0.3758	0.3758	0.3758	0.3758	0.3758
0.3758	0.3758	0.3758	0.3758	0.3758
0.5864	0.5864	0.5864	0.5864	0.5864
0.0693	0.0693	0.0693	0.0693	0.0693
0.7387	0.7071	0.6796	0.6554	0.6339
2,881	2,948	3,010	3,069	3,134

Annex E: Institutional framework

MoCUD

Under both the NPRAEP and previous initiatives, the MoCUD is responsible for the development of housing opportunities for middle- and low-income citizens. This particularly focuses on the redevelopment of the ger districts and supporting the conversion of existing homes to 'green homes' through the provision of affordable loans. Activities that the MoCUD supports include the building of new apartment blocks and infrastructure support, such as connecting existing homes to water and sanitation services, improved heating, electricity connections, and renewable energy for the more remote ger districts.

MoET

The National Committee on Environment Pollution – previously the National Committee on Air Pollution Reduction – was created by ordinance of the Prime Minister of Mongolia. It is chaired by the Prime Minister (with the Minister of Environment and Tourism as Deputy Chairperson) and its Secretariat Committee is based within the MoET. Its officers are responsible for the drafting and subsequent adoption of the NPRAEP across MDAs. The Secretariat Committee is responsible for coordinating its implementation[64].

MoECSS

The MoECSS has an important role to play in reducing children's exposure to air pollution by ensuring that schools are a safe environment for children. This includes providing schools with adequate equipment which helps reduce air pollution levels inside the classroom. The MoECSS can also play an important role in delivering public outreach campaigns which target children.

MoH

The MoH is responsible for taking the necessary measures to ensure that health facilities of all types can deliver services which mitigate the health implications of air pollution. These include the treatment of children suffering from respiratory diseases, ensuring that healthcare facilities provide a clean air environment for its patients, the provision of appropriate drugs to children suffering from acute respiratory infections, and the roll-out of PCV under the Immunisation Programme[65].

SIGO

The SHIF, with an approved budget of MNT 327 billion for 2016, falls within the responsibility of SIGO. The SHIF is funded through a 2% employers' contribution and 2% contribution from employees (forming 68% to 70% of the budget), a government subsidy (for mothers, disabled persons and those under 18 years), voluntary contributions and interest received. Government also currently subsidises 30 drugs for children under the age of five for the three months of winter, when children are most affected by air pollution in Ulaanbaatar[66]. The SHIF population coverage rate reached 95.3% in 1998 but fell to 82.6% in 2010. This was mainly due to the decision taken in 1999 to exclude students and herders from state-subsidised groups. Coverage continued to fall to 74.5% in 2004 but has gradually increased as a result of actions by SIGO, including social insurance coverage targets for regions with benchmarking and performance-based incentives. In 2011, due to a one-off intervention to cover all uninsured people via the Human Development Fund (a stabilisation fund from mining revenue) coverage reached its historically highest level of 98.6%. However, since 2011 coverage has dropped again, with the Fund currently having an 80%–92% population coverage rate[67].

Since 2006 SHIF coverage is compulsory for employees of business entities, institutions and organisations, owners of business entities and sole proprietors, children under 16 and general school students under 18, students at professional schools, citizens for whom their pension is their only income, mothers (fathers) taking care of their babies under the age of two (twins under the age of three), persons on regular military service, herders, citizens who receive social assistance, and convicts serving their sentence. All others, including foreigners and persons without citizenship, can be covered by health insurance on a voluntary basis. The SHIF covers specific services delivered by district and tertiary hospitals. For district hospitals, funds are transferred from the SHIF to Aimag or Ulaanbaatar City Governor's Office Treasury account, and from there to the health facilities. Tertiary hospitals are managed directly by the MoH so the funds flow directly from the SHIF to the MoH's treasury account. The SHIF is a fund, in that it is meant to invest some of its savings to generate more revenue. The team was not able to access data on the volume of the fund.

Capital City Governor's Office

Most air pollution-induced diseases in children occur in Ulaanbaatar, where concentrations of air pollution are highest. The Capital City Governor's Office channels some of its resources and human capacity towards mitigating the effects of this problem. A number of initiatives have been carried out by different departments within the Capital City Governor's Office. Such initiatives include distribution of face-masks (20,000 thus far), distribution of air-purifiers, and the launching of a behavioural change communication plan. Implementation of these initiatives are conducted through the City Health Department.

