2022

DIFFERENT AIR UNDER ONE SKY

The Inequity Air Research

GREENPEACE

Contents

INTRODUCTION

Pollutants emitted into the atmosphere drive the global threats posed by both air pollution and climate change. The negative impacts of these crises are not felt equally and it is often the most vulnerable people who are most severely affected[1].

AIR POLLUTION IS THE LARGEST ENVIRONMENTAL RISK FACTOR FOR HUMAN HEALTH

Exposure to air pollution is a leading global health risk which causes ill health and millions of premature deaths each year worldwide. Recent estimates range from 4 million to 9 million premature deaths per year worldwide.[2,3,4] This health burden falls disproportionately on low and middle-income countries.[5]

In 2021 the World Health Organization (WHO) published new air quality guidelines designed to protect public health. The guidelines were derived using the latest evidence on the adverse health effects of air pollution, including effects which occur at much lower levels than had previously been described. In particular, the new guidelines recognise that chronic exposure to even low concentrations of fine particulate matter is responsible for a significant burden of disease (See Box: What is $PM_{2.5}$?).

This report investigates exposure to fine particulate matter, to determine the extent to which the most vulnerable people, such as children, older adults and pregnant people, are disproportionately affected, an issue that can be compounded by the lack of access to air quality information.

Box: What is $PM_{2.5}$?

Particulate matter is pollution in the form of small solid or liquid particles suspended in the air. $PM_{2.5}$ refers to any particles that measure 2.5 μm or less in diameter, much finer than a human hair. $PM_{2.5}$ is sometimes known as 'fine particulate matter' or 'fine suspended particles' (FSP).

$PM_{2.5}$ can occur naturally, including from desert dust. There are also many human sources of $PM_{2.5}$ including from transport, industry, agriculture, fossil fuelled-power stations and vegetation burning.

Breathing $PM_{2.5}$ can harm our health. Exposure increases the risk of premature death, cardiovascular diseases, and respiratory diseases like asthma and bronchitis. It is also associated with increases in hospital admissions and absences from school or work.

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INTRODUCTION

Inequity from exposure to air pollution of Vulnerable groups

Clean air is not only an issue of environmental health but one of equity and justice. All people deserve to breathe clean air. The WHO defines health equity as the "the absence of unfair and avoidable or remediable differences in health among population groups defined socially, economically, demographically or geographically" and further points out that the existence of health inequities resulting from air pollution represents a barrier to achieving full human rights.[6,7]

Air pollution can affect anyone. It has been estimated that in 2019 more than 90% of the global population lived in areas where the previous WHO air quality guideline for fine particulate matter was breached.[8] However, the negative impact of air pollution on health is unequal. Some people are more vulnerable than others. Examples of factors that can influence the vulnerability of an individual to air pollution include exposure to pollution, social or economic deprivation and the existence of chronic health conditions. Population groups at heightened risk include newborns, children, older people and those who are pregnant.[9,10] These groups are the focus of this report.

Box: At-risk groups

Research has found compelling evidence of environmental and social disparities resulting from exposure to air pollution.[11] Groups that are especially susceptible to the impacts of air pollution include:

- **Infants and pregnant people**
  Effects on children and infants include risk of preterm birth, respiratory diseases such as asthma and increased risk of mortality. Children's relatively higher respiratory rates and still developing bodies are factors that contribute to this risk.[12,13,14,15]

- **Older adults**
  Effects on older adults include increased risk of mortality, respiratory infections and worsening of existing medical conditions. These risks increase as a result of long-term exposure to air pollution, frailty, reduced physiological capacity, lung function and existing health conditions in older people.[16]

- **People with health conditions, and poorer households**
  as a result of poorer diet, long-term health conditions, poor housing, healthcare, and stress.[17,18,19,20]
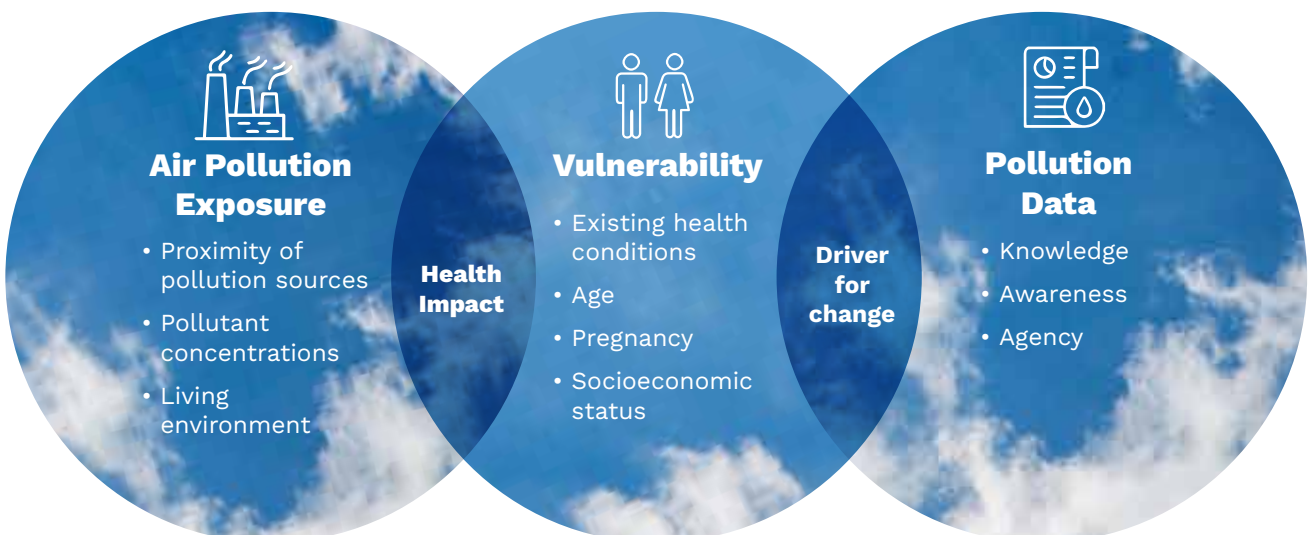
INTRODUCTION

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Inequity of access to Air Quality data

Not only are some populations at greater risk from air pollution, but there are also inequalities in access to information about environmental hazards. Air quality monitoring stations are not evenly or equitably distributed across populated areas.[21] This leaves some communities without access to environmental data and prevents the authorities who are charged with managing environmental health from delivering evidence based programmes of action.

A lack of data obscures environmental problems and health burdens from view. All people, especially the most at-risk groups, deserve to have access to air quality information so that their right to a healthy life can be defended (Figure 1).

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Air Pollution Exposure
- Proximity of pollution sources
- Pollutant concentrations
- Living environment

Health Impact

Vulnerability
- Existing health conditions
- Age
- Pregnancy
- Socioeconomic status

Driver for change

Pollution Data
- Knowledge
- Awareness
- Agency

Figure 1. Exposure to air pollution in vulnerable populations increases the risk of health impacts, while data and knowledge can provide an impetus to take action to reduce health inequalities in these groups.

CLEAN AIR AND A HEALTHY ENVIRONMENT ARE HUMAN RIGHTS

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A clean, healthy and sustainable environment has been recognized to be a universal human right by the United Nations General Assembly.[22] The effects of the combined environmental crises of climate change, biodiversity and ecosystem loss, and pollution, prevent this right being upheld and can be considered to be an issue of equity and justice.[23] Governments have an obligation to promote, protect and fulfill this right.

This study investigates the injustices which arise as a result of unequal access to clean air with specific reference to the inequities that befall vulnerable population groups.

Such environmental injustices are urgent matters that governments need to address without delay to uphold the people's right to a clean, healthy and sustainable life.

KEY FINDINGS

Key Findings

Previous research has established that not everyone is at equal risk from air pollution. Health impacts from air pollution are most prevalent in lower-income countries, and in vulnerable population groups. Vulnerable populations include those with highest exposure to air pollution and those who are more susceptible including infants, older adults and pregnant people.

This report considered exposure to $PM_{2.5}$ and found that:

- Over 99% of the population of countries included in this research are breathing air that exceeds WHO health-based guidelines with respect to $PM_{2.5}$.
- Of the countries included in this research, the country with the greatest proportion of people exposed to $PM_{2.5}$ concentrations more than five times the WHO annual average guideline is India, followed by Türkiye, Thailand and South Africa.
- In India 62% of pregnant people live in the most polluted category, compared to 56% in the whole population. In Thailand infants and older adults are more likely to live in the worst $PM_{2.5}$ pollution category considered in this study.

This report reviewed access to air pollution data and found that:

- In most of the countries researched, over half of the total population have no access to an AQ station within 25 km.
- Some population groups are underrepresented in air quality datasets; they stand less chance of benefiting from monitoring, research and consequent improvements in air quality.
- In every country studied, the proportion of pregnant people living over 25 km from an AQ station was greater than the population average

Figure 2. Residents of Bogota, Colombia wearing masks to protect themselves from dirty air

© Nathalia Angarita

METHODS

Disparities in air pollution exposure between vulnerable population groups are investigated using Geographic Information System (GIS) spatial analysis. The spatial distribution of vulnerable population groups is compared to the location of air quality monitoring stations and gridded estimates of annual average $PM_{2.5}$ exposure.

Analysis is conducted for eight countries which are predominantly located in the Global South. They are India, Malaysia, Thailand, Philippines, Indonesia, Türkiye, South Africa and Colombia.

Data sources

$PM_{2.5}$ data

The global gridded dataset of ground-level $PM_{2.5}$ concentrations published by van Donkelaar et al. (2021)[24] has been used in this study to estimate annual average $PM_{2.5}$ concentrations for the year 2020, the most recent year with available data. This dataset has been developed by combining Aerosol Optical Depth (AOD) retrievals from the NASA MODIS, MISR, and SeaWIFS satellite borne instruments with chemical transport model simulations, which are then calibrated to ground-based observations. The dataset has a spatial resolution of 1 km.

Air quality monitoring station location

The location of governmental air quality monitoring stations are retrieved from the official website of governmental agencies responsible for air pollution monitoring in each territory. Where official government sources could not be identified, data were retrieved from the Center for Research on Energy and Clean Air[25] database. Details of each data source are provided in the results section for that country or region.

Demographic data

Globally gridded population data are used in the analysis. Population count data for the year 2020 are used to differentiate between the total population, children under five (Infants), and adults over 65 (Older adults).[26,27,28,29,30] Data for the year 2015, the most recent year available, are used to describe the population of people who are pregnant (Pregnant people).[31,32,33]

Administrative boundaries

The boundaries of administrative areas, countries and their subdivisions included in this research are applied from GADM Version 4.0.[34]

Spatial Analysis

We evaluated inequities in exposure to $PM_{2.5}$ and inequalities in the availability of air quality data across the eight included countries. A Geospatial Overlay of each dataset is applied and we conduct "$PM_{2.5}$ exposure analysis" and "AQ station accessibility analysis" as described below.

METHODS

PM$_{2.5}$ exposure analysis

The current WHO air quality guideline for annual mean concentrations of PM$_{2.5}$ is 5 µg/m^3. Exceedance of this guideline is associated with important risks to public health. We therefore use this guideline value to categorize annual mean PM$_{2.5}$ concentrations into four levels - concentrations that meet the WHO guideline, concentrations that are no more than five times the WHO guideline, concentrations between five and 10 times the guideline and concentrations more than 10 times the guideline (Table 1).

To aid in the interpretation of each PM$_{2.5}$ category, an estimate is provided of the potential improvement in life expectancy that might be achieved if the people exposed to the PM$_{2.5}$ concentration of each category were instead able to breathe air that met the WHO guideline concentration (Table 1). The estimates are generated according to the methodology of the Air Quality life Index (AQLI).[35,36]

AQ station accessibility analysis

The AQ station accessibility analysis aims to identify the proportion of people who have access to locally relevant AQ data. Spatial variation in air quality depends considerably on local geography, weather conditions, and emissions. Therefore, there is no standard area over which any single AQ station can be said to provide representative data. Instead, comparison is made between the proximity of AQ stations to people of different population groups.

We also provide examples from the AQ station networks of Mainland China, the United States, Japan and Germany (Figure 3). These countries represent four territories with well established AQ Station networks but with different geographic and cultural settings. The proportions of the populations of these countries who live within 5 km, 10 km and 25 km (buffer zones) of AQ stations are provided in Table 2.

Table 1. PM$_{2.5}$ concentration categories

Level	Rational	Concentration (µg/m^3)	Health Benefit[37] (Potential increase in life expectancy if long-term PM$_{2.5}$ exposure was reduced to the WHO guideline level)
1	Meets the WHO guideline	≤ 5	≈0
2	1 to 5 times the WHO guideline	> 5 and ≤ 25	≤ 1.96yrs
3	5 to 10 times the WHO guideline	> 25 and ≤ 50	1.96 to 4.41yrs
4	More than 10 times the WHO guideline	> 50	> 4.41yrs

Table 2. Population (%) within 5, 10 and 25 km buffer zones

Buffer Zone	5km	10km	25km
Germany	43%	63%	93%
Japan	82%	94%	99%
Mainland China	24%	35%	55%
USA	19%	42%	75%

METHODS
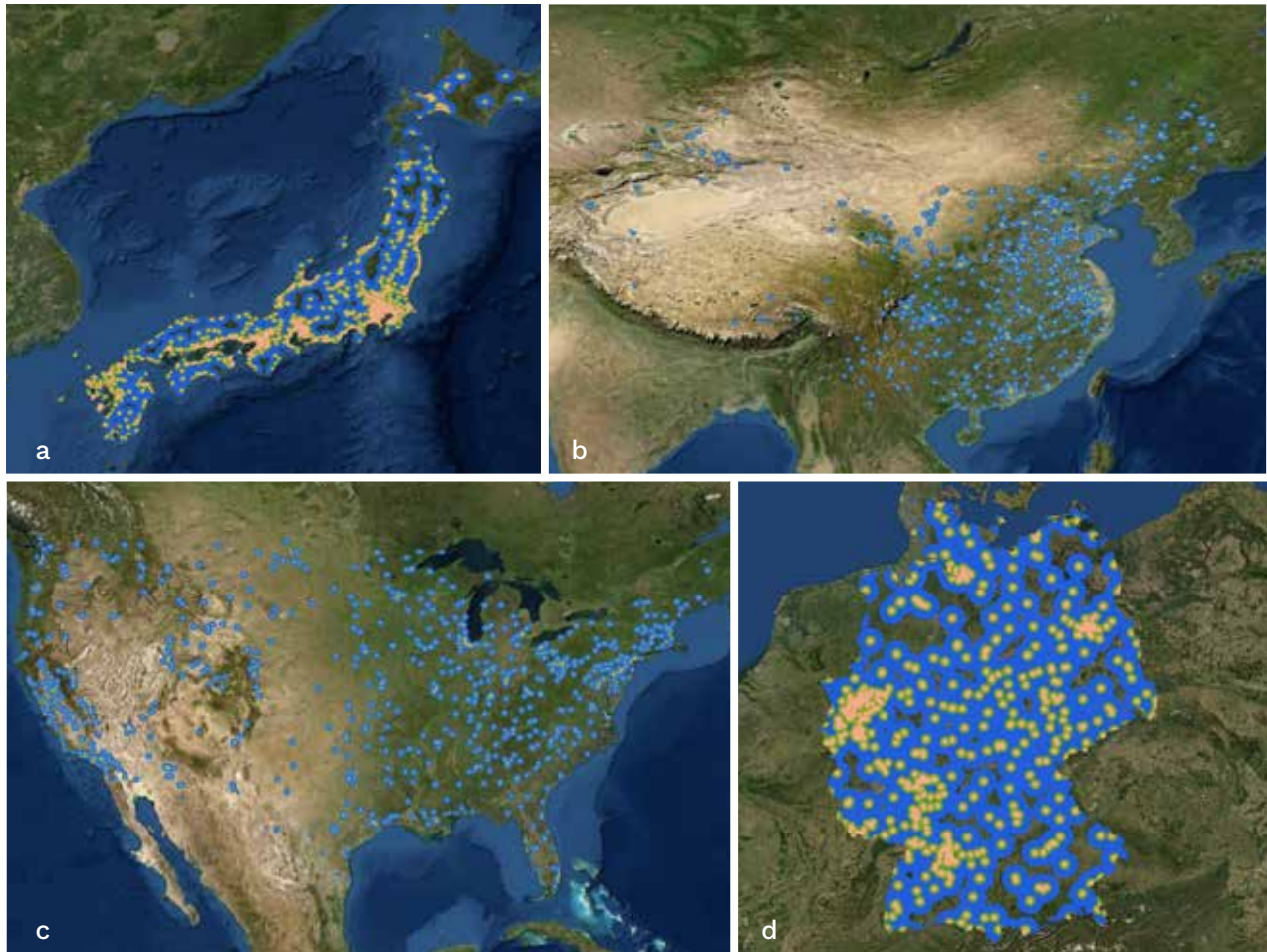
Figure 3. Five, 10 and 25 km buffer zones drawn around each AQ station in (a) Japan, (b) Mainland China, (c) the United States and (d) Germany[38]

At least 55% of the population is within the 25 km buffer zone in each example territory, 35% of the population is within the 10 km buffer zone and at least 19% is within the 5 km buffer zone. These proportions may be used as a benchmark indicator of population access to air quality data.

