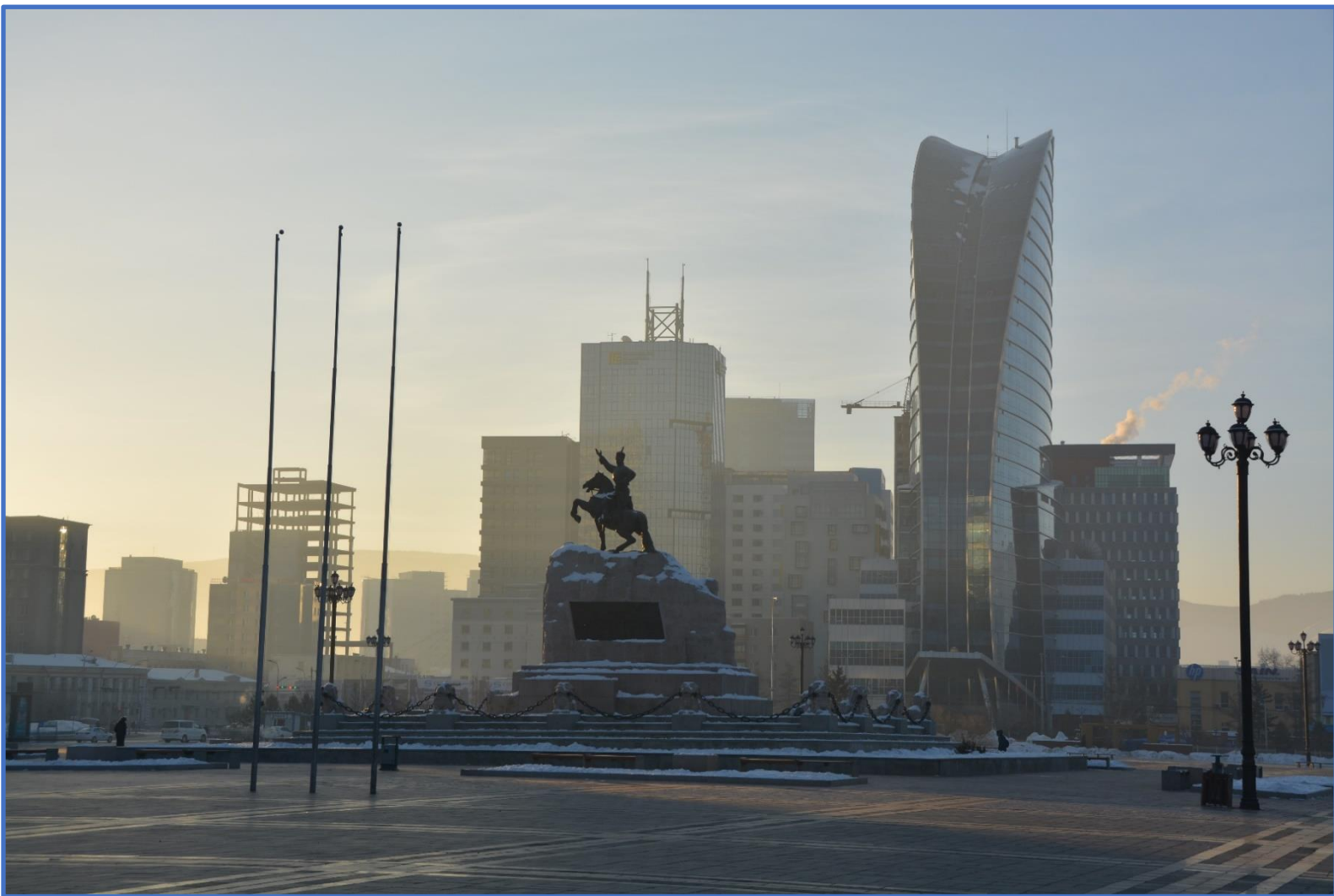


USING DATA TO INFORM AIR POLLUTION POLICY IN ULAANBAATAR: Report on workshop delivered in May 2019



Research
England



"We are interested to see the progress made by this collaboration of the University of Bath and the National University of Mongolia and we are excited to engage with future research. Air pollution is a huge problem in Ulaanbaatar, and I am in no doubt that the impact of this work, both in terms of capacity building and exploring research challenges, will be of great benefit to residents in the city"