Annex F: Implementation Plan of the NPRAEP

№	ACTIVITY	INDICATORS	RESPONSIBLE ORGANISATION	TIMELINE	BUDGET IN MILLION MNT	RESOURCE
1.1.1	Implement and develop a general project on population settlement	Approve a general project on population settlement by the Parliament and related organisations	MoCUD	2017 – 2019	9,800	State Budget
		Develop draft of the general project, including 15 aimags	MoCUD	2018 – 2021	5,174	State Budget
1.3.2	Develop a general plan for the 'smart' standard city, with the new international airport which is being built in the Khushigt valley	Develop and approve a general plan for the 'smart' standard city	MoCUD	2018– 2025	633	State Budget
1.5.3	Establish and implement one-tine grant aid for rural immigrants	Establish tax incentives and good leverage for settlement in the rural areas	Ulaanbaatar City	2017– 2021	1,000	State and overseas development aid
1.7.1	Continue the 'house renting programme'	Provide house renting for 20,000 families	MoCUD	2017– 2021	1,119	State and local budget

№	ACTIVITY	INDICATORS	RESPONSIBLE ORGANISATION	TIMELINE	BUDGET IN MILLION MNT	RESOURCE
1.7.4	Include gas supply and water engineering pipeline in the design of the new buildings	In accordance with design, buildings with gas supply will be constructed	MoCUD	2018 – 2025	4,200	State Budget, foreign loan, private investment
		In accordance with design, buildings with grey water pipelines will be constructed	MoCUD	2018 – 2025	3,000	State Budget, foreign loan, private investment
1.8.1	Build engineering lines step by step in Bayankhoshyy and Selbe of Ulaanbaatar	Build engineering lines step by step in Bayankhoshyy and Selbe	MoCUD	2017 – 2021	220,439	International organisation
1.8.9	Establish 'micro centre' in selected ger districts with high air pollution	Establish 'micro centre' and provide partial engineering infrastructure for 200–300 families to improve conditions of the ger districts	MoET	2017 – 2025	500,000	Foreign loan, State Budget, local budget
1.10.1	Develop and implement a standard sanitation project for ger district households in Ulaanbaatar City	Establish pilot sanitation facilities for 1,230 families	MoET	2017 – 2018	5,300	Foreign resources
		Test improved sanitary facilities and installed for at least 1440 families	MoET	2019 – 2021	4,700	Foreign resources
1.10.2	Follow MNS 5924: 2015 standards for pit latrines and wash-pit facilities that cannot be connected to engineering infrastructure	Support at least 1,000 households to accommodate standard pit latrines	MoCUD	2017 – 2020	20	State Budget, private sector
1.10.3	Develop sanitation facilities step by step for schools, kindergartens, hospitals and service organisations / tourist camps, hotels, shops, and others	Public sanitation facilities of schools, kindergartens, hospitals, petrol stations, shops and other public facilities in Ulaanbaatar should be standardised	Ulaanbaatar City	2017 – 2025	9,000	State Budget
		Public sanitation facilities of schools, kindergartens, hospitals, petrol stations, shops and other public facilities in rural areas should be standardised	Ulaanbaatar City	2017 – 2025	9,000	State Budget, local budget, foreign resource
1.11.1	Establish a factory for wool and leather	Its construction will begin	MoCUD	2017 – 2023	272,000	Foreign loan, private investment

№	ACTIVITY	INDICATORS	RESPONSIBLE ORGANISATION	TIMELINE	BUDGET IN MILLION MNT	RESOURCE
1.11.2	Establish infrastructure and treatment plant for wastewater for the wool factory	Develop feasibility study	Ulaanbaatar City	2018	966	Republic of Korea, Eksim bank loan
		Waste treatment plant with modern advanced technology will be started	Ulaanbaatar City	2018 – 2021	40,000	
1.13.1	According to designs, establish micro-parks in public areas of the apartments and ger districts	Establish 60 micro-parks. Survival of the new planted trees and shrubs will reach 70%–80%	Ulaanbaatar City	2017 – 2021	2800	Local development fund
1.13.3	Establish green areas in apartment areas	Include this in the planned designs	Ulaanbaatar City	2017 – 2025	500	Local development fund
1.13.4	Make a lawn for loose soil	Make a lawn of 150,000 square kilometres a year	Ulaanbaatar City	2017 – 2021	6000	Local budget
2.3.2	Establish centres for selling improved fuels	Establish centres for selling improved fuels	Ulaanbaatar City	2017 – 2025	6000	State Budget
2.4.2	Support target households on providing stoves, fuel, and electric heaters	At least 1,000 target households have been supported	MoET	2017 – 2020	400	State Budget
2.5.2	Support domestic factories with eco-friendly and advanced technologies to reduce the heat loss from buildings	An electronic database of green building materials has been created	MoCUD	2017 – 2018	30	International organisation
		Developed environmentally friendly thermal insulation materials, including glass, steel and cement production	MoCUD	2018 – 2024	9,700	Foreign loan, private sector
2.6.1	Implementation of a national-specific greenhouse gas project in the construction sector	Implement a pilot project	MoCUD	2017 – 2019	3,075	International organisation