A limitation of this indicator approach is that it does not account for factors other than the number and distribution of AQ stations. In a given territory, the number of AQ stations needed to ensure a certain percentage of a population lives within a set distance of an AQ station also depends on the distribution of the population. The example territories used have relatively urbanized populations. In 2021, the percentage of the global population living in urban areas was 57%, whereas in the United States, Mainland China, Germany and Japan the percentage was 83%, 63%, 78% and 92% respectively.[39] Urban areas typically have a higher population density than rural areas, meaning that fewer monitors are needed to ensure that a stated proportion of the population is within a fixed distance of an air pollution monitor than in a country with a more distributed

population. Of course, population distribution should not preclude any individual's right to access air quality data.
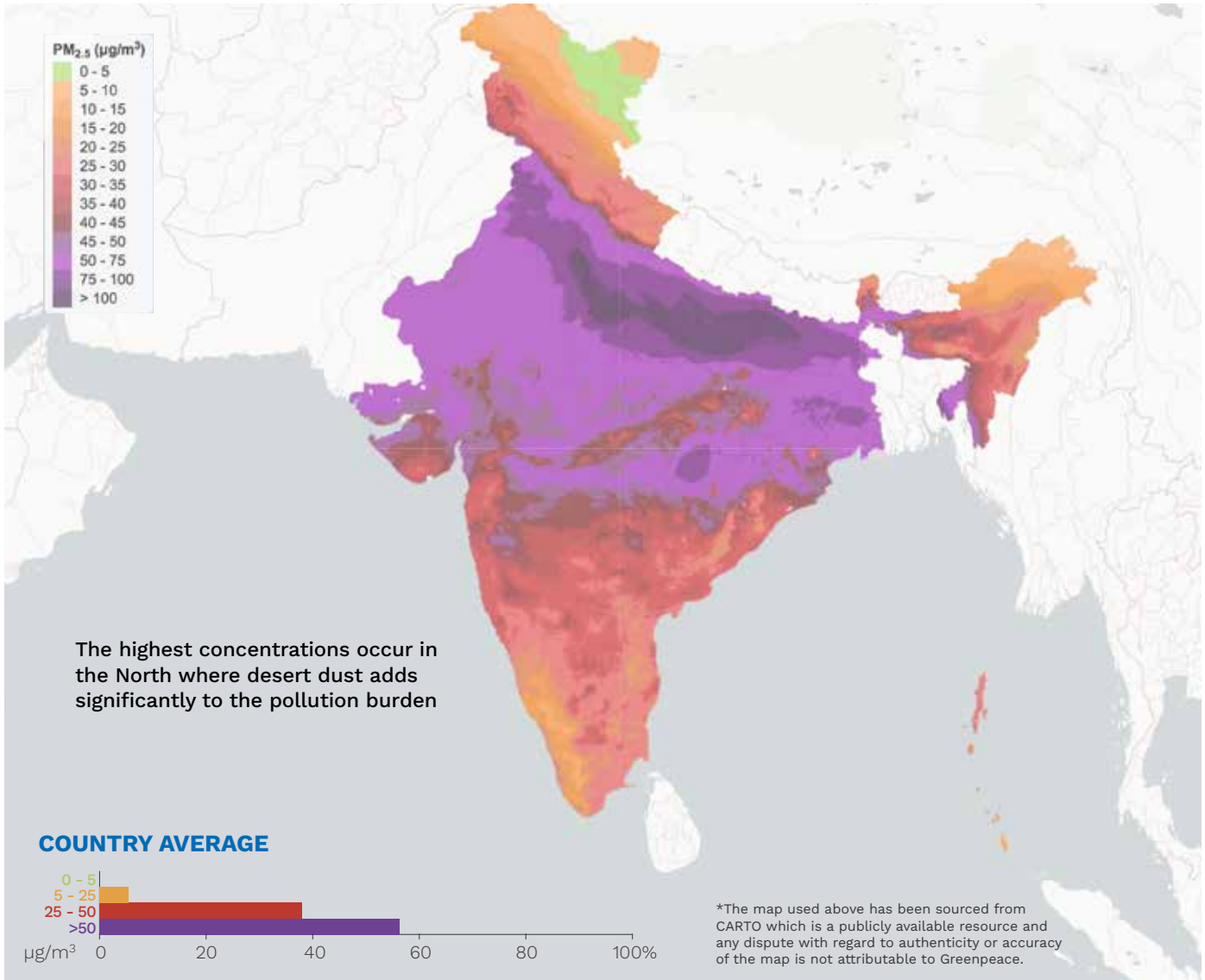
Results ranking

We calculated the proportion of each administrative area's population who are exposed to air pollution in each concentration category and the proportion who live within 5 km, 10 km and 25 km of an AQ station.

The proportions calculated are used to rank their performance in terms of air pollution exposure and the availability of local air quality data. When assessing data on exposure to air pollution the proportion of the population who are "exposed to air where annual average $PM_{2.5}$ concentrations are more than 10 times WHO guideline (>50)" and "exposed to air that meets the WHO annual average $PM_{2.5}$ guideline" are used for the ranking. When assessing availability of air pollution data, the proportion of the population within 5 km is used for the ranking.

INDIA

Map of PM$_{2.5}$ concentration in 2020

PM$_{2.5}$ ($\mu g/m^3$)

	0 - 5
	5 - 10
	10 - 15
	15 - 20
	20 - 25
	25 - 30
	30 - 35
	35 - 40
	40 - 45
	45 - 50
	50 - 75
	75 - 100
	> 100

The highest concentrations occur in the North where desert dust adds significantly to the pollution burden

COUNTRY AVERAGE

0 - 5
5 - 25
25 - 50
>50

$\mu g/m^3$ 0   20   40   60   80   100%

*The map used above has been sourced from CARTO which is a publicly available resource and any dispute with regard to authenticity or accuracy of the map is not attributable to Greenpeace.

Almost

100%

of the total population in India live in areas where estimated annual average PM$_{2.5}$ concentrations were over 5 $\mu g/m^3$.

It is also estimated that:

95%

of the total population were exposed to annual average PM$_{2.5}$ concentrations over 25 $\mu g/m^3$.

57%

of the total population were exposed to annual average PM$_{2.5}$ concentrations over 50 $\mu g/m^3$.

INDIA

Annual average PM$_{2.5}$ exposure analysis

States with the highest exposure to pollution (µg/m³)
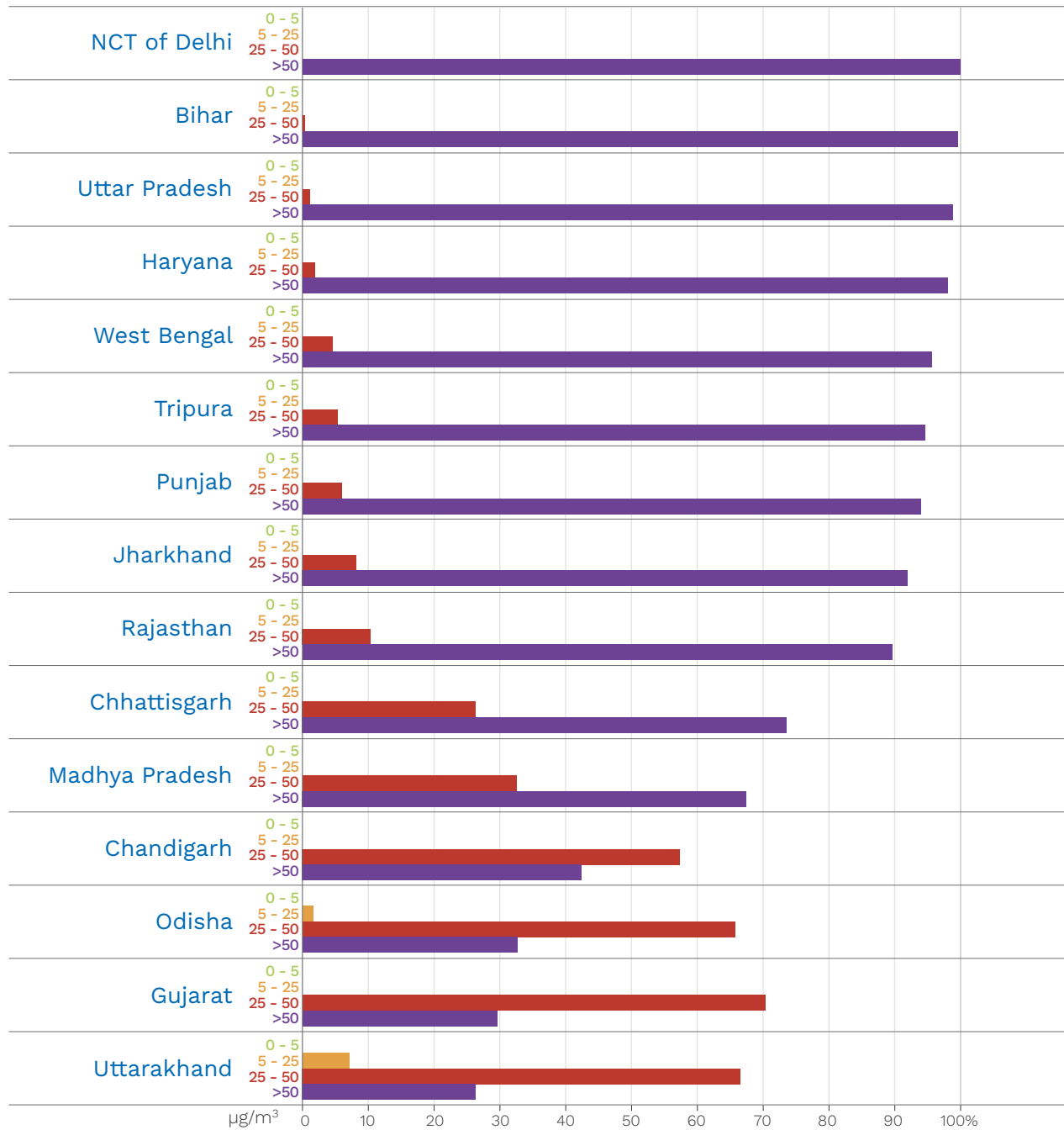
In 9 out of 36 states, more than

90%

of the population were exposed to annual average PM$_{2.5}$ concentrations over 50 µg/m³.

Jammu and Kashmir

was the only state in India to have any areas where air quality met the WHO guideline for annual average PM$_{2.5}$. However, less than 1% of the state's population live in this area.
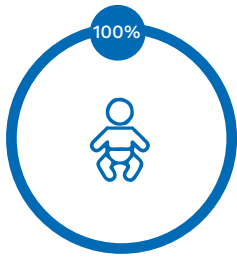
INDIA

Vulnerable Groups

Older adults

It is estimated that:

100%

of older adults in India were exposed to annual average PM$_{2.5}$ concentrations over 5 µg/m^3.

53%

were exposed to annual average PM$_{2.5}$ concentrations over 50 µg/m^3, which is a smaller proportion than in the total population.

Infants

It is estimated that:

100%

of infants in India were exposed to annual average PM$_{2.5}$ concentrations over 5 µg/m^3.

61%

were exposed to annual average PM$_{2.5}$ concentrations over 50 µg/m^3, a bigger proportion than in the total population.

Pregnant people

It is estimated that:

100%

of Pregnant People in India were exposed to annual average PM$_{2.5}$ concentrations over 5 µg/m^3.

62%

were exposed to annual average PM$_{2.5}$ concentrations over 50 µg/m^3, which is a greater proportion than in the total population.
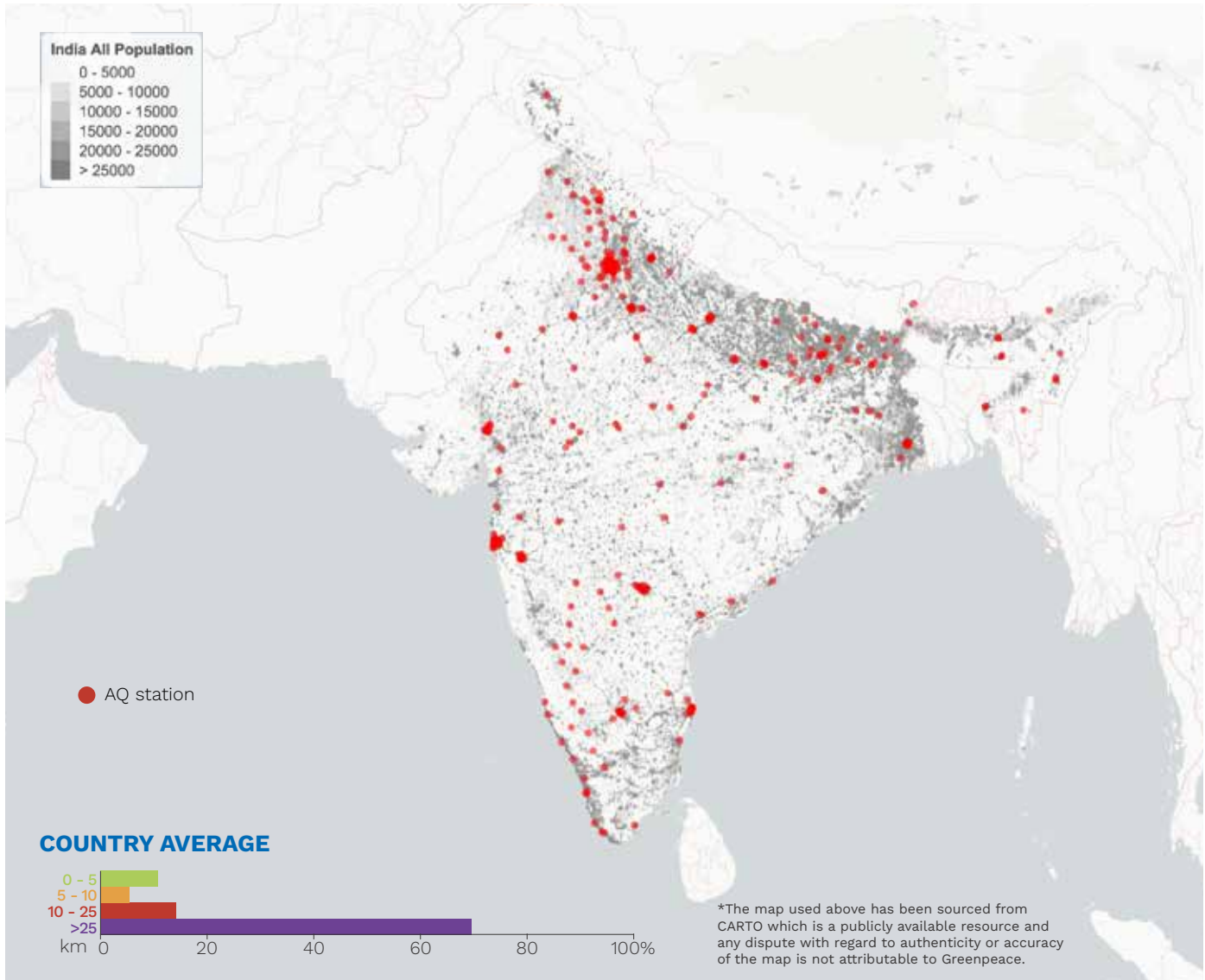
In summary, it is estimated that

100%

of vulnerable groups breathe air with PM$_{2.5}$ concentrations over 5 µg/m3. Infants and pregnant people tend on average to be exposed to worse air than the total population.

INDIA

Map of AQ stations and population distribution

India All Population
0 - 5000
5000 - 10000
10000 - 15000
15000 - 20000
20000 - 25000
> 25000

● AQ station

COUNTRY AVERAGE

0 – 5
5 – 10
10 – 25
>25
km

*The map used above has been sourced from CARTO which is a publicly available resource and any dispute with regard to authenticity or accuracy of the map is not attributable to Greenpeace.

In India, the Central Pollution Control Board manages a network of AQ Stations.[40,41] Overall,

70%

of the total population do not have access to an AQ station within 25 km, worse than all of the example territories of Germany, Japan, the US & mainland China.