*Dr Gantuya Ganbat, Head of unit of Research, Innovation and Environmental Quality
National Committee on Reducing Environmental Pollution
Ministry of Environment and Tourism of Mongolia*

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1. Introduction

This report, collectively written by participants from the University of Bath, describes the build up to, delivery of, and planned follow up from, a workshop delivered at the National University of Mongolia, Ulaanbaatar, by researchers, students and staff from the University of Bath in May 2019 titled '[Using data to inform air pollution policy in Ulaanbaatar](#)'. The workshop was delivered through two interlinked themes and approximately 40 people, from academic, government and private organisations, participated. Morning sessions focused on the development and communication of policy building on robust data analysis, whilst the afternoon sessions provided training for participants on data analysis using the free programming language '[R](#)'.

The workshop had two key aims: (1) To explore how using data science can help inform understanding, and analyse the way in which air pollution relates to key sustainable development goals, and (2) To train participants in basic data science techniques using data related to air pollution.

The goal was to develop a series of questions for use in guiding the collection and collation of a robust data set for future collaborative work (see section 5.2) and provide the basis for funding applications from UK and international agencies (see section 7).

A [film of the experience](#), created by Bath participant, Kevin Olding, outlining the activities of the workshop and including interviews with facilitators and participants, is available.

2. Background

Mongolia is a country of 3.2 million people, 1.4 million of whom live in the capital, Ulaanbaatar. Over the last 30 years, the proportion of the population living in UB has increased from 25% to 50%, driven by the availability of jobs, health care, and education, as well as migration to join family members, amongst other causes. Many new inhabitants to the city settle around the city's perimeter, where they live in traditional round gers (yurts) or small detached, self-constructed housing. It is estimated that 60% of the city's residents live in the ger district.

The Mongolian ger is a centuries-old design appropriate for nomadic living and is heated by a central stove with an exhaust flue protruding from a hole (around 1m in diameter) in the top. Traditionally, dried animal dung (found in abundance in the Mongolian steppe) is used as a source of fuel. Ger dwellers in the city do not have access to this fuel source and have resorted to burning any available combustible material, predominantly untreated coal that has recently become readily available thanks to the expansion of the Mongolian mining industry.

The level of migration to UB associated with ger domicile use, coupled with challenges in city planning, has led to a severe air pollution problem, especially during the cold winter months. The health and economic impact of air pollution is massive, and affects all residents of the city, particularly those living in poverty. The Mongolian government views the problem as a national crisis, with vulnerable groups at particular risk of chronic

respiratory and developmental health problems¹, and is seeking to establish a clear way forward to address it, and to improve the quality of life for residents of UB.



Figure 1: Sunrise over a smoggy Ulaanbaatar, November 2016

The departments of [Mathematical Sciences](#) and [Psychology](#), and the [Institute for Policy Research \(IPR\)](#) from the University of Bath have been working with the National University of Mongolia and other stakeholders in Ulaanbaatar (UB) for nearly 4 years to understand and seek ways to address the challenge of reducing the impact of air pollution.

The collaboration consists of three streams:

- 1) Capacity building in UB, through training people from multiple organisations in the sense of effective collection, analysis and interpretation of data (primarily using R);
- 2) Working with stakeholders to understand the societal drivers and impacts of air pollution, and obtaining robust accompanying data to support findings;
- 3) Developing research collaborations between Bath and UB, including pursuing funding, to explore potential interventions and deliver tangible impact.

3. The use of data to study air pollution

Data and its analysis are fundamental in the development of better air pollution policy. The widely available and wide-ranging data sources can be used to identify links between behaviours and variable factors, such as fuel source selection, dwelling choice, dwelling adaptation, industrial or residential classification etc., and air pollution readings, and to quantify their effects. Spatial and temporal statistical methods may be used to identify and predict the worst affected areas and periods in order to efficiently target interventions. Furthermore, with the right data, it is possible to quantify a potential link between pollutant

¹ UNICEF, *MONGOLIA'S AIR POLLUTION CRISIS: A call to action to protect children's health*, https://www.unicef.org/eap/sites/unicef.org/eap/files/press-releases/eap-media-Mongolia_air_pollution_crisis_ENG.pdf

density and measured health effects, such as hospital admissions for respiratory problems.