№	ACTIVITY	INDICATORS	RESPONSIBLE ORGANISATION	TIMELINE	BUDGET IN MILLION MNT	RESOURCE
2.8.1	Renew Ulaanbaatar's central sewerage system	The waste water is cleaned up to the standard level and the water pollution in the Tuul River has decreased	MoCUD	2017 – 2020	650,000	Private sector
2.8.2	Solve the sludge problem of the Ulaanbaatar central sewerage system	Develop design and conduct survey on sludge of the central sewerage system	MoCUD	2017	500	State Budget, local budget
		The central sewage treatment facility is fully developed	MoCUD	2018 – 2021	2,000	State Budget, local budget
2.8.3	Introduce new advanced technologies to extend, renovate and repair water supply and sewerage networks	Ulaanbaatar's water and sewerage system with 48 kilometres has introduced new technologies	MoCUD	2017 – 2021	17,820	Foreign loan
2.8.4	Build new sewage treatment facility in Darkhan Aimag	This facility will be opened with the support of the ADB	MoCUD	2017 – 2020	44,000	Foreign loan
2.8.5	Build new sewage treatment facility in Dornogovi Aimag	The new central water treatment plant will be commissioned	MoCUD	2017 – 2019	6,394	Foreign loan
2.8.6	Build new sewage treatment facility in Umnugovi Aimag	The new central water treatment plant will be commissioned	MoCUD	2017 – 2020	7000	Foreign loan
2.9.1	Ensure availability of infrastructure and machinery for sorting, transporting solid waste in ger districts	Establish centre for transporting and sorting solid household waste	Ulaanbaatar City	2018 – 2020	2,000	Local budget, loan grant
2.10.1	Establish temporary storage for hazardous waste	Design of centre for storage of hazardous waste will be developed	MoET	2017	60	International organisation
		Establish temporary storage	MoET	2018 – 2021	10,100	State Budget, foreign resource
2.10.2	Register hazardous waste	Create a database for hazardous waste	MoET	2017	80	International organisation

№	ACTIVITY	INDICATORS	RESPONSIBLE ORGANISATION	TIMELINE	BUDGET IN MILLION MNT	RESOURCE
2.10.3	Increase the capacity of the treatment plant, which treats only medical waste	The treatment plant in Ulaanbaatar will be maintained	MoH	2017 - 2025	2,030	International organisation, State Budget
		Establish treatment plant in rural areas	MoH	2017 - 2025	2,756	ADB, State Budget
2.15.2	Connect organisations to the centralised heat system	The heating supply for 53 khoroos has been resolved using renewable energy and other efficient technologies	Ulaanbaatar City	2017 – 2021	6,519	International organisation
2.16.1	Establish at least three show rooms at in Ulaanbaatar	Establish at least three showrooms in Ulaanbaatar	MoET	2017 – 2021	42	State Budget
2.17.2	Conduct relevant research studies to establish a green loan fund for Mongolia	Green loan funds will be established and will support citizens in relation to buying environmentally friendly products	MoET	2017 – 2025	10,000	International organisation
3.4.2	Introduce environmentally friendly transport for public transportation	A project unit will be established and a feasibility study will be developed	Ulaanbaatar City	2017 – 2018	15,000	Foreign resources
		Introduce special road bus service	Ulaanbaatar City	2018 – 2021	295,500	Foreign resources
3.4.4	Install remote sensing equipment in Ulaanbaatar City and measure the emissions of vehicles	Install remote sensing equipment in Ulaanbaatar City and measure the emissions of vehicles and restrict vehicles which do not meet standard requirements	Ulaanbaatar City	2017 – 2021	787	International organisation
3.6.1	Establish a green service complex that meets the passengers' needs for temporary stops along the main road	The feasibility study of the green service complex was developed and land issues were resolved	MoET	2017 – 2018	800	State Budget
		Four green service complexes will be established along the main tourist route	MoET	2018 – 2021	16,000	State Budget, foreign resources