INDIA

AQ Station Accessibility Analysis

States with the best access to AQ stations (km)
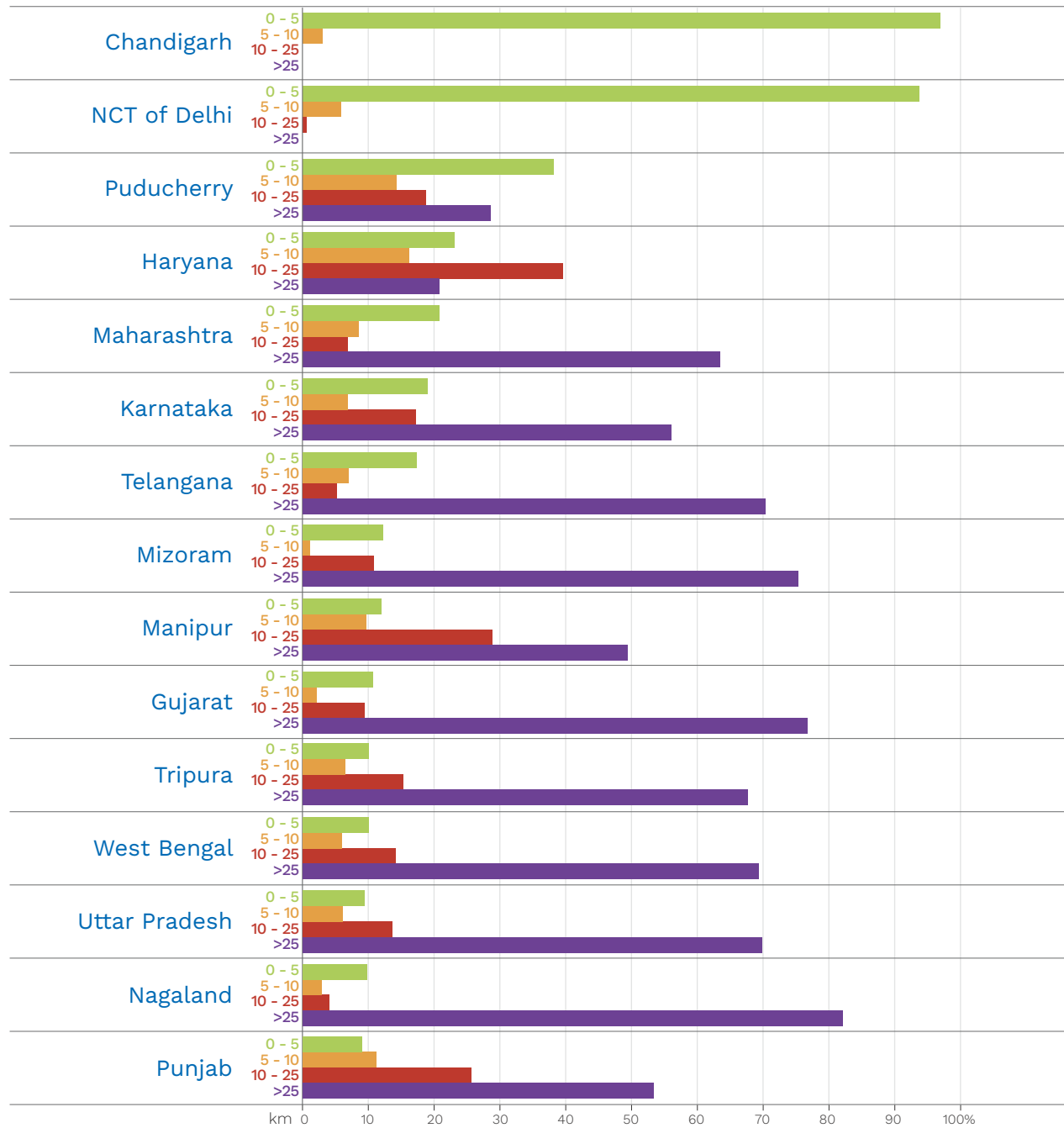
In most states, over

70%

of their population have no access to an AQ station within 25 km.

The population of the urbanized states Chandigarh and the National Capital Territory of Delhi have the best access to AQ stations within
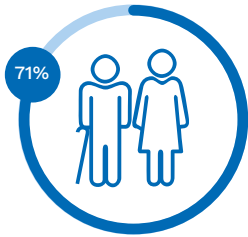
5km

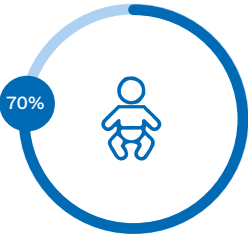(over 90% of their population).

INDIA
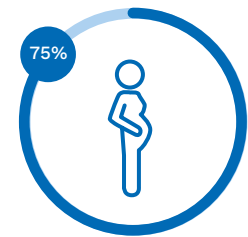
Vulnerable Groups

Older adults

71%

71% older adults in India have no access to an AQ station within 25 km, a slightly higher proportion than in the total population.

Infants

70%

70% infants in India have no access to an AQ station within 25 km, similar to the total population.

Pregnant people

75%

75% pregnant people in India have no access to an AQ station within 25 km, a higher proportion than in other population groups.

In the states of Goa, Andaman and Nicobar, and Lakshadweep, the whole population, including all vulnerable groups, have no access to an AQ station within 25 km. Only the National Capital Territory of Delhi and Chandigarh provide AQ stations within 25 km of their whole population.

INDIA

Highlights

Compared to the total population, it is estimated that infants and a greater proportion of pregnant people were exposed on average to higher concentrations of PM$_{2.5}$ in India. Members of vulnerable groups in India were more likely to be exposed to poorer air quality and have less access to AQ stations, especially pregnant people. The AQ station accessibility in India is worse than all of the comparator territories of Germany, Japan, the US & mainland China

Solutions & Actions

The government must introduce a robust air quality monitoring system across the country and make the data publicly available in real time. This should be coupled with a health advisory and 'red alerts' for bad-air days so that the public are able to take necessary steps to protect their health, and polluters would be required to reduce emissions to protect the environment. The current National Ambient Air Quality Standards (NAAQS) is insufficient and needs immediate revision. The Central Pollution Control Board must set a process of revision of NAAQS based on scientific evidence. The government must ensure the implementation of all the planned activities under the National Clean Air Programme (NCAP). The programme should be legally binding like the Air Act 1981.[41] NCAP also identified the extension of public transport in cities under city action plans and adopted electrifying government run public transport as an action point to tackle vehicular pollution. The cities under NCAP must implement these action points.

There is an urgent need to make NCAP more transparent, comprehensive and stronger. The people are already paying a huge price for the air pollution crisis and it is taking a massive toll on healthcare systems. People are being forced to breathe in polluted air and are faced with a terrible health crisis. They can't afford any delays to act on this crisis.

HUMAN STORY

" *There is smoke all around and we have forgotten the feeling of being in an open, fresh environment, inhaling fresh air.* "

KUSUM LATA

has three children, one of them is 1 and a half years old. She moved to Delhi 30 years ago after getting married.

I am Kusum and I live in Neb Sarai, which is situated in the southern part of Delhi. I live with my three children, my husband, and my mother -in-law.

The air pollution in my area has been very gruesome for a long time. There is smog all around and we have forgotten the feeling of being in an open, fresh environment, inhaling fresh air.

My children and family member are given holidays from school and work when the pollution levels are extremely high.

I moved to New Delhi for marriage 30 years ago. The situation wasn't like this in the early times. Neb Sarai was a pure village but now buildings are being constructed all around, with plants and trees being removed completely.

Whether indoors or outdoors, we don't feel safe to breathe. My children get sick frequently. My mother-in-law also has difficulty breathing.

The worst experience for me is to face the 'smog' (black smoke) from the burning farmlands. After we get wet from the rain, we get abnormal rashes on our skin.

An air purifier is out of my family's budget, we don't even have enough money for the education of our children. For the poor, the money is utilized on food while the rich use the money for their medication and clean air devices.
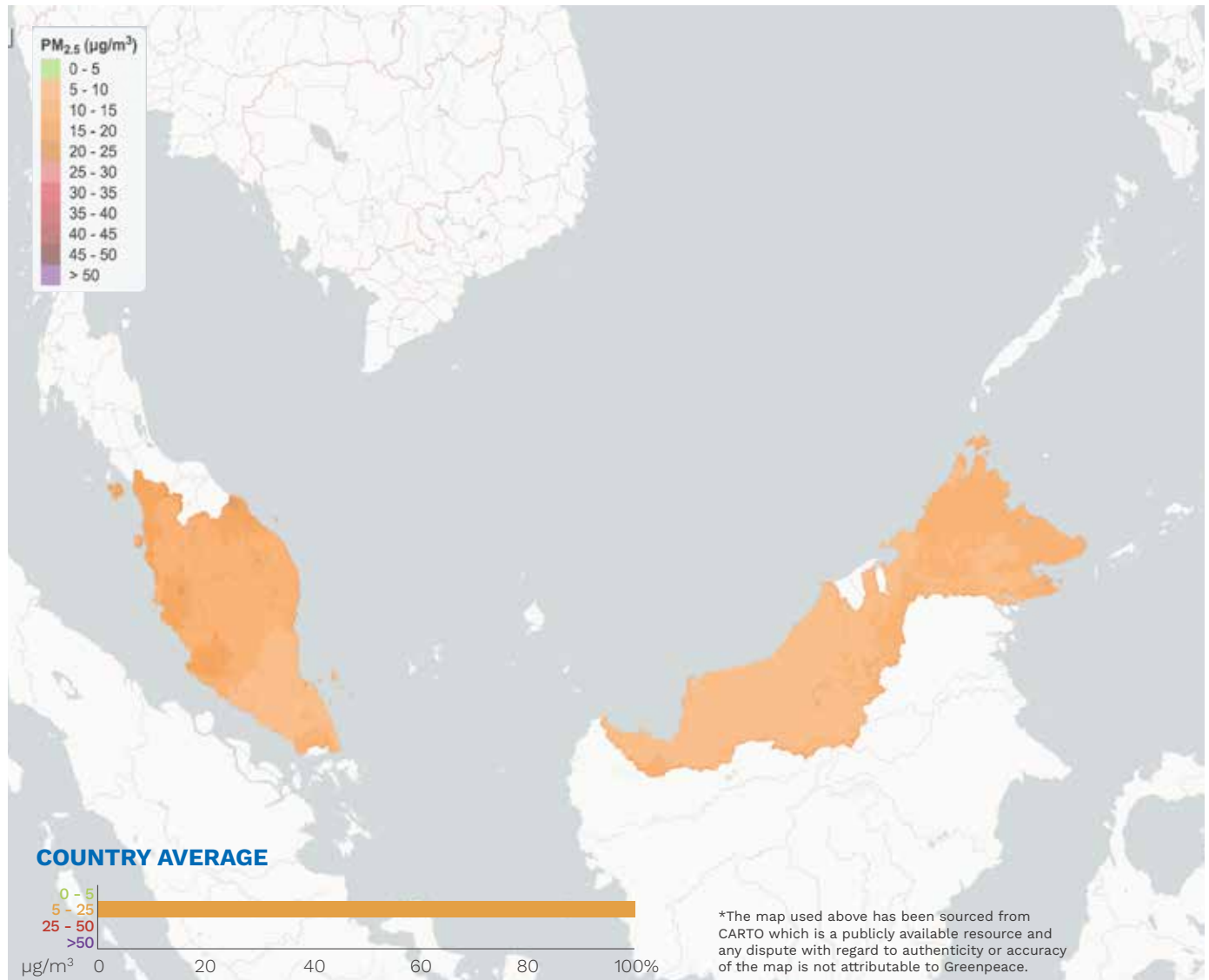
I cycle daily as a solution to air pollution and I suggest that every family should only use one car. I think we need to take immediate steps to tackle air pollution.

MALAYSIA

MALAYSIA

Map of PM$_{2.5}$ concentration in 2020

PM$_{2.5}$ (µg/m³)
- 0 - 5
- 5 - 10
- 10 - 15
- 15 - 20
- 20 - 25
- 25 - 30
- 30 - 35
- 35 - 40
- 40 - 45
- 45 - 50
- > 50

COUNTRY AVERAGE

0 - 5
5 - 25
25 - 50
>50

µg/m³ 0   20   40   60   80   100%

*The map used above has been sourced from CARTO which is a publicly available resource and any dispute with regard to authenticity or accuracy of the map is not attributable to Greenpeace.

100%

of the total population in Malaysia lived in areas where estimated annual average PM$_{2.5}$ concentrations were over 5 µg/m³.

All Malaysians

were therefore breathing air that exceeds WHO health-based guidelines with respect to PM$_{2.5}$.
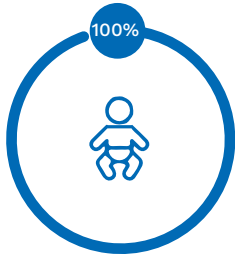
MALAYSIA

Vulnerable Groups

Older adults

It is estimated that:

100%

of older adults in Malaysia were exposed to annual average $PM_{2.5}$ concentrations over 5 μg/m^3.

Infants

It is estimated that:

100%

of infants in Malaysia were exposed to annual average $PM_{2.5}$ concentrations over 5 μg/m^3.
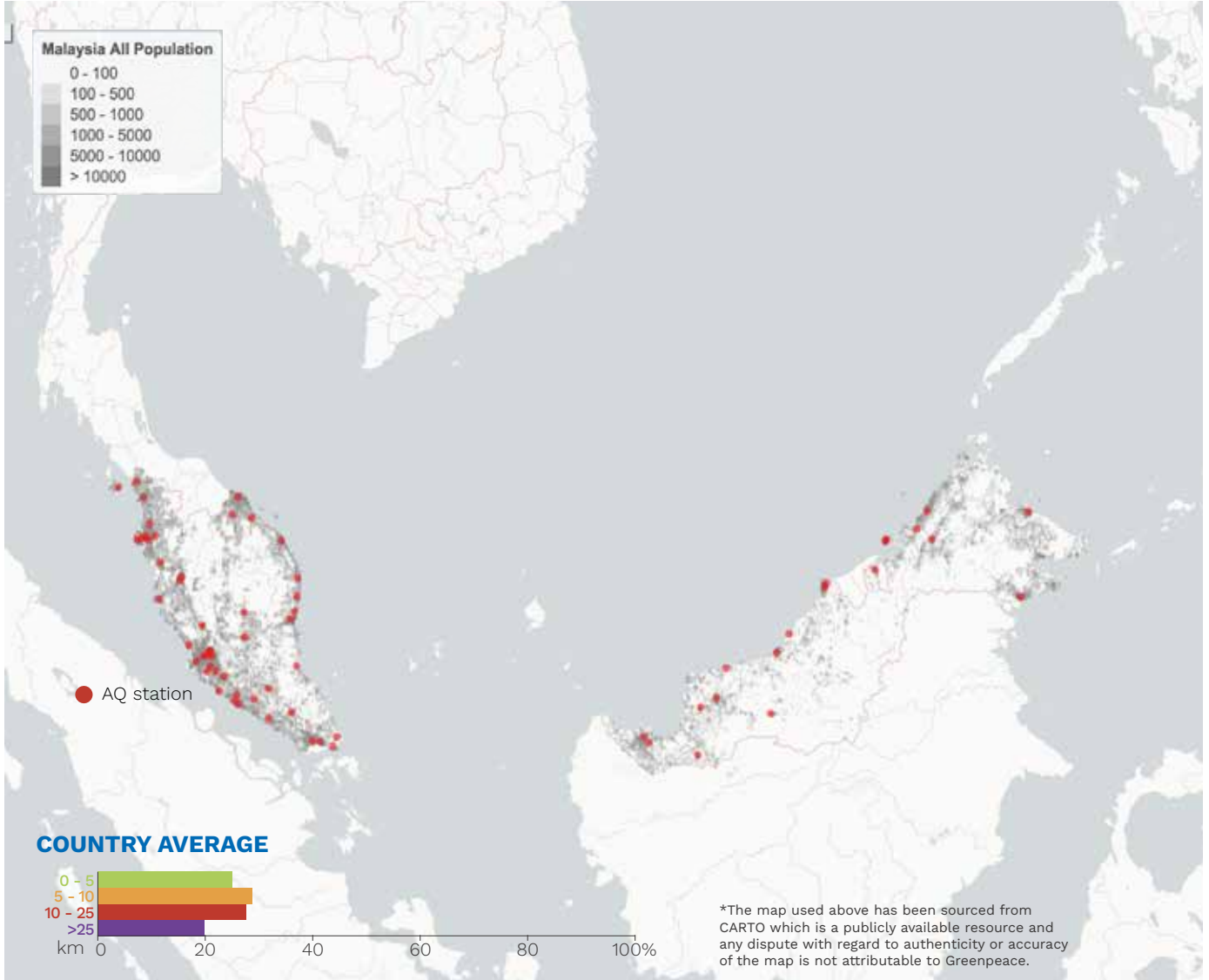
Pregnant People

It is estimated that:

100%

of pregnant people in Malaysia were exposed to annual average $PM_{2.5}$ concentrations over 5 μg/m^3.

MALAYSIA

Map of AQ stations and population distribution

Malaysia All Population
0 - 100
100 - 500
500 - 1000
1000 - 5000
5000 - 10000
> 10000

● AQ station

COUNTRY AVERAGE

0 – 5
5 – 10
10 – 25
>25
km   0   20   40   60   80   100%

*The map used above has been sourced from CARTO which is a publicly available resource and any dispute with regard to authenticity or accuracy of the map is not attributable to Greenpeace.