For example, suppose that the data suggests quality of life is reduced during winter months. With access to a broad enough dataset it may be possible to quantify the reduction attributable to increased air pollution, and how much is due to seasonality alone. Clearly, a better understanding of the causes that drive quality of life is crucial to make suggestions for policy reform and to determine the effectiveness of possible solutions. Measurements may be taken in an area in which an intervention is being trialled and compared to equivalent measurements in a similar area without the trial. This allows the effectiveness of the policy to be quantified, enabling policy makers to compare the relative worth of possible actions.

4. Build up to the workshop

The University of Bath has been collaborating with the National University of Mongolia (NUM) since 2015 when a meeting, consisting of mini-courses and lectures delivered by international experts, was organised at NUM on the topic of [Stochastic Processes and Applications](#).



Figure 2: Group photo from 2015 meeting on the steps of the National University of Mongolia

This meeting began a strong collaboration between the Institute of Mathematics at NUM (led by Otgonbayar Uuye) and the department of Mathematical Sciences at the University of Bath (led by Andreas Kyprianou). In particular, [the EPSRC Centre for Doctorial Training in Statistical Applied Mathematics \(SAMBa\)](#), a centre which was established in 2014 and will deliver PhD research training for upwards of 150 students by 2028, provided a foundation to collaboratively deliver training and research impact. Funding from the University of Bath supported a visit of 6 staff and 4 SAMBa students to [UB in November 2016](#). Bath delegates delivered a short training course in data science and also ran a number of discussion groups with key stakeholders across UB identifying potential areas for collaboration to deliver research and impact. From these discussions, it quickly became clear that the severe air pollution and its effects on the citizens of UB was a huge challenge facing the city and the country of Mongolia.



Figure 3: Participants in 2016 data science training with SAMBa student trainers

From this point, regular communication was established between Bath staff (Andreas Kyprianou, Susie Douglas (Department of Mathematical Sciences), Julie Barnett (Department of Psychology)) and stakeholders in UB, primarily with NUM (Otgonbayar Uuye) with whom a practice of fortnightly Skype calls was instituted. Seeking funding for further face-to-face interaction and collaboration initially proved challenging and it was not until September 2018 that a Bath delegation returned to UB. Two [lecture courses](#) were delivered and multiple meetings held across the city with the express purpose of focusing in on potential research collaborations. This visit led directly to further funding from the University of Bath to support the workshop and associated activities described below.

The Bath-UB relationship continues to go from strength to strength as we expand our networks and seek to support deeper interactions. Collaborators, in both cities, within the remits of health, environmental sciences, chemical sciences, and computer science are now joining the activity around the core that has been established.

4.1 Faculty for the Future funding from Schlumberger Foundation



Figure 4: Tsogzolmaa Saizmaa

Concurrently to the activity described above, Tsogzolmaa Saizmaa, who is part of the faculty at NUM has [joined SAMBa as a PhD student](#). Tsogzolmaa is funded through the Schlumberger Foundation's Faculty for the Future fund. This supports her study abroad with the expectation that she will then return to Mongolia and build research and training capacity. Tsogzolmaa's participation in SAMBa has proved invaluable to both the Bath and Ulaanbaatar sides of the relationship, providing a permanent link between the University of Bath and the National University of Mongolia and driving exceptionally strong personal links. Tsogzolmaa will graduate from SAMBa in the summer of 2020 to return to NUM.

4.2 Scoping visit to Ulaanbaatar

The scope of the workshop described below was developed following an extended visit to Ulaanbaatar by two researchers: Teo Deveney (SAMBa) and Jess Lloyd-Evans (IPR) in March 2019. Teo and Jess spent 5 weeks exploring the landscape of Ulaanbaatar, meeting researchers, sourcing potential data, and gathering information on the training requirements of stakeholders. Their five week preliminary visit was hosted by NUM but

with generous support, including the provision of office space and the facilitation of meetings, from the [National Statistics Office \(NSO\)](#) and [Unicef Mongolia](#).

Contextual Understanding: The visit was invaluable to develop contextual understanding of the policy and data landscape in Mongolia. Jess and Teo held a series of meetings with experts from the UN Economic and Social Commission for Asia and the Pacific (UN-ESCAP), and the Asian Development Bank. Through these meetings, it became apparent that those in the UB-based professional community with capacity to undertake data collection, methodology and analysis, would greatly appreciate additional support.

There was also interaction with local citizens, learning how health concerns around air pollution caused them to adapt their everyday decision-making. These included avoiding pregnancy during certain times of the year and sending children away from the city during the highly polluted winter period.