№	ACTIVITY	INDICATORS	RESPONSIBLE ORGANISATION	TIMELINE	BUDGET IN MILLION MNT	RESOURCE
3.7.1	Establish rain gutter system in roads in Ulaanbaatar	The Ulaanbaatar drainage centre will increase its network by 30 km	Ulaanbaatar City	2017 – 2021	50,000	Local budget, loan grant
3.7.2	Establish road-washing system in Peace Avenue	A new system will be introduced to increase the road-washing system by 20 km	Ulaanbaatar City	2017 – 2023	3,000	State Budget, private sector
4.1.2	Establish an 'anti-pollution fund' in accordance with the law and collect funds for reducing air pollution	Is accordance with the law on air pollution payment, the fund will be collected	MoET	2018 – 2021	97,000	Air pollution fund
5.1.1	Organise extra-curricular activities for the public to reduce air pollution	The public has been given an understanding of air and pollution sources, harmful effects, advanced technology and green lifestyle	MoET	2017 – 2021	450	State Budget, international organisation
5.3.1	Monitor the 'air pollution control' within the ger areas, monitor the burning of waste, including wheels and lubricants, in the ger areas	In collaboration with civil society organisations, 21 car and activist inspectors will monitor ger areas to improve air quality, conduct relevant surveys and provide legal information to the public	MoET	2017 – 2018	30	State Budget
5.7.1	Renew the central environmental laboratory and equip analytical equipment to determine organic and toxic substances	Determine heavy metals in air, soil and petrol, and toxic substances in air, soil, petrol samples	MoET	2018 – 2021	30,000	State Budget, international organisation
5.8.2	Conduct a survey of high polluted zones	Determine pollution level in areas with high pollution	MoET	2018 – 2021	250	State Budget, foreign resource
5.9.1	Accommodate automatic tools to measure PM10, PM2.5 in some aimags and big cities	Accommodate automatic tools in five areas to measure PM10, PM2.5 concentrations in the air every hour	MoET	2018 – 2025	1,600	State Budget, foreign resource, private sector
5.10.1	Create an electronic database for registering air pollution	Create an electronic database for registering air pollution	Ulaanbaatar City	2017 – 2021	150	Local budget

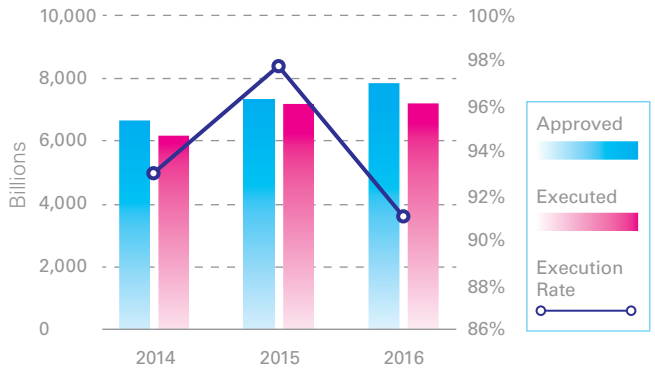
№	ACTIVITY	INDICATORS	RESPONSIBLE ORGANISATION	TIMELINE	BUDGET IN MILLION MNT	RESOURCE
5.10.2	Develop and test methods for air-polluting waste		MoET	2017 – 2018	100	State Budget, international organisation
5.11.1	Conduct research on electromagnetic waves in Ulaanbaatar	Determine the state of electromagnetic waves in Ulaanbaatar	MoECSS	2018 – 2019	40	State Budget

Annex G: Expenditure trends of GoM

The GoM's execution rate has been consistently above 90% in the period 2012-2016. This suggests that the GoM, when compared with other countries with similar institutional capacity, has a very high absorption capacity. The MDAs manage to spend most of the funds allocated to them in the annual budget. This means that there is relatively little wastage of budgeted funds. Although budget data suggest that most ministries do engage in fund transfer between different line items, over the past years there has been a noticeable alignment between approved budget and executed budget – particularly in 2016.