There are a total of

65

governmental AQ stations in Malaysia.[42,43]

Overall, about

20%

of the total country population do not have access to AQ stations within 25km. This is a similar proportion of the population to the USA but is a considerably smaller proportion than in Germany and Japan.
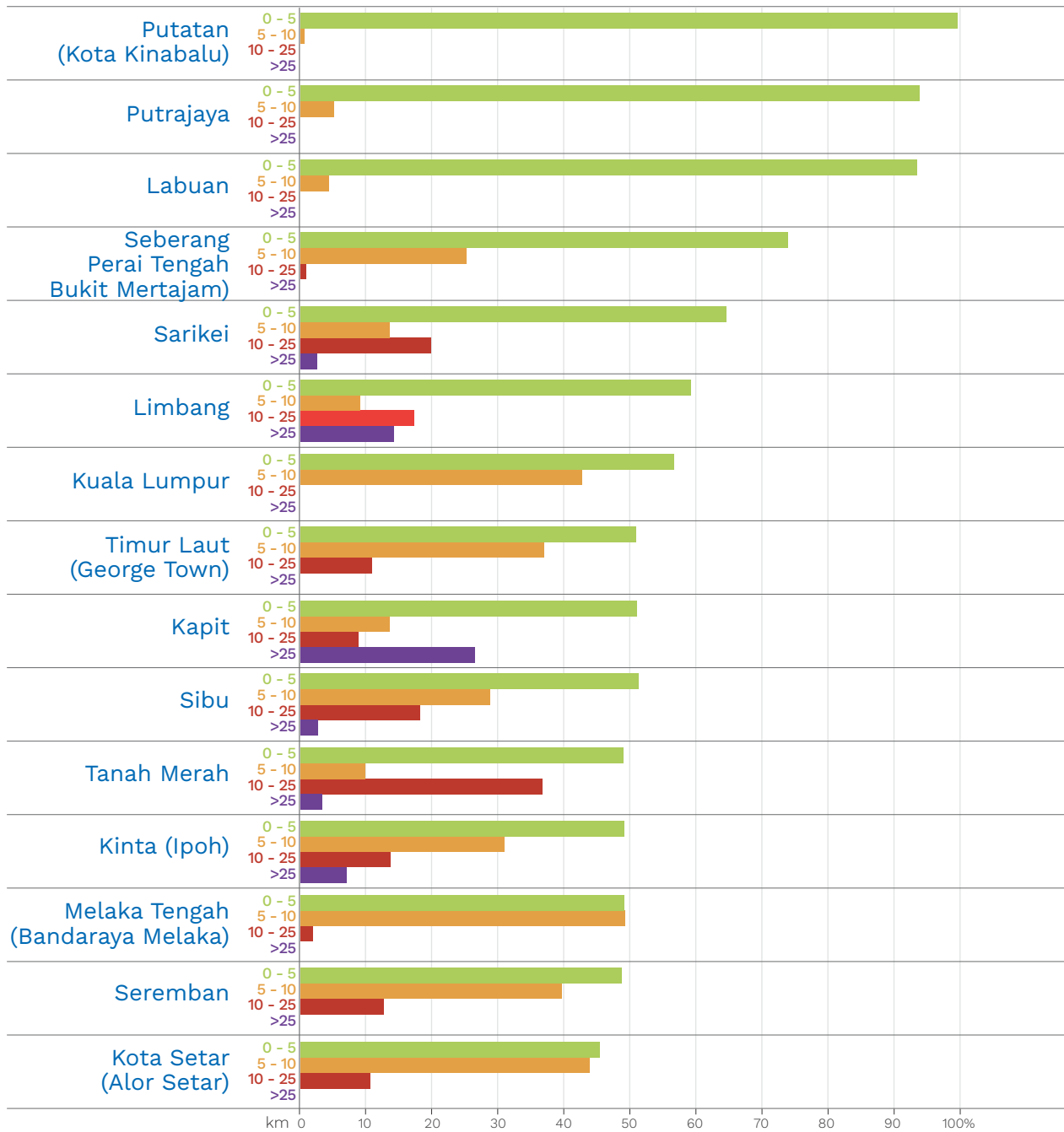
About

25%

of the population have access to an AQ station within 5 km.

MALAYSIA

AQ Station Accessibility Analysis

Districts with the best access to AQ stations (km)

People living in densely populated districts are more likely to live within 10 km of an AQ station. All of Kuala Lumpur's population have access to an AQ station within 10 km; in Putatan almost 100% of the population lives within 5 km of an AQ station.
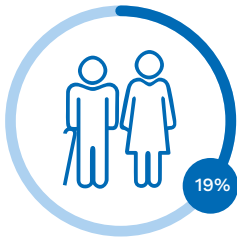
However, in

30 out of 144

districts in Malaysia, almost the entire population have no access to an AQ station within 25 km. Lahad Datu, Kinabatangan and Hilir Perak are examples of districts with large populations who have no access to local air quality data.
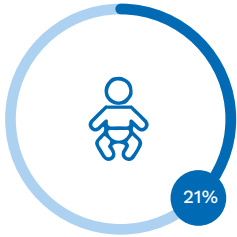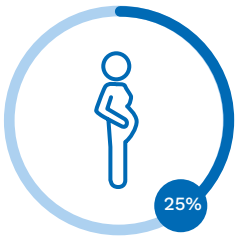
MALAYSIA

Vulnerable Groups

Older adults

About **19%** of older adults in Malaysia have no access to an AQ station within 25 km, slightly lower than the total population.
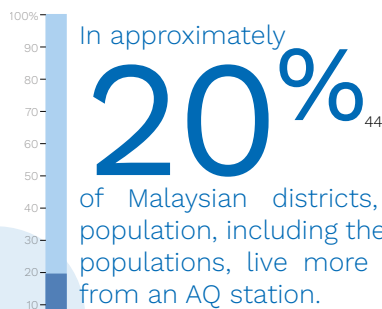
Infants

About **21%** of infants in Malaysia have no access to an AQ station within 25 km, slightly higher than the total population.

Pregnant Women

About **25%** of pregnant people in Malaysia have no access to an AQ station within 25 km, higher than the other groups.

In approximately **20%** [44] of Malaysian districts, the whole population, including their vulnerable populations, live more than 25 km from an AQ station.

MALAYSIA

Highlights

100% of the total population in Malaysia were breathing unhealthy air. All vulnerable groups were exposed to $PM_{2.5}$ concentrations that breach the WHO's guidelines, yet 25% of them live in areas with no AQ stations within at least 25 km. The AQ station accessibility for Malaysia is similar to the USA but is considerably worse than in Germany and Japan.

Solutions & Actions

The Malaysian government should make ambient air quality standards legally binding, time-bound and enforceable through transparency, access to information, public participation and accountability.

The government should also enact a Transboundary Haze Pollution Act to take action against Malaysian-owned companies operating abroad that significantly contribute to the haze in Malaysia to ensure that these companies operate responsibly.

HUMAN STORY

" *I lost my source of income as I could not go fishing in the sea because of poor visibility and health issues.* "

HAJI ZAKARIA

is a fisherman and he is over 65 years old. He lives in a village in Penang together with his family.

I was born and raised in Penang, Malaysia, in a rural seacoast village called Sg Batu. I experienced a very bad air pollution situation back in 2015 and 2019 due to haze.

As a result of the haze, my family suffered from severe respiratory conditions. I lost my source of income as I could not go fishing in the sea because of poor visibility and health issues.
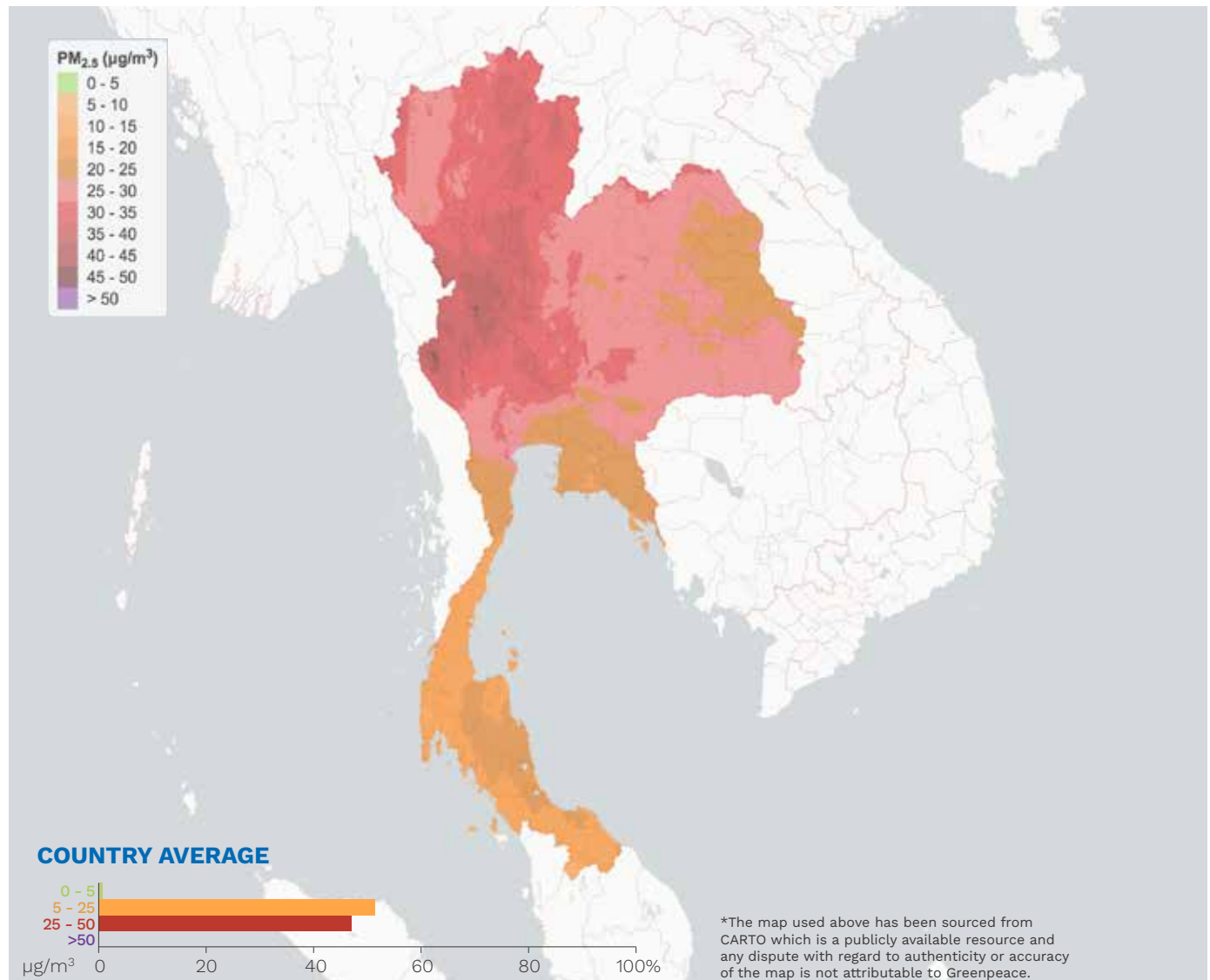
The haze had severely impaired every fisherman's vision, making them lose sight of landmarks and islands. It is dangerous and may lead to a loss of direction and communication. The fishermen are already limited in resources and can barely survive the season. Most people coultn't afford an air purifier at that time.

I don't have any access to air quality information. But I'm grateful enough to wait until the air is clean and I get healthy again so that I can continue with my livelihood.

THAILAND

THAILAND

Map of PM$_{2.5}$ concentration in 2020

PM$_{2.5}$ (µg/m³)
- 0 - 5
- 5 - 10
- 10 - 15
- 15 - 20
- 20 - 25
- 25 - 30
- 30 - 35
- 35 - 40
- 40 - 45
- 45 - 50
- > 50

COUNTRY AVERAGE

µg/m³	0 - 5	5 - 25	25 - 50	>50

*The map used above has been sourced from CARTO which is a publicly available resource and any dispute with regard to authenticity or accuracy of the map is not attributable to Greenpeace.

100%[4]

of the total population of Thailand lived in areas where estimated annual average PM$_{2.5}$ concentrations were over 5 µg/m³, meaning that almost everyone was breathing air that doesn't meet WHO guidelines.
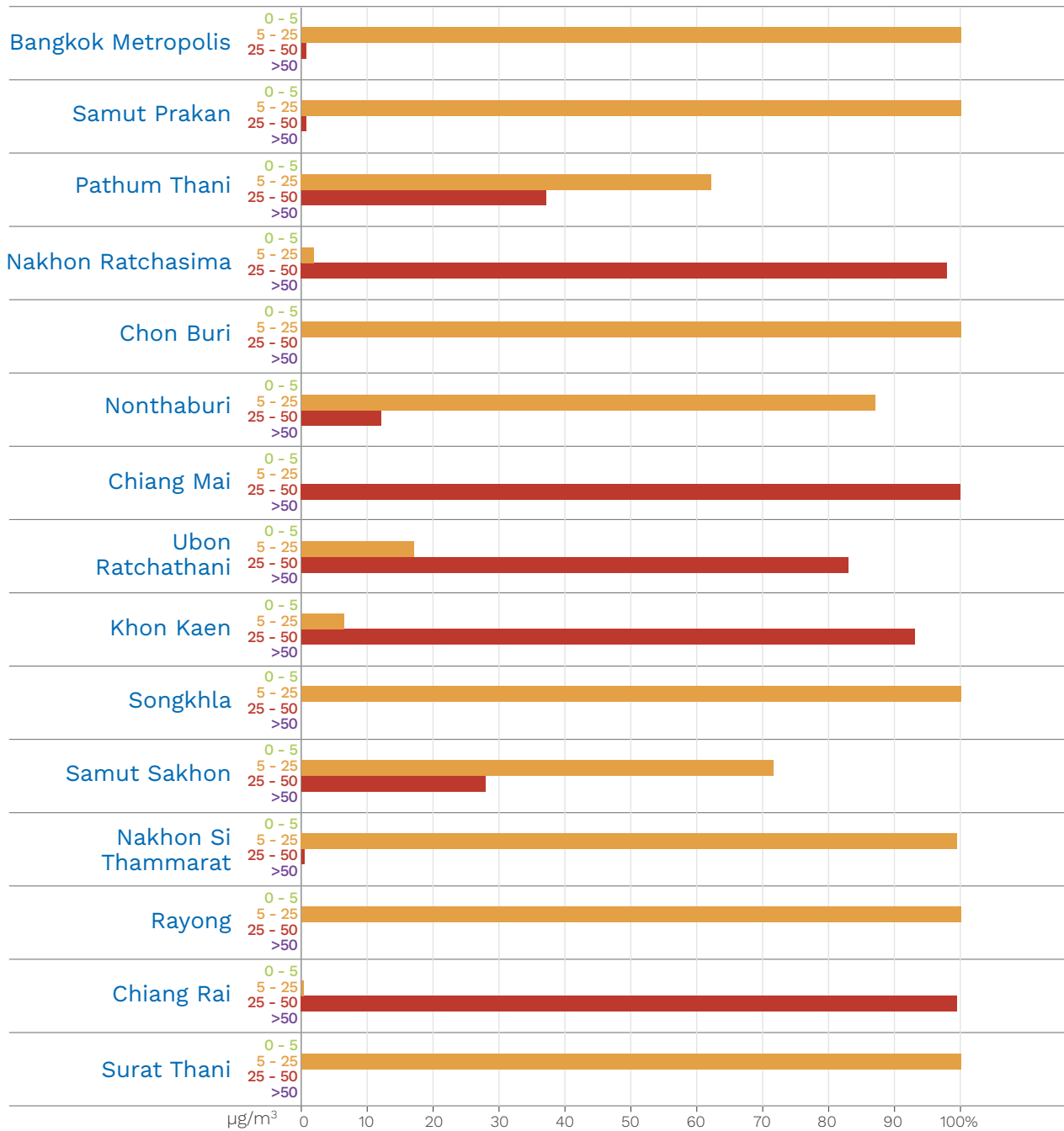
It is estimated that:

48%

of the total population were exposed to annual average PM$_{2.5}$ concentrations that were at least five times over the WHO guideline.

THAILAND

Annual average PM$_{2.5}$ exposure analysis

Exposure of top 15 populated provinces (µg/m^3)

Of the top

15

populated provinces in Thailand, Chiang Mai and Chiang Rai had the highest estimated exposure, their whole population exposed to estimated annual average PM$_{2.5}$ concentrations over 25 µg/m^3.
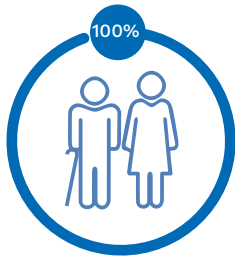
It is also estimated that, in

44 out of 77

provinces in Thailand, almost the whole population were exposed to annual average PM$_{2.5}$ concentrations over 25 µg/m^3. Even the provinces with lowest exposure to pollution exceeded the WHO guideline concentration.
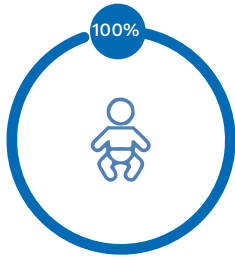
THAILAND

Vulnerable Groups

Older adults

It is estimated that:

100%

of older adults in Thailand were exposed to annual average $PM_{2.5}$ that exceeds the WHO guideline concentration. More than half (52%) were exposed to $PM_{2.5}$ concentrations of more than 25 μg/m^3, five times the WHO guideline.

Infants

It is estimated that:

100%

of infants in Thailand were exposed to air with annual average $PM_{2.5}$ concentrations over 5 μg/m3, and that slightly under half of all infants (49%) were exposed to $PM_{2.5}$ concentrations of more than 25 μg/m^3, five times the WHO guideline.