Relationship building: The Bath researchers met with representatives from Unicef Mongolia to discuss their strategic priorities, which included local capacity building for research and data analysis; practical action initiatives such as placing air pollution monitors in schools, and the development of evidence-based policy solutions. From these discussions, they then identified areas of potential alignment for future collaboration.

They also connected with the Ulaanbaatar Air Pollution Reduction committee, responsible for the implementation of government policy on air pollution. This department had a keen interest in the use of data in forecasting pollution to improve the city's response to the crisis.

The historic collaborations with the NSO, the National Development Agency (NDA), and NUM were significantly strengthened through the visit. As part of this, Teo delivered a technical mathematical presentation covering air pollution modelling and some modern methods of using data for forecasting at NUM.

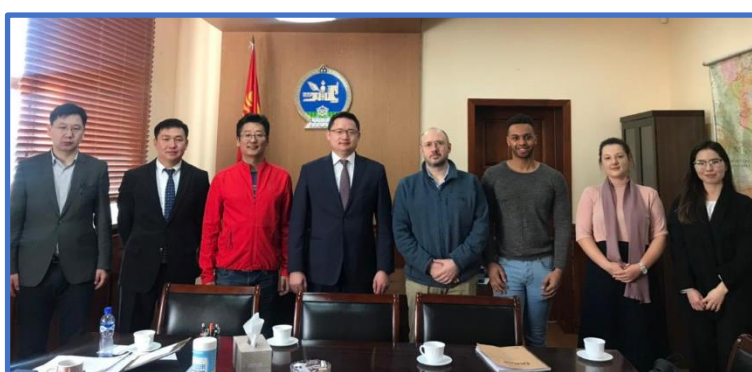


Figure 5: Visiting the National Development Agency

Capacity building: The team was also able to offer several introductory capacity building activities, including providing statistical consultancy to a range of organisations with immediate and pressing concerns. This led to immediate impact. For example, the training allowed the National Centre for Public Health to uncover links between air pollution and hospital admissions for various ailments. NUM students were also assigned to shadow Jess and Teo, offering technical support in data cleaning and policy mapping.



Figure 6: Teo Deveney and Jess Lloyd-Evans in UB, with Andreas Kyprianou

In addition, Jess and Teo provided group training. This served the dual purpose of building capacity amongst a large number of people (including researchers at the Mongolian National University of Medical Sciences and civil servants at the Department of Public Health) in the field of statistical data analysis, and ensuring the content for the May workshop aligned with the needs and experience of local stakeholder groups.

5. Structure and delivery of the workshop

The workshop was split into two strands: (1) understanding data-informed policy and (2) training in statistical methods. The two were interlinked and the majority of participants were involved in all sessions. The training material was continually adapted throughout the workshop as we learnt more about the participants' needs and interests.

Monday 13 th May	09.30-10.00	REFRESHMENTS	Tuesday 14 th May	09.30-10.00	REFRESHMENTS	COME PREPARED! Please download 'R' packages to your laptop http://people.bath.ac.uk/tjd314/install_R_and_RStudio_instructions.pdf	
	10.00-10.30	Introduction session: who's here and how we got here		10.00-10.15	Recap		
	10.30-11.00	The relationship between data and policy		10.15-11.30	Exploring root causes of large and complex problems		
	11.00-11.30	Case Study of Air Pollution		11.30-11.45	REFRESHMENTS		
	11.30-11.45	REFRESHMENTS		11.45-13.00	Citizen perspectives and citizen data		
	11.45-13.00	Introduction to good data		13.00-14.00	LUNCH		
	13.00-14.00	LUNCH		14.00-17.00	Data visualisation and regression to demonstrate intersection of complex problems and impact on citizen perspectives		
Wednesday 15 th May	14.00-17.00	How to prepare a dataset for analysis, ensuring it is ready to explore complex, interrelated questions	Thursday 16 th May	09.30-10.00	REFRESHMENTS	Friday 17 th May	
		REFRESHMENTS BREAK 15:30		10.00-10.15	Recap		
				10.15-11.30	Exploring how data can inform policy and interventions		
	09.30-10.00	REFRESHMENTS		11.30-11.45	REFRESHMENTS		
	10.00-10.15	Recap		11.45-13.00	Presenting and analysing public perceptions data		
	10.30-11.30	Understanding policy options		13.00-14.00	LUNCH		
	11.30-11.45	REFRESHMENTS		14.00-17.00	Piloting and evaluating interventions using statistical power and exploring differences		
	11.45-13.00	Using public perception data to test hypotheses			REFRESHMENTS BREAK 15:30		-Consultation and discussion on participant data sets -Exploring and discussion of policy options REFRESHMENTS BREAK 15:30
	13.00-14.00	LUNCH					
	14.00-17.00	Data analysis techniques for decision making					
		REFRESHMENTS BREAK 15:30					