FIGURE 11

Whole of Government Execution Rate

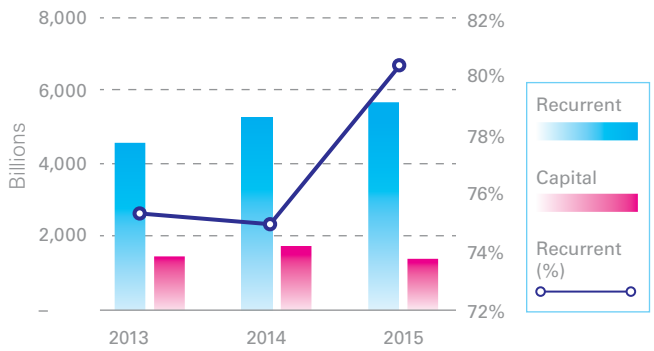


Another noticeable characteristic of public expenditure in Mongolia is the low share of development expenditure in relation to recurrent expenditure (Figure 12). Recurrent expenditure includes fixed costs, such as goods and services (wages and salaries, employer contributions), interest payments, subsidies and transfers. Salaries and wages constitute the single largest expenditure item in the integrated budget, taking up 13% of the total budget in 2013.

Capital expenditure, on the other hand, describes payments for acquisition of fixed capital assets, stock, land or intangible assets.

FIGURE 12

Share of Recurrent Expenditure

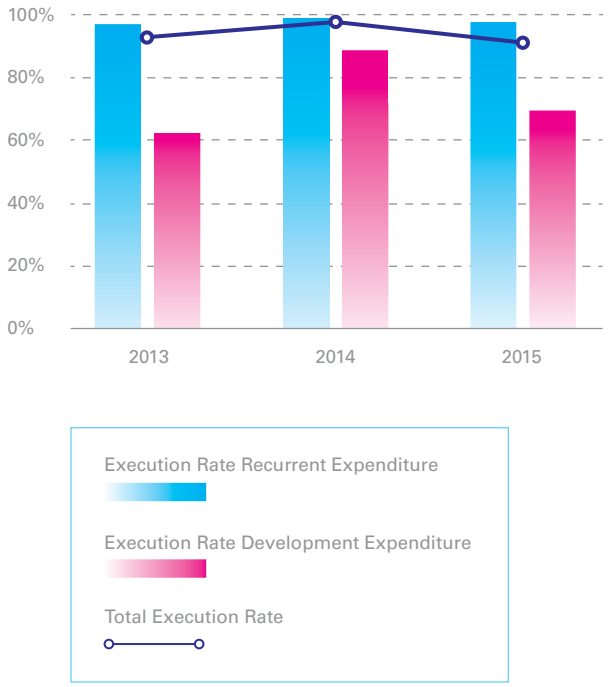


The current economic climate in Mongolia places significant pressure on the GoM to reduce growth in recurrent expenditure and to put a halt to the introduction of new development projects. This situation is likely to remain unchanged until the fiscal targets proposed by the IMF are met.

Furthermore, there is a significant disparity between execution rates for recurrent expenditure and for development expenditure. The execution rate of the recurrent budget in Mongolia has remained persistently above 97% from 2013 to 2015 (Figure 13). Development expenditure, despite having typically displayed a significantly lower execution rate[68], at 69% in 2015, is likely to increase in upcoming years due to restrictions placed on the introduction of new development projects by the GoM. To identify consistently underspent expenditure items which can be reallocated towards financing the potential interventions therefore requires an analysis of both recurrent and development expenditure.

FIGURE 13

Capital and Recurrent Execution Rates



Annex H: Flows of funds for health provision

Flow of funds for health provision

While the previous sections described the key stakeholders involved in the fight against air pollution in Ulaanbaatar, it is also of relevance to understand the institutional framework guiding the flow of funds for health expenditure in Mongolia. The sources of these financial flows are ultimately responsible for the provision of necessary funding for healthcare of children affected by air pollution-related diseases. As such, they play a vital role in the mitigation of the health effects caused by air pollution and need to comply with the prioritisation of children's health in their allocation of funds, for any health intervention to be successful. Figure 14 provides a clear description of the financial flows for health providers.