Pregnant People

It is estimated that:

100%

of pregnant people in Thailand were exposed to $PM_{2.5}$ concentrations over 5 μg/m^3 and that slightly under half (45%) were exposed to $PM_{2.5}$ concentrations of more than 25 μg/m^3, five times the WHO guideline.
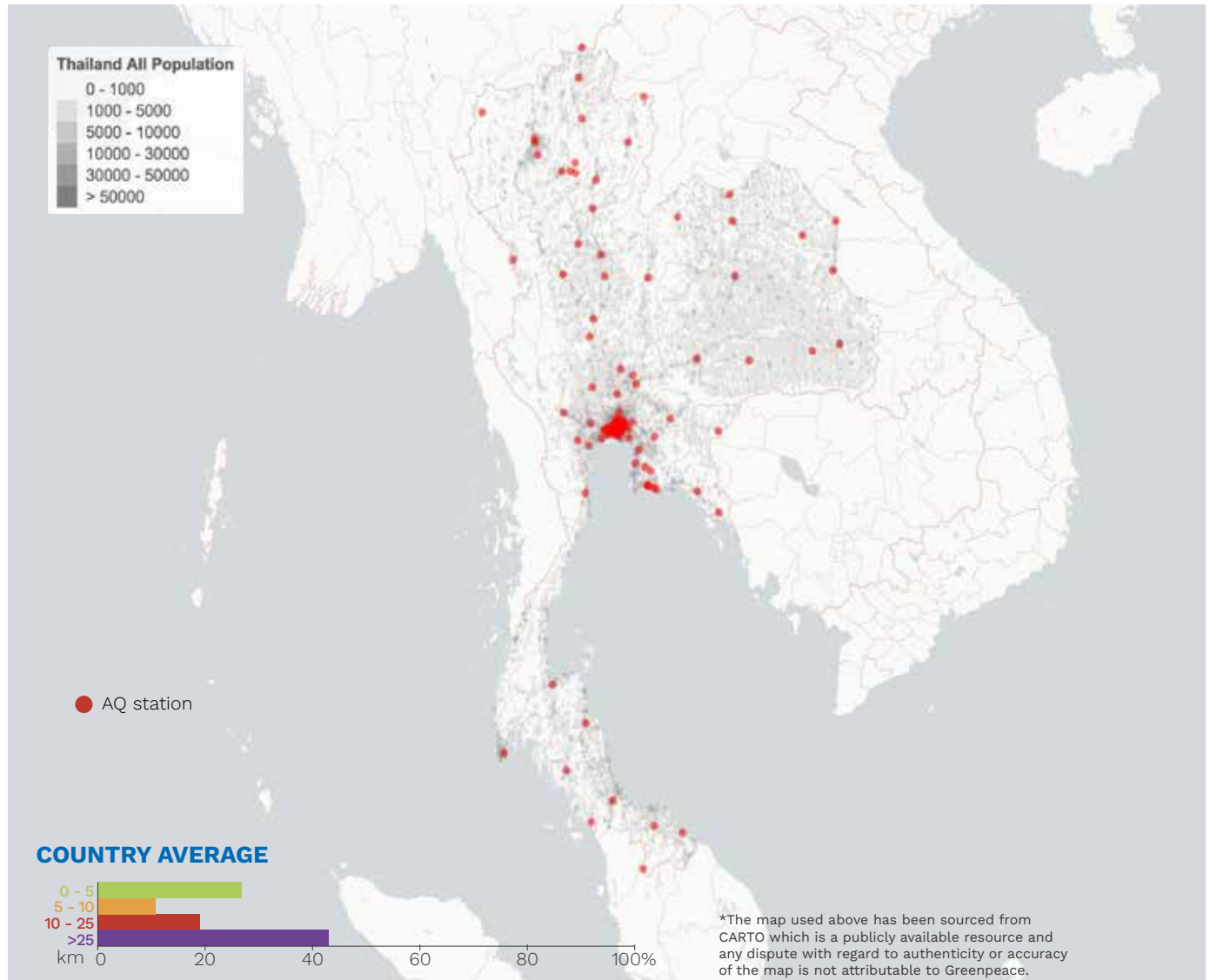
It is therefore estimated that

infants, older adults and pregnant people

in Thai provinces breathed air with $PM_{2.5}$ concentrations over 5 μg/m^3. Furthermore, older adults and infants tended to be exposed to worse air than the total population on average. Northern Thailand was the most polluted.

THAILAND

Map of AQ stations and population distribution

Thailand All Population
- 0 - 1000
- 1000 - 5000
- 5000 - 10000
- 10000 - 30000
- 30000 - 50000
- > 50000

● AQ station

COUNTRY AVERAGE

0 – 5
5 – 10
10 – 25
>25

km 0   20   40   60   80   100%

*The map used above has been sourced from CARTO which is a publicly available resource and any dispute with regard to authenticity or accuracy of the map is not attributable to Greenpeace.

There are a total of

138

governmental AQ stations in Thailand.[45]

Overall, about

43%

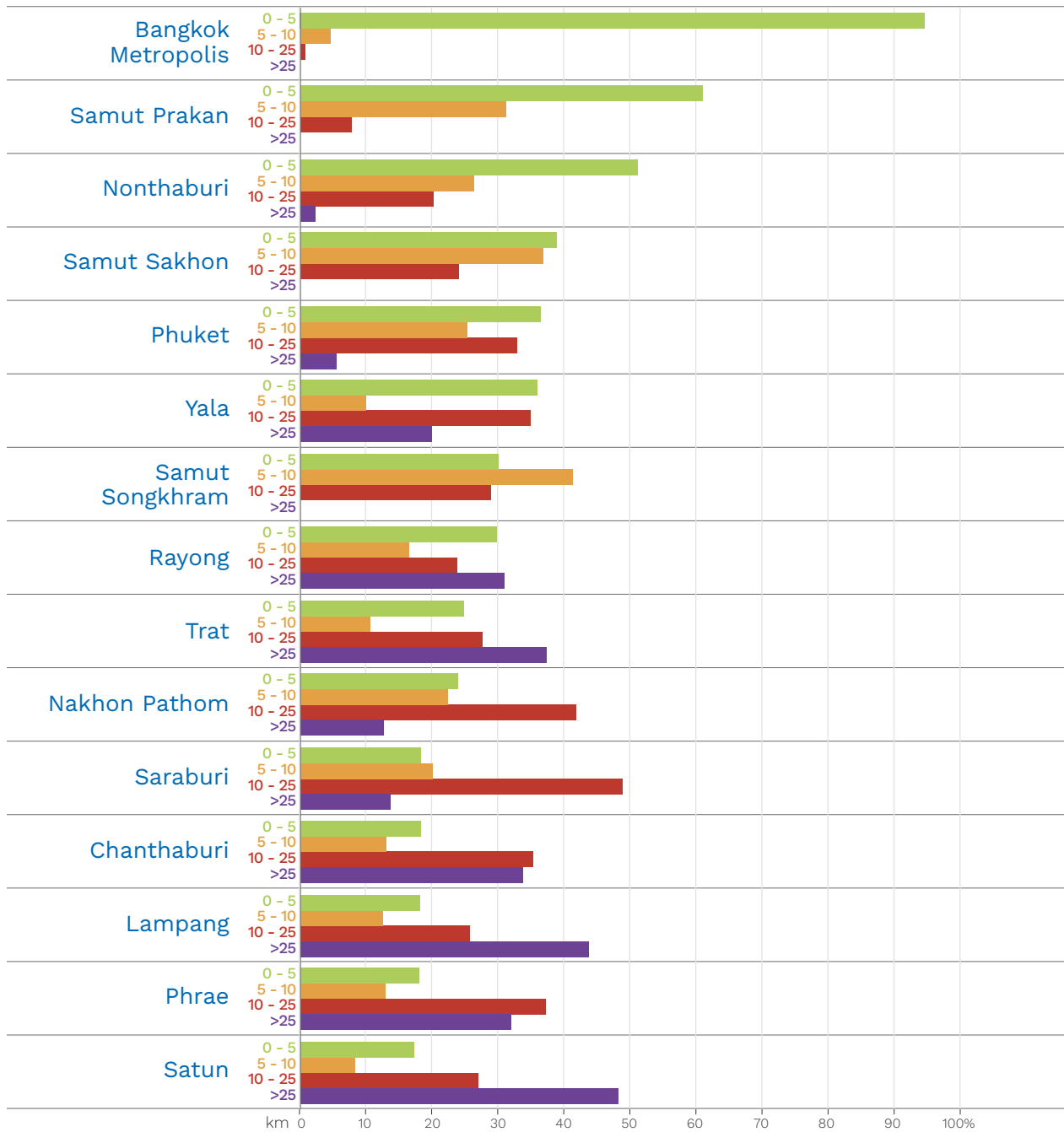of the total population live more than 25 km from an AQ station.

Only about

27%

of the population live within 5 km of an AQ station.

THAILAND

AQ Station Accessibility Analysis

Provinces with the best access to AQ stations (km)

| | km 0 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100% |

Bangkok Metropolis
- 0 - 5
- 5 - 10
- 10 - 25
- >25

Samut Prakan
- 0 - 5
- 5 - 10
- 10 - 25
- >25

Nonthaburi
- 0 - 5
- 5 - 10
- 10 - 25
- >25

Samut Sakhon
- 0 - 5
- 5 - 10
- 10 - 25
- >25

Phuket
- 0 - 5
- 5 - 10
- 10 - 25
- >25

Yala
- 0 - 5
- 5 - 10
- 10 - 25
- >25

Samut Songkhram
- 0 - 5
- 5 - 10
- 10 - 25
- >25

Rayong
- 0 - 5
- 5 - 10
- 10 - 25
- >25

Trat
- 0 - 5
- 5 - 10
- 10 - 25
- >25

Nakhon Pathom
- 0 - 5
- 5 - 10
- 10 - 25
- >25

Saraburi
- 0 - 5
- 5 - 10
- 10 - 25
- >25

Chanthaburi
- 0 - 5
- 5 - 10
- 10 - 25
- >25

Lampang
- 0 - 5
- 5 - 10
- 10 - 25
- >25

Phrae
- 0 - 5
- 5 - 10
- 10 - 25
- >25

Satun
- 0 - 5
- 5 - 10
- 10 - 25
- >25

95%

of the population in Bangkok Metropolis have access to an AQ station within 5 km, much better than other provinces. The entire population in 12 out of 77 provinces have no access to an AQ station within 25km.
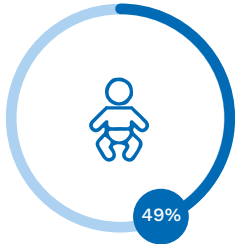
THAILAND

Vulnerable Groups

Older adults

About **46%**

of older adults in Thailand live further than 25 km from an AQ station, this is a higher proportion than the total population.
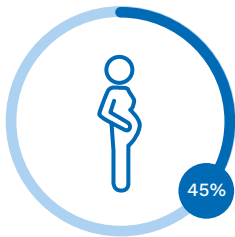
46%

Infants

About **49%**

of infants in Thailand live in areas with no AQ stations within 25 km, this is a higher proportion than in the total population.

49%

Pregnant People

About **45%**

of pregnant people in Thailand live at least 25 km from an AQ station, this is a higher proportion than in the total population.

45%

In 12 of Thailand's 77 provinces,

all members of the vulnerable groups considered in this report live further than 25 km from an AQ station. All the vulnerable groups have less local access to AQ station data than the Thai population as a whole.

THAILAND

Highlights

The availability of local AQ station data is worse for vulnerable groups in Thailand than in the total population as a whole. Entire populations of some provinces in Thailand have no access to AQ station data within 25 km of where they live, yet they are all exposed to unhealthy air. Only about 26.8% of the population live within 5 km of an AQ station, located mainly in urbanized provinces.

Solutions & Actions

The Thai government needs to develop and apply a Pollutant Release and Transfer Register (PRTR) and include $PM_{2.5}$ in the lists of pollutants or chemicals that industrial facilities are required to publicly disclose and report. A PRTR can be an effective mechanism to empower ordinary citizens and civil society to participate in monitoring, auditing, and protecting public health from $PM_{2.5}$, including by reducing dangerous emissions.

HUMAN STORY

" *I have to pay a lot for air purifiers and masks for my family's health.* "

ANCHALEE P.

is a mother of a son who is 2 and a half years old. She lives in Bangkok, the capital city of Thailand.

I am from Bangkok, Thailand. I have a baby boy who is younger than 4. There's air pollution in most of my daily life in Bangkok. Vehicles and industrial facilities are the main causes of pollution. During my pregnancy, I was concerned about the impact on fetal development and child development from $PM_{2.5}$.

I have diabetes and my husband has heart disease so I have to pay a lot for air purifiers and masks for my family's health. I can't afford an air purifier for every room so I just use it in my son's bedroom and we stay together in the same room at bedtime.
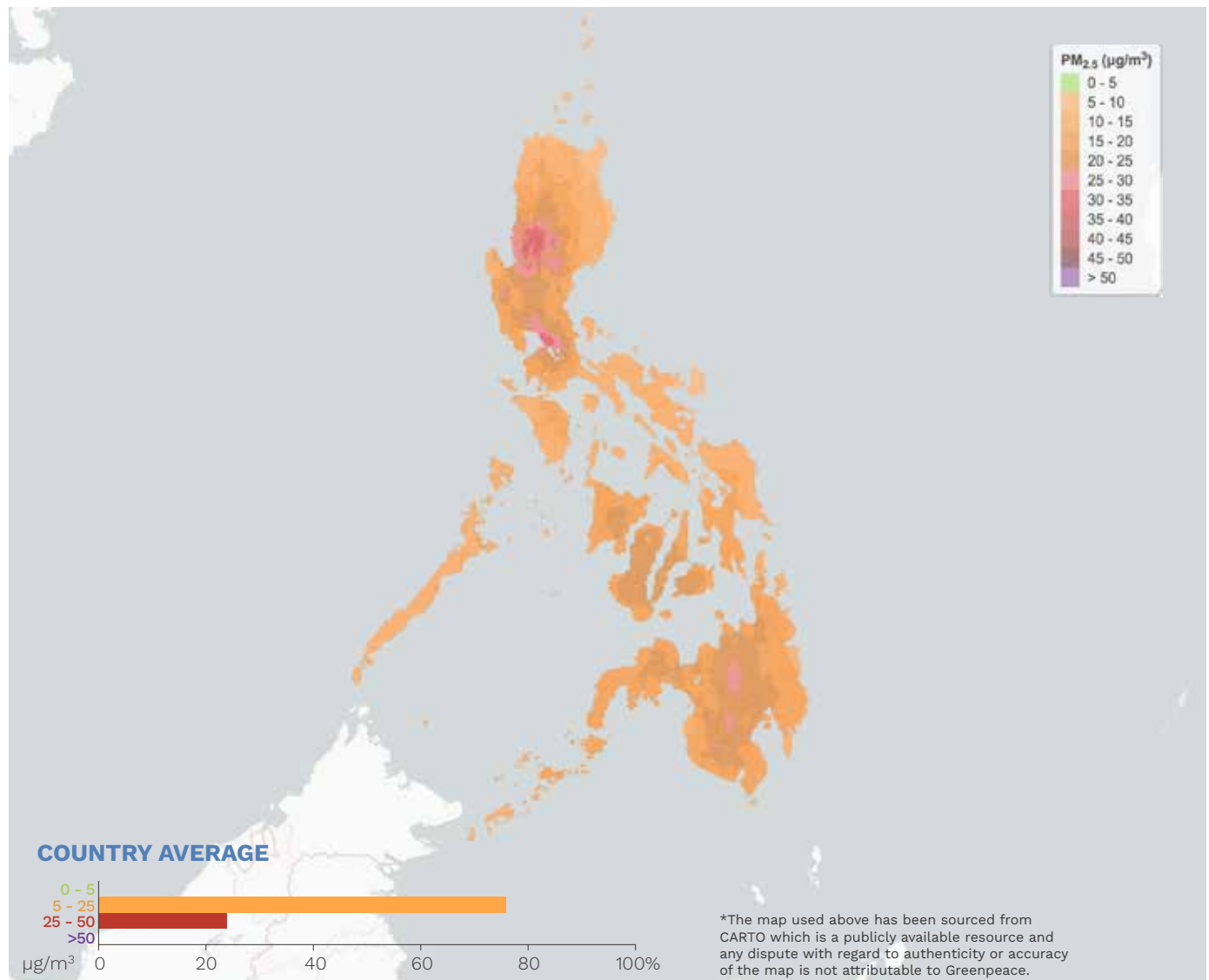
In the interest of the health of my family, I am thinking of moving away to an area with better air quality.

We need good law and enforcement from the government and responsibility from the business sector as well. We need good air quality standards as recommended by WHO.

PHILIPPINES

PHILIPPINES

Map of PM$_{2.5}$ concentration in 2020

PM$_{2.5}$ (µg/m³)
0 - 5
5 - 10
10 - 15
15 - 20
20 - 25
25 - 30
30 - 35
35 - 40
40 - 45
45 - 50
> 50

COUNTRY AVERAGE

0 - 5
5 - 25
25 - 50
>50

µg/m³   0   20   40   60   80   100%

*The map used above has been sourced from CARTO which is a publicly available resource and any dispute with regard to authenticity or accuracy of the map is not attributable to Greenpeace.