Figure 7: Outline structure of the workshop

5.1 Policy sessions

The morning sessions of the workshop were focused on considering the causes and possible policy responses to the air pollution issue in Ulaanbaatar. In particular, the role that data plays in enhancing understanding of the causes, and in designing

and evaluating interventions to reduce or manage air pollution was presented in the context of the UN's [sustainable development goals](#). The sessions were led by [Julie Barnett](#), with support from Jess Lloyd-Evans and PhD students Eleanor Eaton (Department of Economics) and Aoibheann Brady (SAMBa).

Good quality policy making depends on high quality information, derived from a variety of sources – expert knowledge; existing domestic and international research, existing statistics, stakeholder consultation; evaluation of previous policies.
Modernising Government White Paper, UK Cabinet Office 1999

5.2 Exploring the causes of air pollution in Ulaanbaatar

In order to explore air pollution issues with workshop participants, we used interactive voting software ([Mentimeter](#)) and spent time working in small groups, as well as delivering plenary presentations. Thinking about air pollution from a policy perspective in the morning provided an important backdrop to the afternoon sessions where participants were taught some basic statistical procedures using air pollution data collected in Ulaanbaatar.

*Not everything that
can be counted
counts.*

*Not everything that
counts can be
counted.*

Тоолж болдог бүхэн

Ач холбогдолтой

байх албагүй

Ач холбогдолтой

бүхнийг

Тоолж болох албагүй

One particularly informative session involved small groups working to produce ‘fishbone’ diagrams describing the four broad causes of air pollution in Ulaanbaatar - people, technology, environment and policies. These were then used as the basis of a detailed exploration of *why* each factor causes air pollution and which is the most important. Participants also considered where opportunities exist for using data to increase our understanding of these causes.

Several common themes emerged from the group discussions, which included:

- Lack of infrastructure e.g. transport, buildings;
- Uncontrolled and unsupported migration;
- Poor implementation of proposed policies;
- Lack of focus on renewable/alternative options to coal;
- Continued reliance on coal for a variety of reasons (cheap, lack of alternatives, over population, tradition); and
- Misaligned organisational priorities, including misdirected funding and insufficient expert input.



Figure 8: Example output of discussion group

Poverty was identified as a common driver of many of these themes.

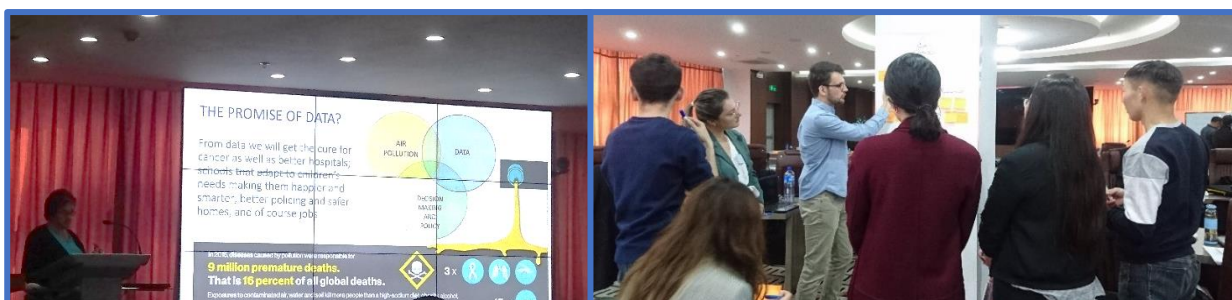


Figure 9: Policy sessions during the workshop

5.3 Statistical capacity building

Four afternoons from the workshop were devoted to statistics training using the programming language ‘R’. Participants learned how to import, manipulate, merge and plot data. They also learned some linear and generalised linear modelling and were challenged to demonstrate their proficiency in R with various exercises, assisted by SAMBa students.