FIGURE 14

Flow of Funds in the Mongolian Health System

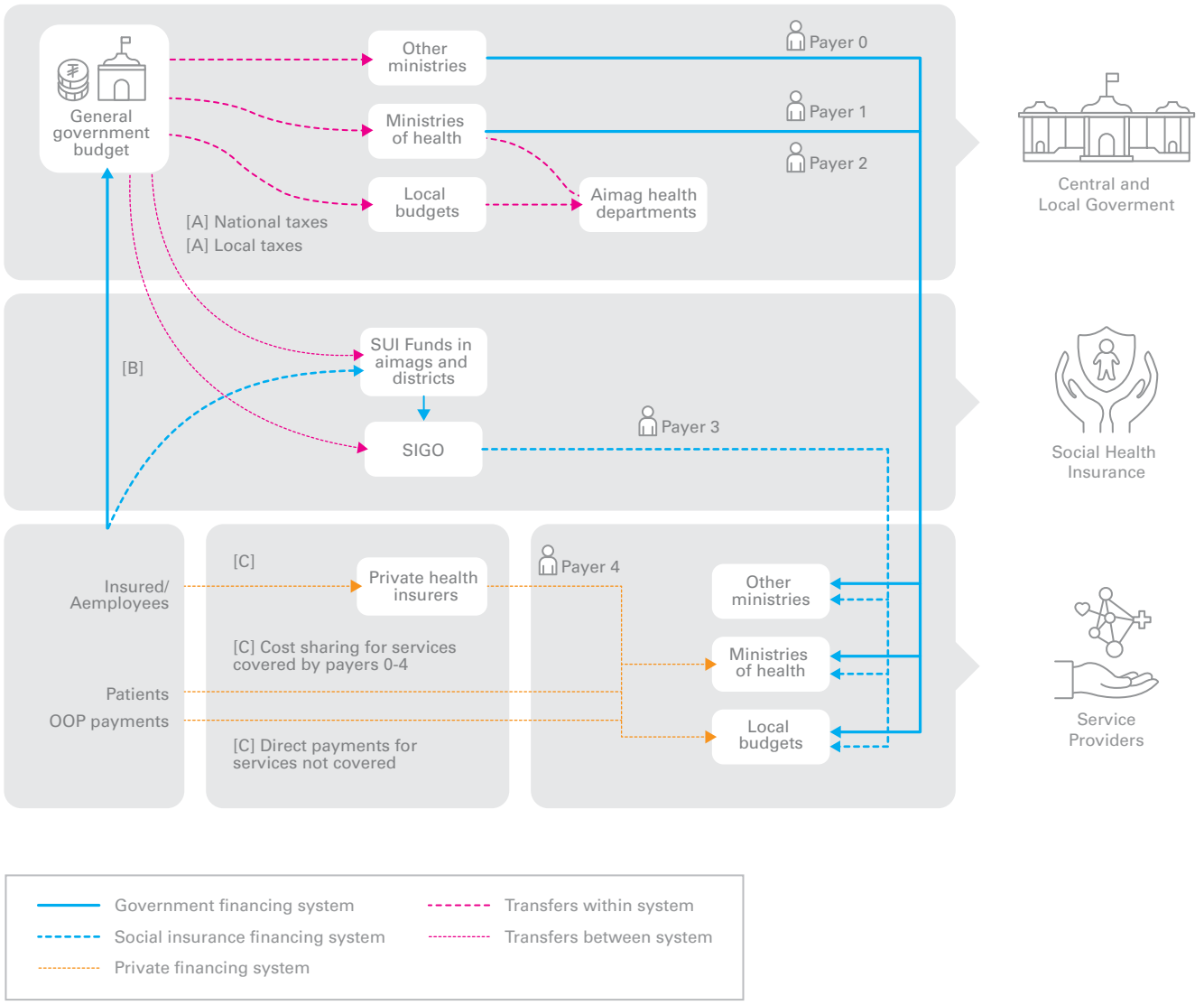


Table 15 below disaggregates the type of healthcare services covered by each of the sources of financing with a specific focus on public funds.