100%

of the total population of the Philippines lived in areas where estimated annual average PM$_{2.5}$ concentrations were greater than 5 µg/m³, meaning that almost everyone is breathing air that doesn't meet WHO guidelines.

It is estimated that:

25%

of the total population are exposed to annual average PM$_{2.5}$ concentrations that are at least five times over the WHO guideline.

PHILIPPINES

PM$_{2.5}$ Exposure Analysis

Provinces with the highest exposure to pollution (µg/m^3)
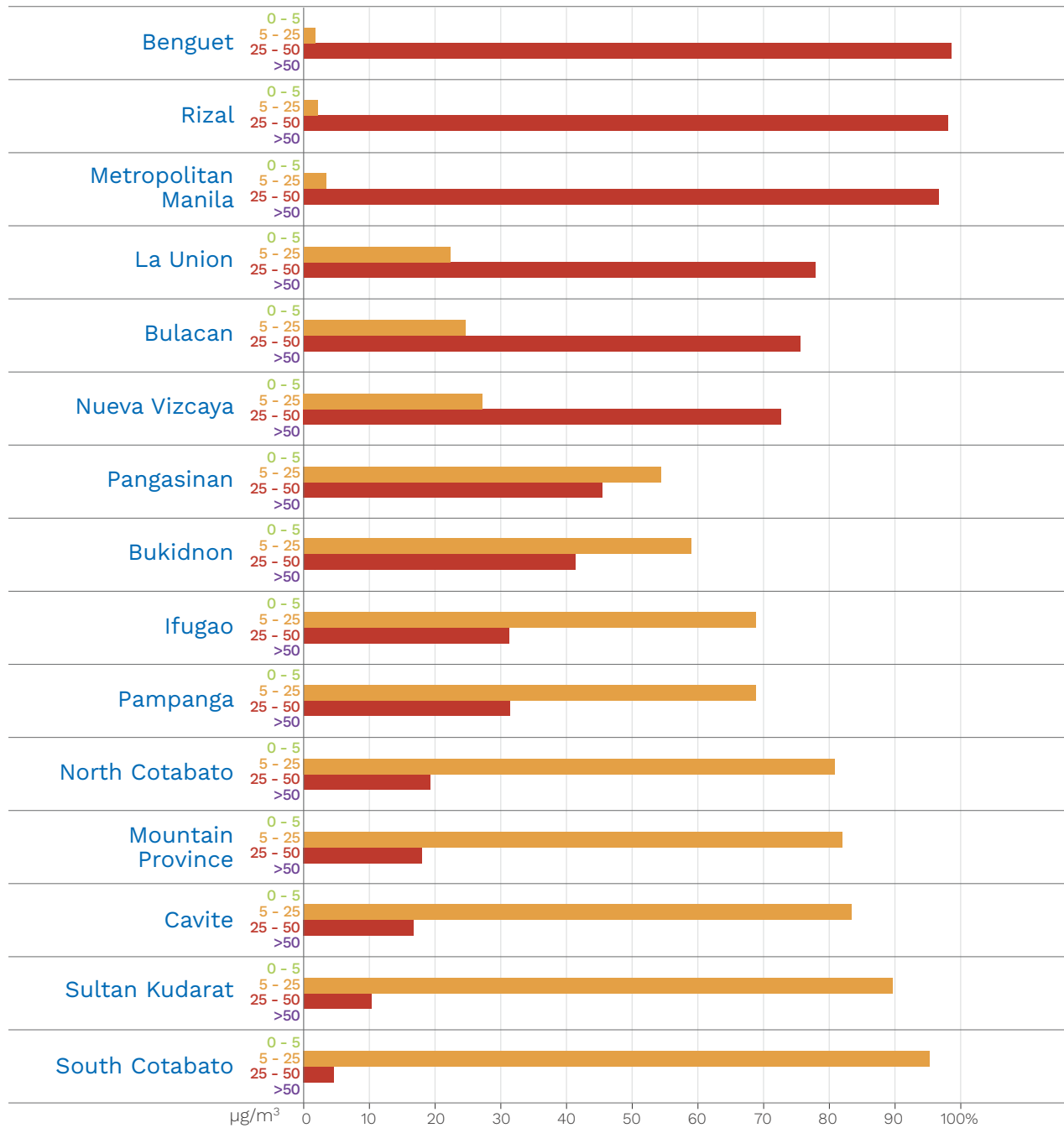
Even the provinces with lowest exposure to pollution are estimated to exceed the WHO guideline concentration

Benguet, Rizal and Metro Manila were the highest polluted provinces, with over

97%

of their total population estimated to be exposed to annual average PM$_{2.5}$ concentrations greater than 25 µg/m^3.

PHILIPPINES

Vulnerable Groups

Older adults

It is estimated that:

100%

of older adults in the Philippines were exposed to annual average PM$_{2.5}$ that exceeds the WHO guideline concentration.

Over

20%

were exposed to PM$_{2.5}$ concentrations of more than 25 µg/m^3, five times the WHO guideline. This is a lower proportion than the population as a whole.

Infants

It is estimated that:

100%
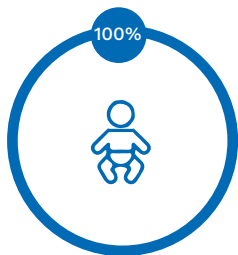
of infants were exposed to air with annual average PM$_{2.5}$ concentrations over 5 µg/m^3.

24%

were estimated to be exposed to annual average PM$_{2.5}$ concentrations of more than 25 µg/m^3, five times the WHO guideline. This is a slightly lower proportion than in the total population.

Pregnant people

It is estimated that:

100%

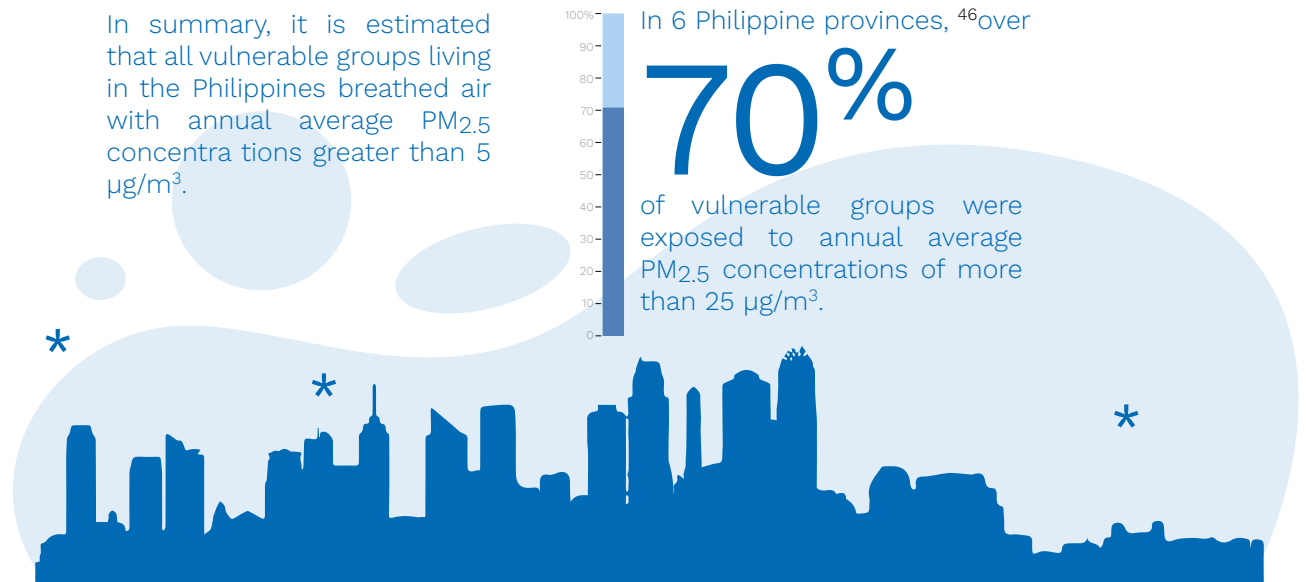of pregnant people were exposed to annual average PM$_{2.5}$ concentrations over 5 µg/m^3.

20%

were exposed to annual average PM$_{2.5}$ concentrations of more than 25 µg/m^3, five times the WHO guideline. This is a lower proportion than the population as a whole.

In summary, it is estimated that all vulnerable groups living in the Philippines breathed air with annual average PM$_{2.5}$ concentrations greater than 5 µg/m^3.
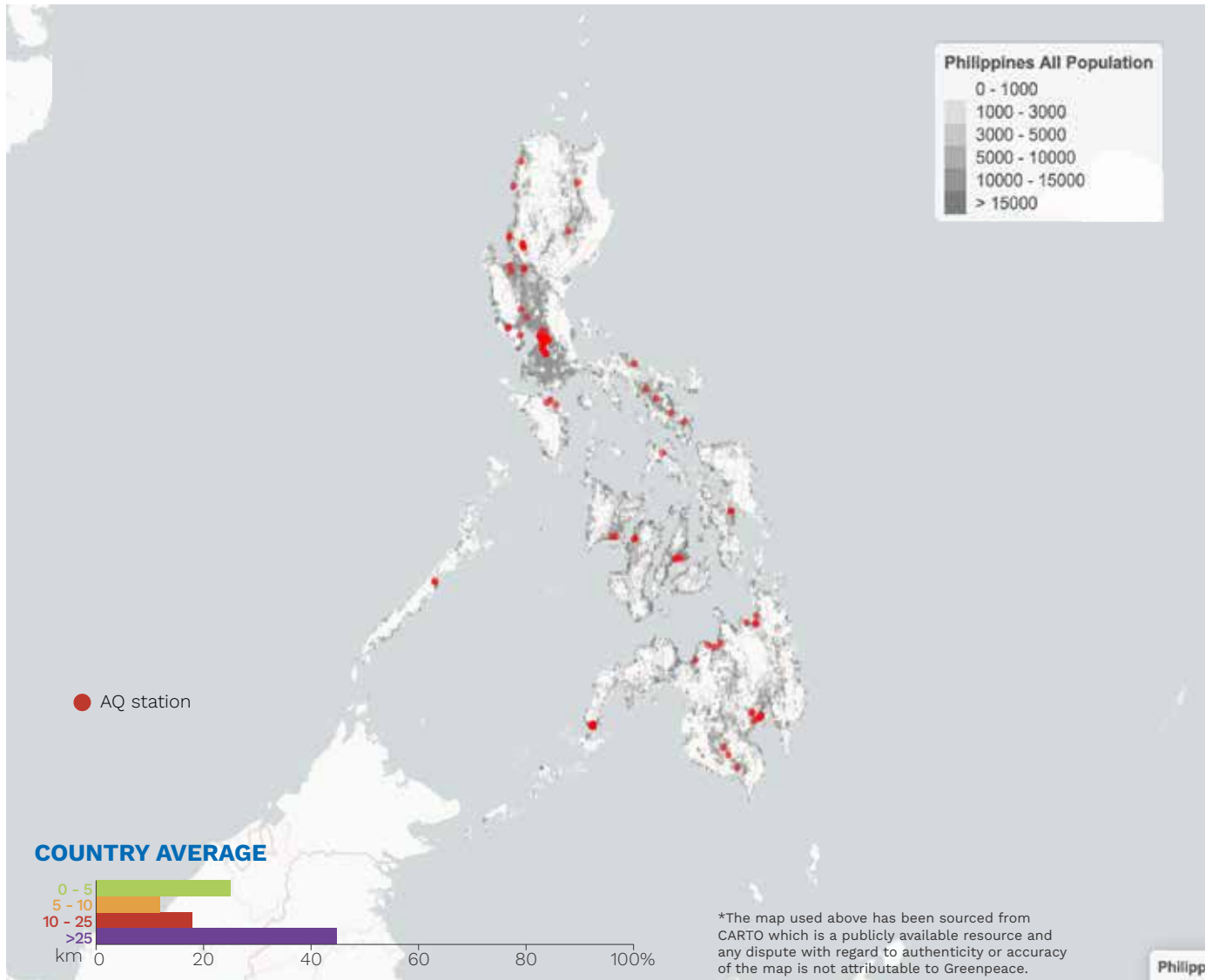
In 6 Philippine provinces, [46]over

70%

of vulnerable groups were exposed to annual average PM$_{2.5}$ concentrations of more than 25 µg/m^3.

PHILIPPINES

Map of AQ stations and population distribution

Philippines All Population
- 0 - 1000
- 1000 - 3000
- 3000 - 5000
- 5000 - 10000
- 10000 - 15000
- > 15000

● AQ station

COUNTRY AVERAGE

0 – 5
5 – 10
10 – 25
>25
km

*The map used above has been sourced from CARTO which is a publicly available resource and any dispute with regard to authenticity or accuracy of the map is not attributable to Greenpeace.

There are a total of

57

governmental PM$_{2.5}$ AQ stations with publicly accessible data in the Philippines,.[47,48].

Overall, about

45%

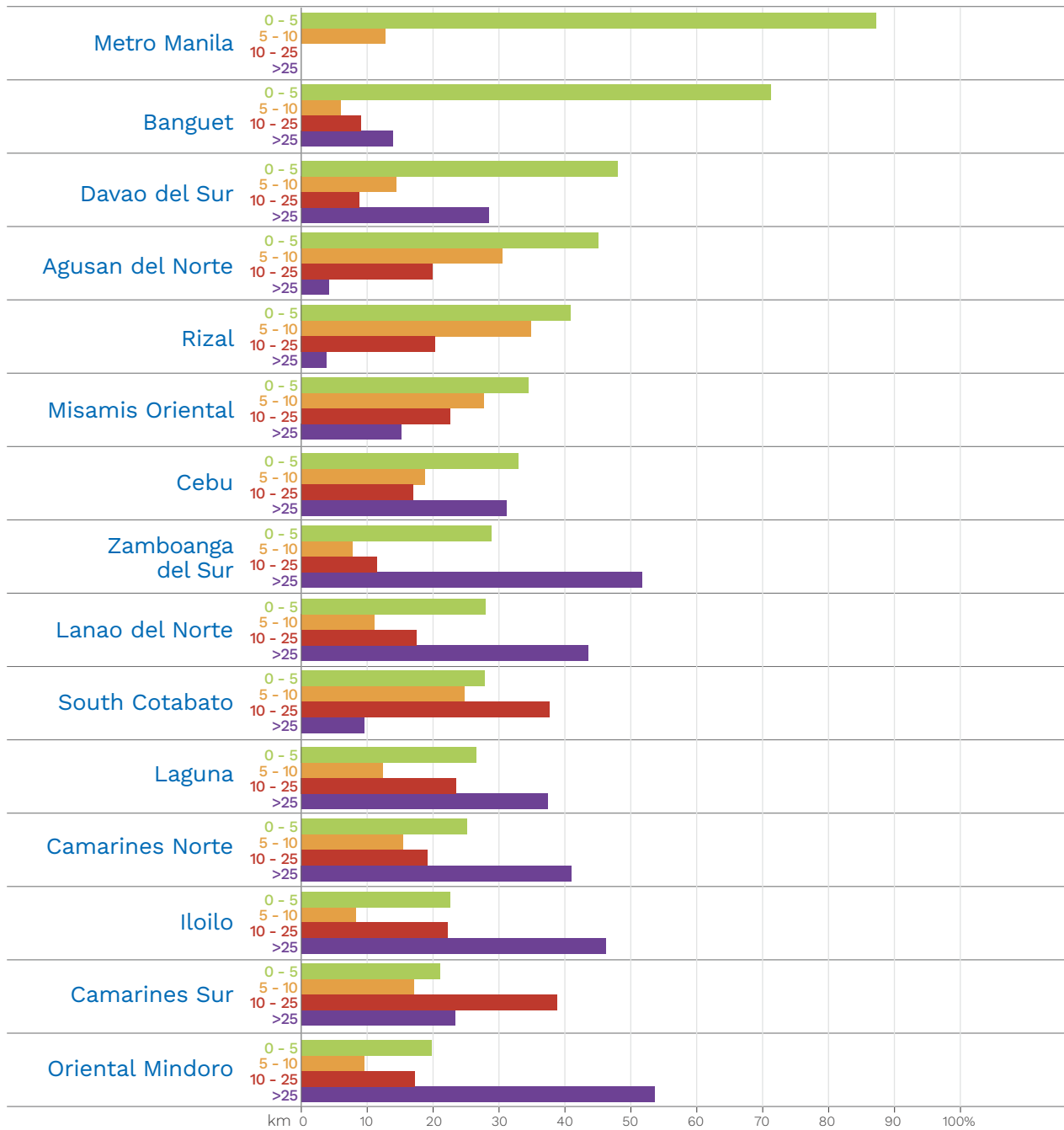of the total population live more than 25 km from an AQ station.

About

25%

of the population live within 5 km of an AQ station.

AQ Station Accessibility Analysis

Provinces with the best access to AQ stations (km)

In about

37%
49

of provinces, the total population does not have access to AQ stations within 25 km.