Many participants indicated that following the training they were better able to analyse their own data, enabling new approaches or making older methods more efficient. The data used for the examples was air pollution readings and hospital admission information from Ulaanbaatar. We were able to draw some interesting conclusions from the data within the workshop and to identify worthwhile avenues for future research. All the [materials from the workshop](#) have been made available to the participants and other interested researchers.

5.4 Conducting a survey of citizens of Ulaanbaatar

In order to inform discussion at the workshop, as well as provide training materials, a survey was commissioned in May 2019² to gather Ulaanbaatar residents' opinions and understanding of air pollution. This survey was proposed for a variety of reasons, including:

- Lack of evidence on nature and distribution of residents' views about air pollution;
- To gain some insights into residents' views of air pollution;
- To share and discuss the survey as a focal point of the workshop; and
- To help identify what else should be asked in further survey work.

Information gathered included population demographics (age, gender, employment, education, location, housing, income), the respondents' knowledge of air pollution and its consequences, their preferred sources of information on air pollution, their beliefs about its severity and about whose responsibility it is to improve air pollution, and their understanding of actions taken to guard against the health effects of air pollution and their perceived effectiveness.

A total of 570 people took part in the survey – 387 in face-to-face surveys, 157 online and 26 at the workshop itself. Of these respondents, 221 were male and 349 were female. Ages of respondents ranged from 15 to 84 with a median age of 35. Respondents had between 0 and 9 children, with an average of 1.5 and between 1 and 11 household members, with a median of 4.

465 respondents believed that burning raw coal was the main source of air pollution, corresponding to almost 82% of the total respondents. The most trusted source of information on air pollution was the Mongolian Meteorological Agency, with 257 participants choosing this option. Just 65 respondents chose government announcements on the topic as the most trusted source of information. The respondents noted a variety of government interventions to improve air pollution, with improved stoves (222), improved fuel (92) and reduction in electricity tariffs (42) being the most common. However, 108 were not aware of any such interventions, while a further 26 thought no action had been taken. The majority of interventions were judged to be “moderately effective” from the scales provided in the review.

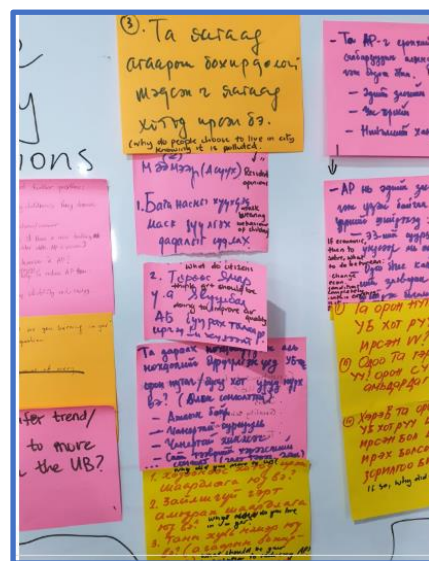


Figure 10: Reflections from workshop participants on the survey results

² Carried out by [Access Solutions, Mongolia](#)

It is possible that there might be differences between opinions on effectiveness when splitting by age group, gender or income levels. This, along with further hypotheses on the impacts and understanding of air pollution by income, household type, education level and other demographics will be further explored in a future research article to be jointly published by Bath and Ulaanbaatar workshop participants.

Both the results of the survey and its design were discussed during the workshop and participants were asked to explore what they learned from the survey and how it could be improved. From this we now have an extremely valuable collection of information and ideas that will inform future interaction in the policy development remit between Bath and Ulaanbaatar.

5.5 Valuing the societal impact of air pollution

Developing effective interventions to improve the air quality of Ulaanbaatar will require a more detailed understanding of the societal impact of air pollution on the population, and the economic consequences, and we incorporated two questions into the survey we commissioned in order to form a platform for future research collaboration in this area.

The clean air policies for the EU³ and the UK⁴ have been developed using an approach that forecasts the number of cases of illness or mortality on which a policy is expected to impact, and this is quantified by a monetary cost. In this way, a cost-benefit analysis can be produced, allowing policy makers to evaluate the effectiveness of interventions.

In Mongolia the existing valuation of health impacts related to pollution is not represented in the literature, except in a paper by Hoffman et al, (2012), which explored the Willingness to Pay (WTP) of residents to reduce risk of mortality associated with air pollution⁵.