Table 15 - Health financing system in Mongolia[69]

	PRIMARY CARE	SECONDARY CARE	TERTIARY CARE	PRIVATE HOSPITAL
GOVERNMENT BUDGET	Outpatient visits, in-patient admission, routine Immunisation	• Treatment of tuberculosis, cancer, HIV/AIDS and mental illness (by diagnosis-related group (DRG)) for outpatient visits, diagnosis and tests • Consultation, diagnosis and treatment related to pregnancy and childbirth until the end of postnatal period for outpatient visits, diagnosis and tests • Medical emergency service for outpatient visits and diagnosis and tests • Ambulance service • Some drugs for diseases that require lengthy treatment and palliative care	• Treatment of tuberculosis, cancer HIV/AIDS and mental illness (by DRG) for outpatient visits, diagnosis and tests and in-patient, medical emergency service for outpatient visits and diagnostic and tests • Ambulance service • Some drugs for diseases that require lengthy treatment and palliative care	None
SOCIAL HEALTH INSURANCE	Outpatient essential drugs	• Day care • Outpatient visits (excluding drugs) • Diagnosis and tests (up to MNT 36,000) • In-patient admission (outside of government budget care) • In-patient admission for traditional medicine • In-patient admission to rehabilitation centre • In-patient admission for palliative care	• Outpatient visits (excluding drugs) • Diagnosis and tests (up to MNT 55,000) • In-patient admission (outside of government budget care) • In-patient admission for traditional medicine • In-patient admission to rehabilitation centre • In-patient admission for palliative care	• Some payment of in-patient admission (outside government budget care) • Some payment of in-patient admission for traditional medicine • Some payment of in-patient admission for rehabilitative care • Some payment of in-patient admission for palliative care

Health services, and particularly health services to mitigate the impact of air pollution on child health, are provided by one of four types of facility in Ulaanbaatar:

- FHCs;
- district hospitals;
- tertiary hospitals; and
- private hospitals.

This report focusses exclusively on FHCs, district hospitals and tertiary hospitals. District and tertiary hospitals are owned and managed directly by the MoH. While some of their activities are financed by the SHIF, these funds are channelled via the MoH, giving the MoH full oversight over the spending patterns of each facility.

There is, however, a managerial difference between FHCs and other service providers. Unlike tertiary and district hospitals, FHCs are independent budget entities[70]. As such, they have an annual budget allocation and a monthly budget allotment that determines how much they can spend per month. The MoH prepares the annual budgets, based, for the most part, on capitation financing formulae that determine the allocation for each service delivery unit based on school enrolment and population coverage.

Once the budget is approved and the monthly allotment determined by the MoF, the budget is entered into the Government Financial Management Information System (GFMIS). Each FHC has an administrative code in the GFMIS and, as direct budget governors, primary health clinic directors are authorised to spend the budget allocated as per the government rules and regulations[71].

There are some delays in the budget allotment and in the payments from the Treasury Single Account to FHCs. While the annual budget is approved by 15 November of each year, the monthly allotment[72] is usually not approved until the end of January. It usually takes between 10 days and two weeks after the submission of the monthly invoice for the treasury to make payments to FHC accounts so they can pay salaries and other expenses. Data on budget allotments and execution are prepared on a monthly basis by FHCs[73] and are sent to the Ulaanbaatar City Governor's Office and the MoH. FHCs also have to prepare individual financial statements on the full accrual basis of accounting. The Accounting Law of Mongolia also mandates that all budget entities prepare their financial statements in line with the International Public Sector Accounting Standards (IPSAS).

The budget process for district and tertiary hospitals is aligned with that of the MoH and no separate reporting is required.

Annex I: Detailed results of the cost of inaction analysis

Population 0–18 years
Total cost of inaction (USD)

Type of cost	Direct healthcare costs, public sector	Of which, co-payments for in-patient stays	Indirect costs, lost productivity of sick adults	Indirect costs, lost productivity of carer adults	TOTAL
2017	245,303	25,562	-	218,509	463,812
2018	251,689	26,199	-	223,125	474,814
2019	501,954	52,178	-	443,327	945,282
2020	900,150	93,421	-	793,526	1,693,677
2021	1,560,478	161,816	-	1,373,086	2,933,564
2022	1,571,122	162,812	-	1,380,323	2,951,444
2023	1,579,921	163,630	-	1,386,540	2,966,461
2024	1,586,618	164,296	-	1,392,800	2,979,418
2025	1,584,885	164,061	-	1,390,476	2,975,361

Population 0–18 years
Direct cost of inaction by service delivery level (USD)