Metropolitan Manila has the best access,

87%

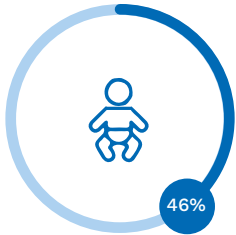of the total population have access to an AQ station within 5 km.

PHILIPPINES

Vulnerable Groups

Older adults

About **50%** of older adults in the Philippines live further than 25 km from an AQ station, this is a higher proportion than the total population.

50%

Infants

About **46%** of infants in the Philippines live in areas with no AQ stations within 25 km, this is a higher proportion than in the total population.

46%

Pregnant People

About **53%** of pregnant people in the Philippines live at least 25 km from an AQ station, this is a higher proportion than in the total population.

53%

All the vulnerable groups

have less local access to AQ station data than in the national population as a whole.

PHILIPPINES

Highlights

The AQ station accessibility in Philippines is similar to Mainland China (about 55% of total population are within 25 km) yet worse than other comparator territories of Germany, Japan and the US. Slightly greater proportions of older adults, infants and pregnant people live in places more than 25 km from an AQ Station. Future developments in the air quality monitoring network of the Philippines should aim to ensure the most vulnerable groups are represented in air pollution exposure datasets.

Solutions & Actions

The Filipino government should declare air pollution as a national issue and order all line agencies involved in air quality monitoring and regulation to prioritize this issue. There are several points it needs to work on :

- Enhance transparency and expedite the review and update of the air pollution standards under Republic Act 8749 or the Clean Air Act of 1999
- Government owned air pollution monitoring devices must be publicly accessible in real time and it should be mandatory in all cities, government offices, particularly in heavy polluting industries/facilities such as coal power plants and in areas with high concentration of motorized vehicles
- Allocate more funds and manpower to the Department of Environment and Natural Resources to increase their capacity in air quality monitoring, including enabling the department to install its own emissions monitoring devices in existing coal power plants and, in the meantime, adopt a stringent process for validating self-monitoring reports of emissions rates
- Address the root cause of air pollution in the country by implementing a transition plan away from the use of coal energy and fossil fuels in the transport sector.
- Issue a moratorium on all permits to operate air pollutant installations especially for proposed coal power plants until the Ambient Air Quality Guideline Values and Standards and Emission Standards are updated.

HUMAN STORY

" *Air pollution is my main concern and biggest difficulty since my child suffers from asthma.* "

RIZA PALAPAN

is a mother of 2 children, one of them is four year old. She is also the primary caregiver of her mother. They live in Mindanao, the southernmost island of the Philippines.

I live in a remote village up in the mountains by the coast of Malita, Davao Occidental, with my mother and my two children. It takes 2 hours to walk to the city. I chose to stay here because my mom suffers from bronchopneumonia and I need to take care of her.
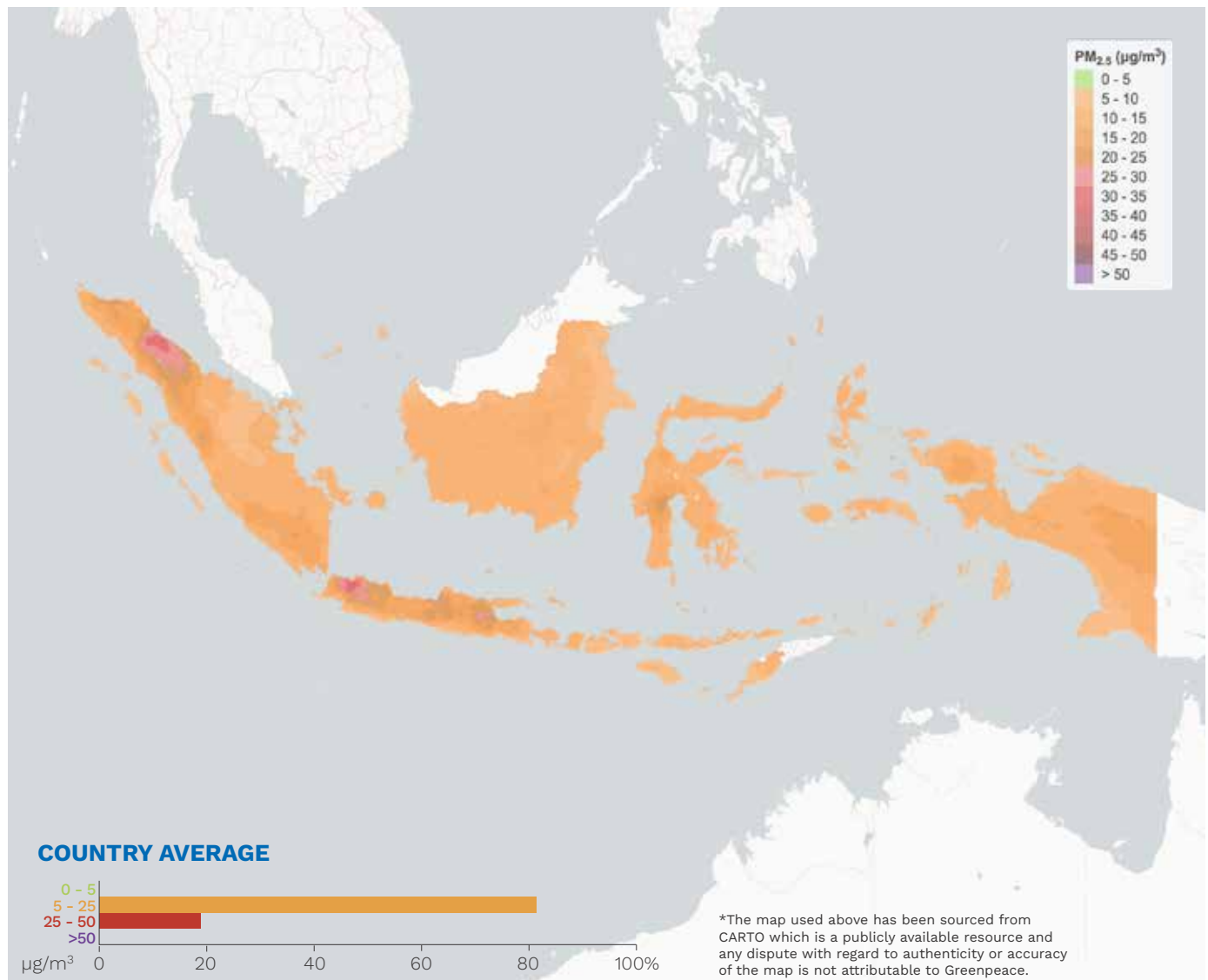
Since the coal power plant started operating in our province, the residents have been experiencing many health problems such as coughs, colds, and fever. My house is at the back of the power plant facing the sea. There are many cargo vessels passing by carrying chemical materials for the power plant. During the shipping hours, people experience coughing, colds and difficulty breathing.

As a mother of a 4-year-old child, air pollution is my main concern since my child suffers from asthma. When the power plant is operating and emiting smoke, we can smell the foul odor coming from it. This happens around 1:00 AM to 3:00 AM and 5:00 AM to 6:00 AM on a daily basis.

Although our house is right beside the power plant and we are deeply impacted, we don't know what to do to change the situation because we are only ordinary people in the province.

INDONESIA

INDONESIA

Map of PM$_{2.5}$ concentration in 2020

PM$_{2.5}$ (µg/m³)
0 - 5
5 - 10
10 - 15
15 - 20
20 - 25
25 - 30
30 - 35
35 - 40
40 - 45
45 - 50
> 50

COUNTRY AVERAGE

0 – 5
5 – 25
25 – 50
>50
µg/m³   0   20   40   60   80   100%

*The map used above has been sourced from CARTO which is a publicly available resource and any dispute with regard to authenticity or accuracy of the map is not attributable to Greenpeace.

100%

of the total population of Indonesia lived in areas where estimated annual average PM$_{2.5}$ concentrations were greater than 5 µg/m³, meaning that almost everyone was breathing air that didn't meet WHO guidelines.

It is estimated that:

19%

of the total population were exposed to annual average PM$_{2.5}$ concentrations that were at least five times over the WHO guideline.

INDONESIA

PM$_{2.5}$ Exposure Analysis

Provinces with the highest exposure to pollution (µg/m^3)
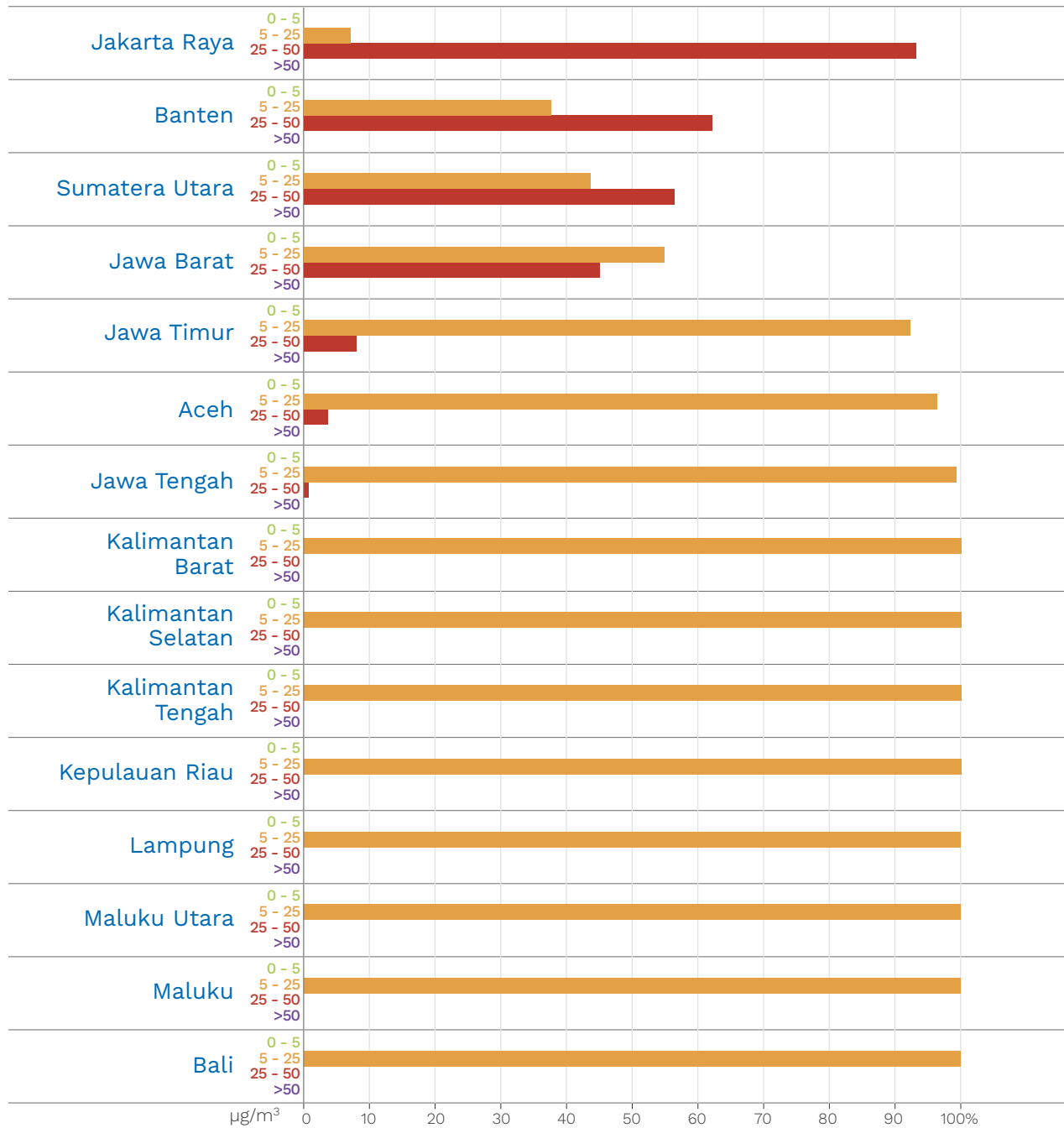
At the province level, it is estimated that

93%

of the total population in Jakarta Raya was exposed to annual average PM$_{2.5}$ concentrations over 25 µg/m^3. In Banten, Sumatera Utara and Jawa Barat the estimated proportion was 63%, 57% and 46% respectively.
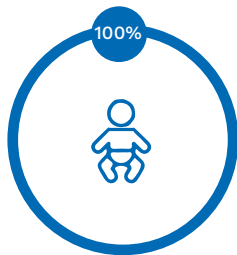
INDONESIA

Vulnerable Groups

Older adults

It is estimated that:

100%

of older adults in Indonesia were exposed to PM$_{2.5}$ that exceeds the WHO guideline concentration and

that

12%

were exposed to PM$_{2.5}$ concentrations of more than 25 µg/m^3, five times the WHO guideline.
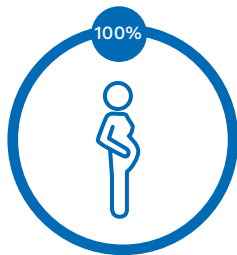
Infants

It is estimated that:

100%

of infants were exposed to air with PM$_{2.5}$ concentrations over 5 µg/m^3.

17%

were exposed to PM$_{2.5}$ concentrations of more than 25 µg/m^3, five times the WHO guideline.

Pregnant People

It is estimated that:

100%

of pregnant people were exposed to PM$_{2.5}$ concentrations over 5 µg/m^3.
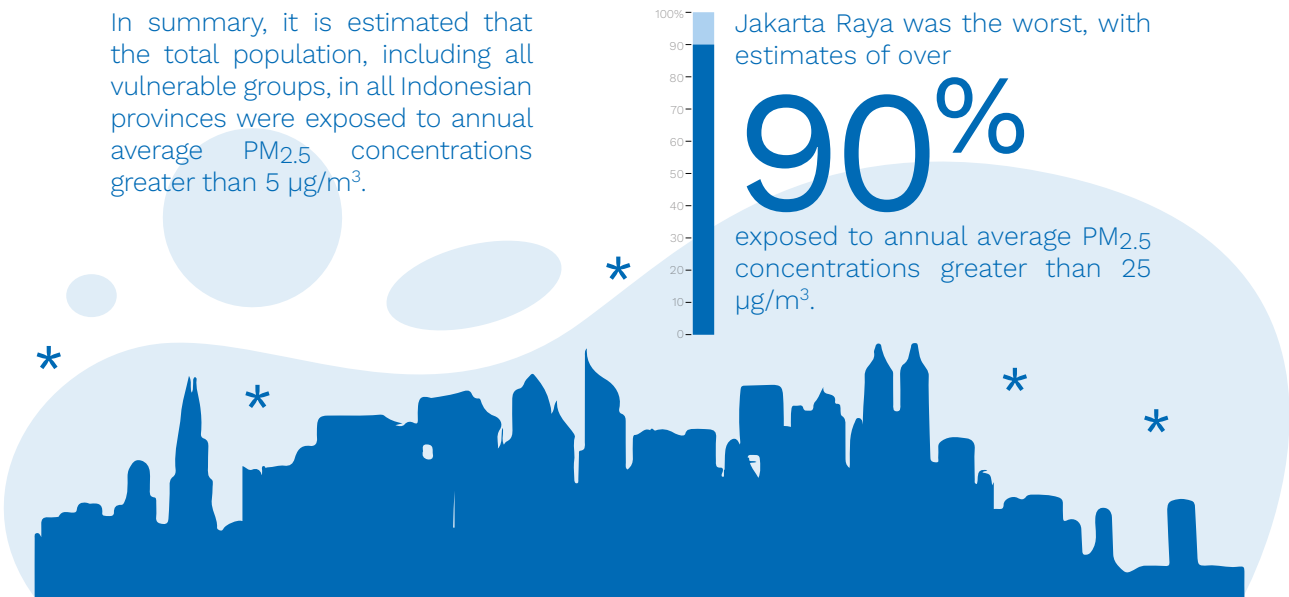
19%

were exposed to PM$_{2.5}$ concentrations of more than 25 µg/m^3.