Our survey of Ulaanbaatar residents compliments this work by eliciting a value for the societal cost of illness – in this case Chronic Bronchitis (CB), associated with air pollution. Hoffman found that 23% of UB residents suffer from CB.⁶

Respondents were offered a choice of payment rates ranging from zero to 500,000₮ per month and asked to consider what they would be willing to pay to avoid CB related to air pollution. From 543 respondents, we found that residents were willing to pay an annual amount of 1.9 million₮ (£565) on average to avoid the symptoms of chronic bronchitis, with the median value of 1.2 million₮ (£360). This represents around 14% of declared household income. 53% of all respondents had been affected or their families had been affected by diseases caused by air pollution.

Although the elicitation methods used were very simple compared with some other non-market valuation techniques, early results indicate that the welfare value of interventions that reduce air pollution could be significant. This initial study is expected to inform future collaboration and research led by the Department of Economics at the University of Bath.

³ http://ec.europa.eu/environment/air/index_en.htm

⁴ <https://www.gov.uk/government/publications/clean-air-strategy-2019>

⁵ Hoffmann et al, Resource and Energy Economics, Vol. 34, Issue 4, 2012, pp 493-513, <https://doi.org/10.1016/j.reseneeco.2012.04.005>.

⁶ Mejza et al, European Respiratory Journal Nov 2017, 50 (5) 1700621; DOI: 10.1183/13993003.00621-2017

5.6 Experience of working with delegates

Throughout the week, a group of SAMBa PhD students assisted in the facilitation of the workshop, providing technical assistance and logistical support. The students contributed by delivering parts of the training, acting as tutors in the statistical workshop (including dealing with computer installation problems), and as facilitators in the policy sessions.

On the last day of the workshop, SAMBa students offered 1 to 1 assistance to participants with the goal of aiding them in the analysis of their own data. The analyses performed on this day spanned identifying links between environmental factors and children's birth weight, socio economic research using Unicef's most vulnerable children index, and transaction data analysis with a business school. This was a great opportunity for participants to apply some of the training to their own data, guided through the obstacles arising when working with real data outside of a structured training environment.

As well as being of benefit to the participants, the training provided valuable insight and experience to the SAMBa students who had the opportunity to apply their knowledge to real world applications and to gain teaching experience in an unusual environment. It was also beneficial for them to gain insight into the challenges and rewards of implanting capacity building partnerships and data-driven policy advisory work for development in general as well as in the particular context of air pollution in Ulaanbaatar.



Figure 11 Training for participants in R, from SAMBa students

6. Exploring Mongolian culture

Taking time to enjoy Mongolian life and culture is an essential part of any visit to Ulaanbaatar. This is not only because of the opportunity presented to gain new experiences, but also helps to develop a sense of the country and its people, which is critical in any collaboration of this nature. Solutions that have worked elsewhere in the world in tackling air pollution will not necessarily be translatable to Mongolia where the culture and infrastructure is different. In addition, meeting citizens of Mongolia, outside of those involved directly in exploring the causes and impacts of air pollution, can give a wider aspect of how Mongolians view the challenges of tackling the problem, and how pertinent issues differ between Ulaanbaatar and the countryside. Bath visitors in May managed to visit the 13th Century Mongolian experience, see traditional music at the National Academic Drama Theatre, attend the ballet (courtesy of Unicef Mongolia), meet herders in the steppe, and sample khorkhog (lamb cooked with hot stones). We are so very grateful to our hosts for sharing their wonderful country and unique culture with us.



Figure 12: A selection of experiences from our time in UB and around

7. Future activity

The workshop and the preceding visit of Bath researchers Teo Deveney and Jess Lloyd-Evans is the latest in the line of capacity building activities that have been delivered through collaboration between the National University of Mongolia and the University of Bath. Whilst previous workshops/training events have had a much stronger mathematical flavour, the May 2019 training event concentrated on evidence-based policy research, with a strong focus on air pollution management.

This slight change in direction represents a better understanding (on the part of Bath researchers) of the more immediate needs of the Mongolian scientific community, as well as better connectivity with some of the key stakeholders therein. The pervasive nature of the air pollution problem in Ulaanbaatar has been well represented and communicated to researchers in Bath by local experts, both in its severity and in the complexity of issues at stake. As such, the May 2019 workshop provided an excellent opportunity to set a number of targets for further engagement of mutual benefit that will deepen the relationship of Bath researchers with Mongolian experts as well as lay a pathway to maximum impact. We highlight these targets below.