Type of cost	FHCs	Outpatient district	In-patient district	Outpatient tertiary	In-patient tertiary	TOTAL
2017	1,226	5,155	202,040	1,164	35,717	245,303
2018	1,165	5,693	206,600	1,305	36,926	251,689
2019	2,179	11,973	411,565	2,760	73,478	501,954
2020	4,226	22,372	736,806	5,145	131,602	900,150
2021	7,220	39,897	1,276,267	9,167	227,927	1,560,478
2022	7,259	41,163	1,283,449	9,467	229,783	1,571,122
2023	7,400	42,185	1,289,260	9,716	231,361	1,579,921
2024	7,419	43,015	1,292,878	9,920	233,385	1,586,618
2025	7,429	43,546	1,290,354	10,051	233,505	1,584,885

Population 0–5 years:
Total cost of inaction (USD)

Type of cost	Direct healthcare costs, public sector	Of which, co-payments for in-patient stays	Indirect costs, lost productivity of sick adults	Indirect costs, lost productivity of carer adults	TOTAL
2017	183,224	19,114	-	162,472	345,696
2018	171,098	17,843	-	151,640	322,737
2019	315,116	32,840	-	279,014	594,130
2020	527,982	54,998	-	467,065	995,047
2021	829,390	86,394	-	734,095	1,563,485
2022	762,569	79,442	-	675,210	1,437,779
2023	705,630	73,524	-	625,031	1,330,660
2024	655,967	68,364	-	581,283	1,237,250
2025	609,469	63,534	-	540,468	1,149,936

Population 0–5 years:
Direct cost of inaction by service delivery level (USD)

Type of cost	FHCs	Outpatient district	In-patient district	Outpatient tertiary	In-patient tertiary	TOTAL
2017	923	2,912	153,670	739	24,980	183,224
2018	849	2,836	143,246	714	23,453	171,098
2019	1,539	5,411	263,594	1,370	43,202	315,116
2020	2,539	9,356	441,162	2,381	72,543	527,982
2021	4,019	14,498	693,753	3,662	113,458	829,390
2022	3,722	13,131	638,385	3,311	104,020	762,569
2023	3,469	11,959	591,098	3,009	96,095	705,630
2024	3,249	10,933	549,855	2,742	89,188	655,967
2025	3,046	9,992	511,117	2,499	82,815	609,469

Population of all ages (children and adults): Total cost of inaction (USD)

Type of cost	Direct healthcare costs, public sector	Of which, co-payments for in-patient stays	Indirect costs, lost productivity of sick adults	Indirect costs, lost productivity of carer adults	TOTAL
2017	591,429	64,126	247,922	218,509	1,057,860
2018	563,610	61,156	228,038	223,125	1,014,774
2019	998,482	108,192	381,452	443,327	1,823,261
2020	1,596,572	172,721	577,975	793,526	2,968,074
2021	2,502,679	270,584	887,437	1,373,086	4,763,202
2022	2,450,267	265,052	847,798	1,380,323	4,678,387
2023	2,410,853	260,974	815,831	1,386,540	4,613,225
2024	2,381,238	257,938	790,420	1,392,800	4,564,458
2025	2,348,456	254,519	764,784	1,390,476	4,503,716

Population of all ages (children and adults): Direct cost of inaction by service delivery level (USD)

Type of cost	FHCs	Outpatient district	In-patient district	Outpatient tertiary	In-patient tertiary	TOTAL
2017	2,126	13,952	401,664	13,959	159,727	591,429
2018	2,044	14,353	379,971	12,849	154,393	563,610
2019	3,752	26,940	675,022	21,502	271,267	998,482
2020	6,205	45,106	1,085,964	31,799	427,498	1,596,572
2021	10,010	72,803	1,710,885	45,681	663,301	2,502,679
2022	9,768	73,651	1,668,746	43,583	654,519	2,450,267
2023	9,577	74,569	1,635,443	41,734	649,530	2,410,853
2024	9,901	75,506	1,608,130	40,198	647,502	2,381,238
2025	9,869	76,207	1,580,526	38,742	643,110	2,348,456

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28. In addition to robust PAFs, these nine diseases are also the most commonly recurring diseases in patients exposed to air pollution according to MoH data.
29. The contribution of a risk factor to a disease is quantified using the PAF. The PAF is the proportional reduction in population disease that would occur if exposure to a risk factor were reduced to an alternative ideal exposure scenario (no air pollution).
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72. Document laying out the monthly schedule of the budget.
73. As per the government's regular reporting requirements.

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