- Publish an academic article from the survey data, co-authored by University of Bath and Ulaanbaatar-based researchers.
- Pursue publishable and advisory research based on a number of data sets that have been shared between Bath and Mongolian researchers.
- To date, we have developed a relatively complete stakeholder map of those engaged with air pollution in UB. In addition to continuing to expand it, we will use it to better align a number of new Bath/UK-based academics into future research work with our Mongolian partners as well as in the preparation of grant applications (see bullet points below). With the historical evolution of the Bath-Mongolian collaboration being rooted in the mathematical community, greater emphasis will be placed on bringing more diverse expertise from Bath on board.
- Progress the vision of collaborative research through capacity building with follow on funding that will permit further visits of Bath researchers to Mongolia and Mongolian researchers/policy advisors to the UK. The following grant opportunities have been identified:
 - EPSRC⁷ GCRF⁸ [Capacity building in mathematical sciences call](#) (circa £150k): Here Bath researchers will focus on capacity building in data science in the public domain.⁹ The core of the proposal is driven by statistical science experts with an emphasis towards social science, public health and economic impacts.
 - ESRC¹⁰ GCRF [Off-grid cities call](#) (circa £2M): Here Bath researchers will put forward a case to study Ulaanbaatar in tandem with Dhaka in Bangladesh looking at community engagement to drive policy making in communities living off the grid and dealing with air pollution. This is led by social policy and psychology experts and includes statistics, computer science, and civil

⁷ EPSRC: Engineering and Physical Sciences Research Council, UK.

⁸ GCRF: Global Challenges Research Fund. This is a £1.5 billion budget from the UK government aid budget that has been committed to research.

⁹ At the time of writing, we have received the good news that this has been awarded and will support activities between 2020 and 2021.

¹⁰ ESRC: Economic and Social Research Council, UK.

engineering researchers from the University of Bath and many stakeholders from UB and Dhaka.

- NERC¹¹ GCRF [multi-hazards and systemic risks call](#) (circa £3.5M): Here Bath researchers focus on collecting and analysing chemical and biochemical markers that can be used to fingerprint health and social factors in communities, and explore how associated data can be used in policy interventions¹². Three cities will play the core study domains, Ulaanbaatar being one of them. Expertise driving this is in (bio)chemical science, with strong underpinning investment from social science and statistics from the University of Bath and the Mongolian National University of Medical Sciences.
- GCRF [Research England 2019-2020 call](#) (circa £50k): Here Bath researchers aim to extend the initial funding that underpinned the activities in this report, allowing the next phase of data analysis, coupled with capacity building training. This is led by Mathematics researchers but with a strong mandate to draw in researchers from other disciplines. If successful, the funding will allow a Mongolian researcher to spend up to three months in Bath, and to deliver a training event for Mongolian professionals in Bath¹³.



Figure 13: Traditional Mongolian gers at a tourist camp in the beautiful steppe

¹¹ NERC: Natural and Environmental Research Council, UK.

¹² We have recently learned that this was unsuccessful at the initial stage but have plans to submit similar ideas to the Wellcome Trust and EPSRC

¹³ This has been submitted and the result is due in July 2019

8. Bath participants at the May 2019 workshop



From left to right, top to bottom, with emails of corresponding authors embedded:

- [Professor Julie Barnett](#), Department of Psychology, Associate Dean of Health and Social Science;
- [Dr Susie Douglas](#), SAMBa Centre for Doctoral Training;
- [Professor Julian Faraway](#), Department of Mathematical Sciences;
- Jess Lloyd-Evans, Institute for Policy Research;
- Teo Deveney, SAMBa PhD student;
- Professor Paul Milewski, Department of Mathematical Sciences and SAMBa co-Director;
- Kevin Olding, SAMBa PhD student;
- Eleanor Eaton, PhD student, Department of Economics;
- Aoibheann Brady, SAMBa PhD student;
- Adwaye Rambojun, SAMBa PhD student;
- Tom Smith, SAMBa PhD student;
- Elizabeth Gray, SAMBa PhD student;
- [Dr Tsogzolmaa Saizmaa](#), SAMBa PhD student and academic staff National University of Mongolia;
- Emma Horton, SAMBa PhD student;
- [Professor Andreas Kyprianou](#), Department of Mathematical Sciences and SAMBa co-Director.