In summary, it is estimated that the total population, including all vulnerable groups, in all Indonesian provinces were exposed to annual average PM$_{2.5}$ concentrations greater than 5 µg/m^3.
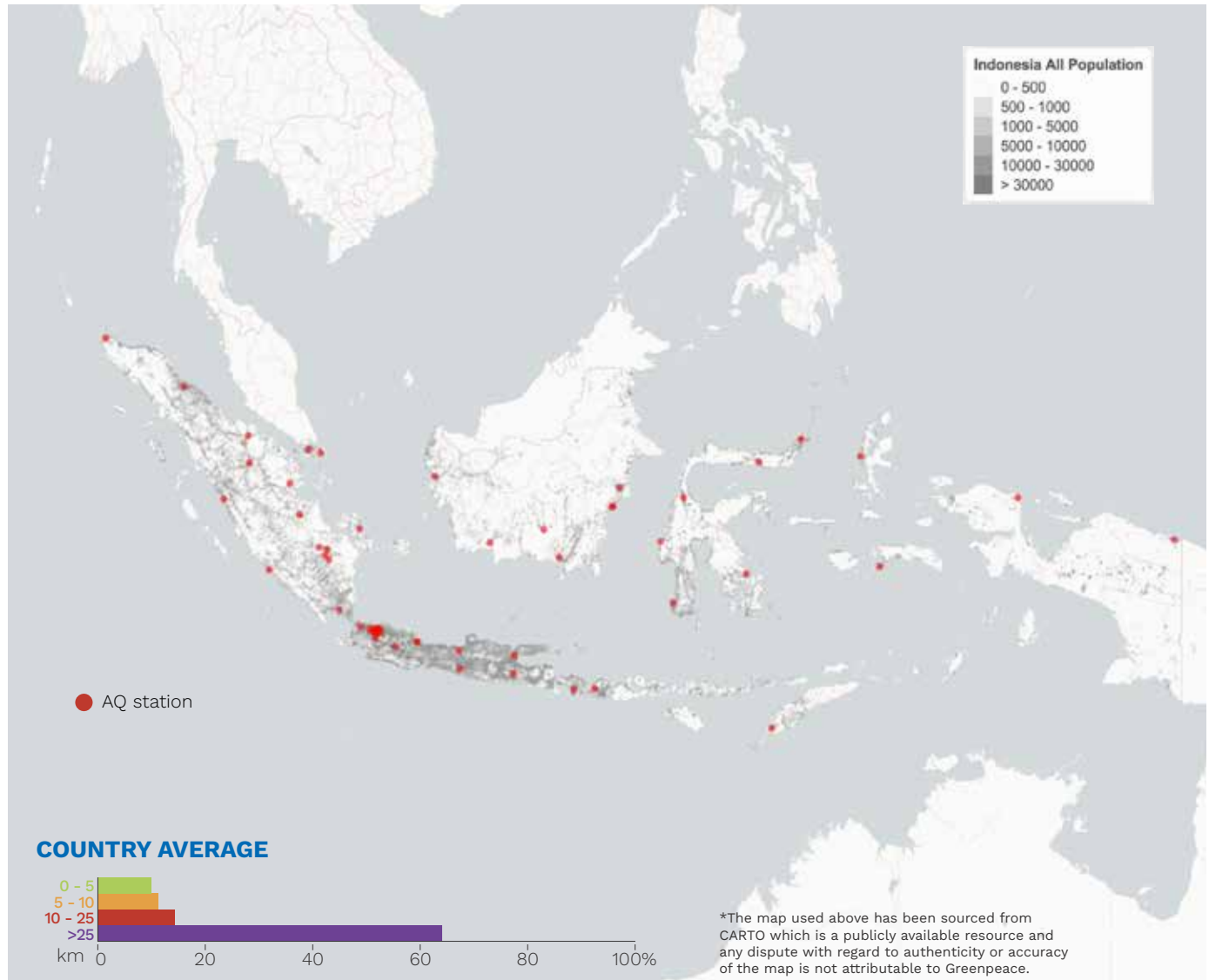
Jakarta Raya was the worst, with estimates of over

90%

exposed to annual average PM$_{2.5}$ concentrations greater than 25 µg/m^3.

INDONESIA

Map of AQ stations and population distribution

Indonesia All Population
0 - 500
500 - 1000
1000 - 5000
5000 - 10000
10000 - 30000
> 30000

● AQ station

COUNTRY AVERAGE

0 – 5
5 – 10
10 – 25
>25
km

*The map used above has been sourced from CARTO which is a publicly available resource and any dispute with regard to authenticity or accuracy of the map is not attributable to Greenpeace.

AQ stations in Indonesia are sparsely distributed across its islands[50].
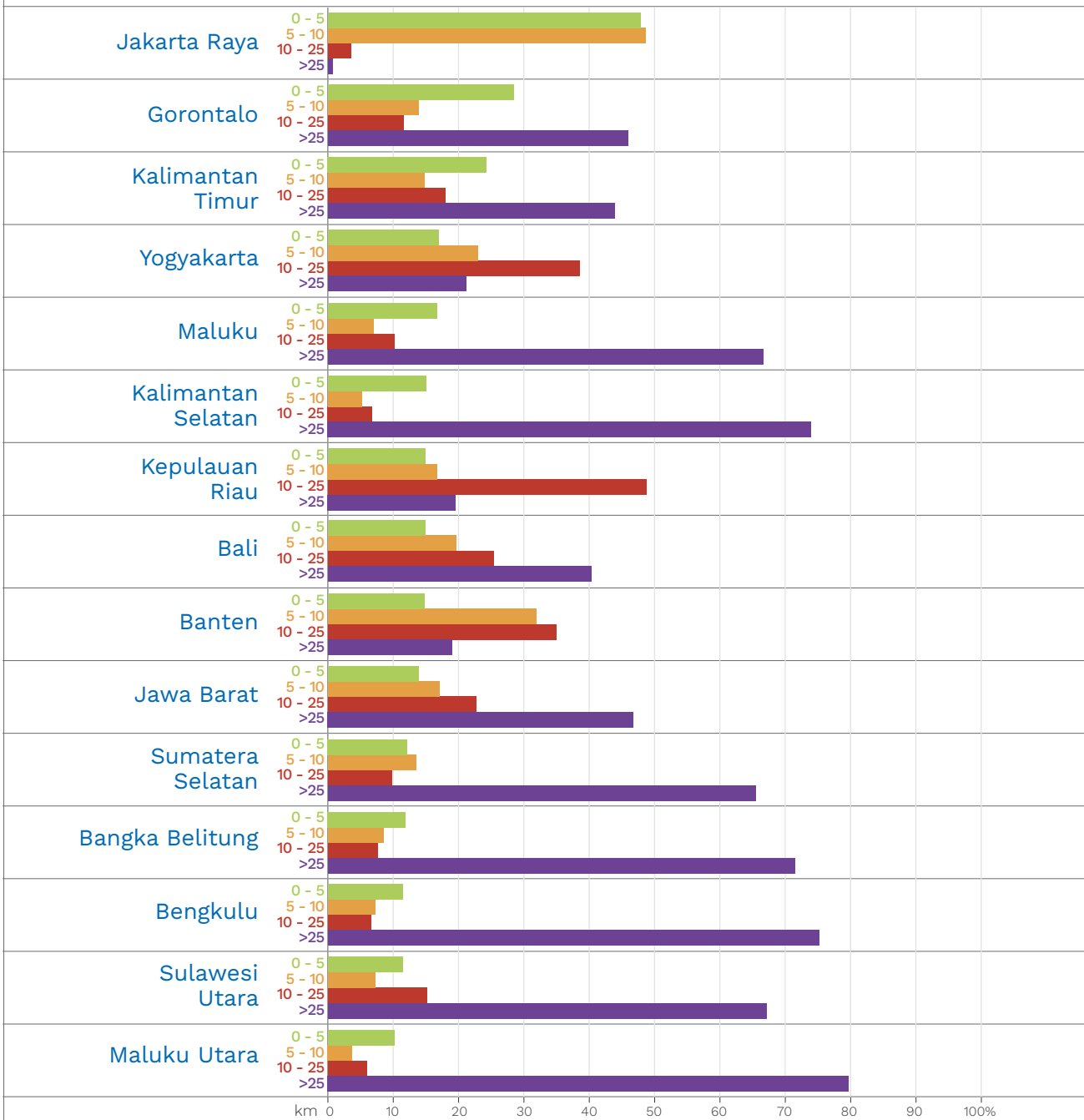
Overall, about

64%

of the total population in Indonesia do not have access to AQ stations within 25 km.

About

10%

of the population have access to AQ stations within 5 km.

INDONESIA

AQ station accessibility analysis

Provinces with the best access to AQ stations (km)

(Horizontal bar chart. Each province has four bars: 0 – 5, 5 – 10, 10 – 25, >25. X-axis in km from 0 to 100%.)

Province	0 – 5	5 – 10	10 – 25	>25
Jakarta Raya	48	49	4	1
Gorontalo	28	13	11	46
Kalimantan Timur	24	14	17	44
Yogyakarta	16	23	38	21
Maluku	16	7	10	66
Kalimantan Selatan	14	5	7	74
Kepulauan Riau	14	16	48	19
Bali	14	19	25	40
Banten	14	31	34	18
Jawa Barat	13	16	22	47
Sumatera Selatan	12	13	9	65
Bangka Belitung	11	8	7	71
Bengkulu	11	6	6	75
Sulawesi Utara	11	7	15	67
Maluku Utara	10	3	6	80

77%[51]
of Indonesian provinces have populations where over 50% of people do not have access to an AQ station within 25 km.

In Kalimantan Utara, the entire population has no access to an AQ station within **25km**
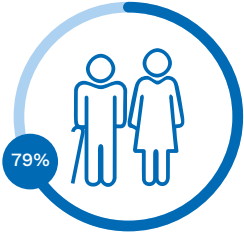
Jakarta Raya has the best AQ accessibility, about **48%** of the total population has access within 5 km.
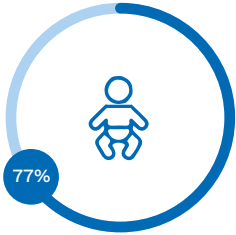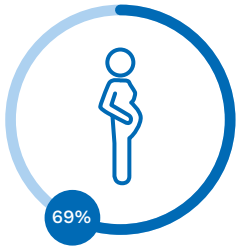
INDONESIA

Vulnerable Groups

Older adults

About **79%** of older adults in Indonesia do not have access to AQ stations within 25 km, much higher than the total population.

79%

Infants

About **77%** of infants in Indonesia do not have access to AQ stations within 25 km, much higher than the total population.

77%

Pregnant People

About **69%** of pregnant people in Indonesia do not have access to AQ stations within 25 km, slightly higher than the total population.

69%

Half[52] of the population in Indonesian provinces, including older adults and infants, have no access to an AQ station within

25km

In Kalimantan Utara, pregnant people have no access to an AQ station within

25km

INDONESIA

Highlights

In Indonesia, many people live far from AQ stations. Where AQ Stations are making measurements, the Indonesian government only discloses an air quality index (ISPU standard index of air pollutants). This index differs from internationally used Air Quality Indexes and does not provide details of pollutant concentrations. There is currently no regulation requiring the Indonesian government to disclose concentration data, instead regulations require that people pay to access data. While the entire Indonesian population is breathing unhealthy air, a lack of accessible air pollution data hinders efforts to prevent or mitigate the pollution problem.

Solutions & Actions

The Indonesian government must immediately implement a-year-old court's[53] decision on an air pollution citizen lawsuit, such as the establishment of a national air quality standard to protect human health by the president and also strategies to control air pollution by the health minister and Jakarta governor.

As WHO has mentioned, clean air is a fundamental human right. There is also an urgent need to declare that neglecting the people's right to clean air is a human rights violation – which was not ruled on by the court's decision last year. The negligence will affect vulnerable groups, such as infants, older adults, pregnant people and low-income groups who cannot afford health costs, more.

On the other hand, the national standard must be revised to be aligned with the latest WHO's air quality guidelines. Currently, there's a huge gap between the two, which will hinder the process of achieving clean air for all.

In doing so, the Indonesian government should implement an ambitious and timely energy transition by shifting from fossil fuels to clean and renewable energy in air polluting sectors such as power and transportation.

HUMAN STORY

"*I'm currently 5 months pregnant, I keep worrying about how air pollution impacts my pregnancy and the baby.*"

ARSI AGNITASARI

is five months pregnant and living with her husband in Kebon Jeruk, Jakarta.

I live in Kebon Jeruk, in West Jakarta, where the air is seriously polluted. I look at the average air quality index from an application called Nafas every day, and it is very rare to see a "Good" indicator.

I'm currently 5 months pregnant. I keep worrying about how air pollution will impact my pregnancy and the baby. My husband, who suffers from a nasal allergy, always sneezes when the window is open.

I live in a high-rise apartment building where I usually see grey sky and have low visibility of the other high buildings around. Up until now, the best view I've gotten of the clear blue sky was during the country's first Covid restriction.

Last June I bought an air purifier to improve the air quality in my bedroom. I think one air purifier is not enough but that's all I can afford.

Jakarta's air is so highly polluted because people rely heavily on private transportation that is still fueled by fossil fuels. Jakarta is also surrounded by several coal power plants situated less than 100km from the city - the nearest is Suralaya 1-8 Power Plant in Banten.

I want the government, both central and local, to take air pollution seriously. With the 2021 winning of a civil lawsuit against the government in Jakarta, it's clear that air pollution can be reduced and mitigated through stricter regulations.

The government must release the daily air quality data and remind people to use masks outdoors. Let's stop pretending that it's okay outside.
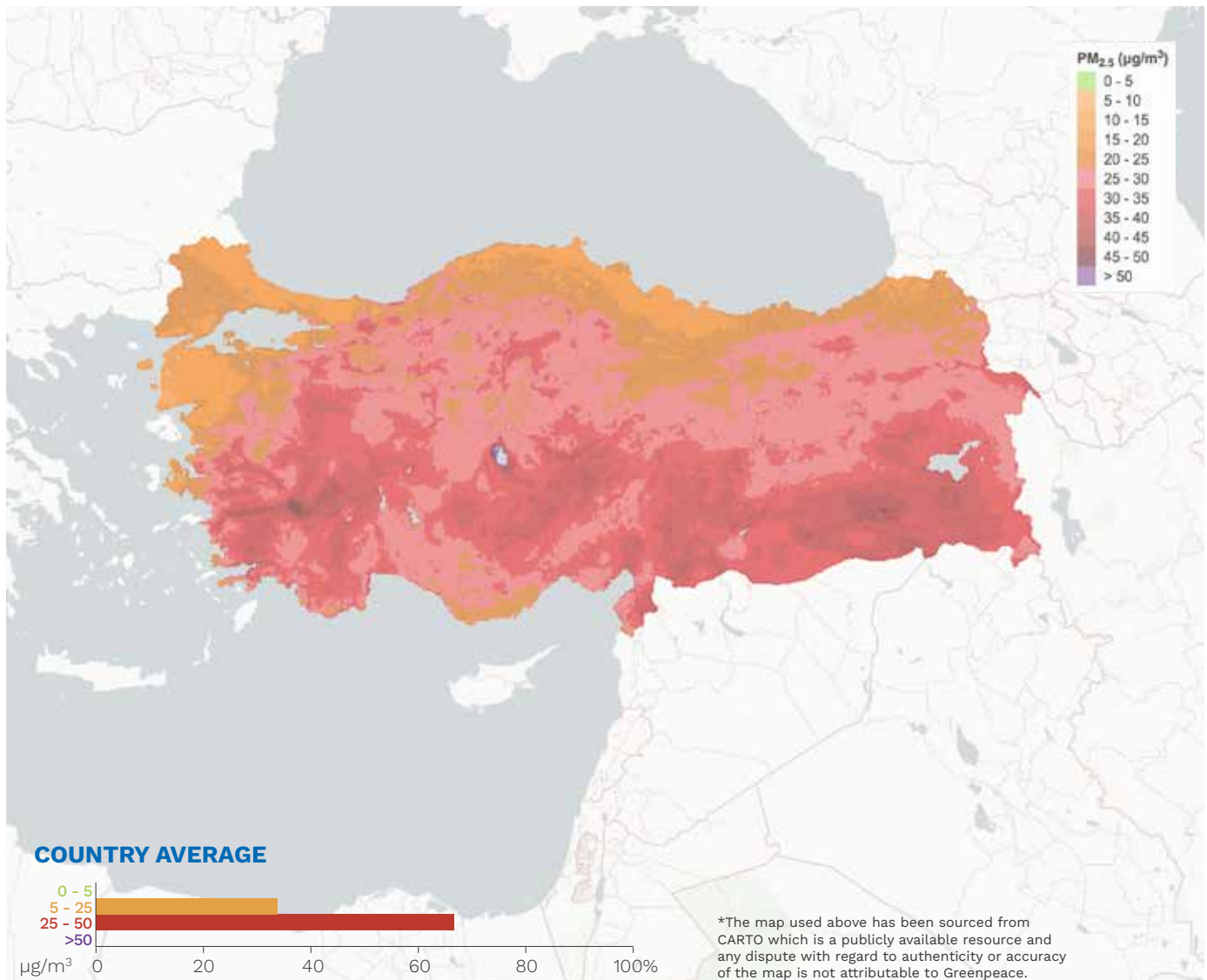
TÜRKIYE

TÜRKIYE

Map of PM$_{2.5}$ concentration in 2020

COUNTRY AVERAGE

0 – 5	
5 – 25	
25 – 50	
>50	

μg/m³ 0   20   40   60   80   100%

*The map used above has been sourced from CARTO which is a publicly available resource and any dispute with regard to authenticity or accuracy of the map is not attributable to Greenpeace.

100%

of the total population in Türkiye lived in areas where estimated annual average PM$_{2.5}$ concentrations were greater than 5 μg/m³.

It is estimated that

67%

of the total population were exposed to annual average PM$_{2.5}$ concentrations that are over 25 μg/m³.

TÜRKIYE

Annual average PM$_{2.5}$ Exposure Analysis

Cities with the **lowest** exposure to pollution (µg/m³)

	0 – 5	5 – 25	25 – 50	>50
Çanakkale				
Edirne				
Kirklareli				
Ordu				
Tekirdag				
Ardahan				
Samsun				
Yalova				
Rize				
Sinop				
Giresun				
Trabzon				
Istanbul				
Artvin				
Kastamonu				
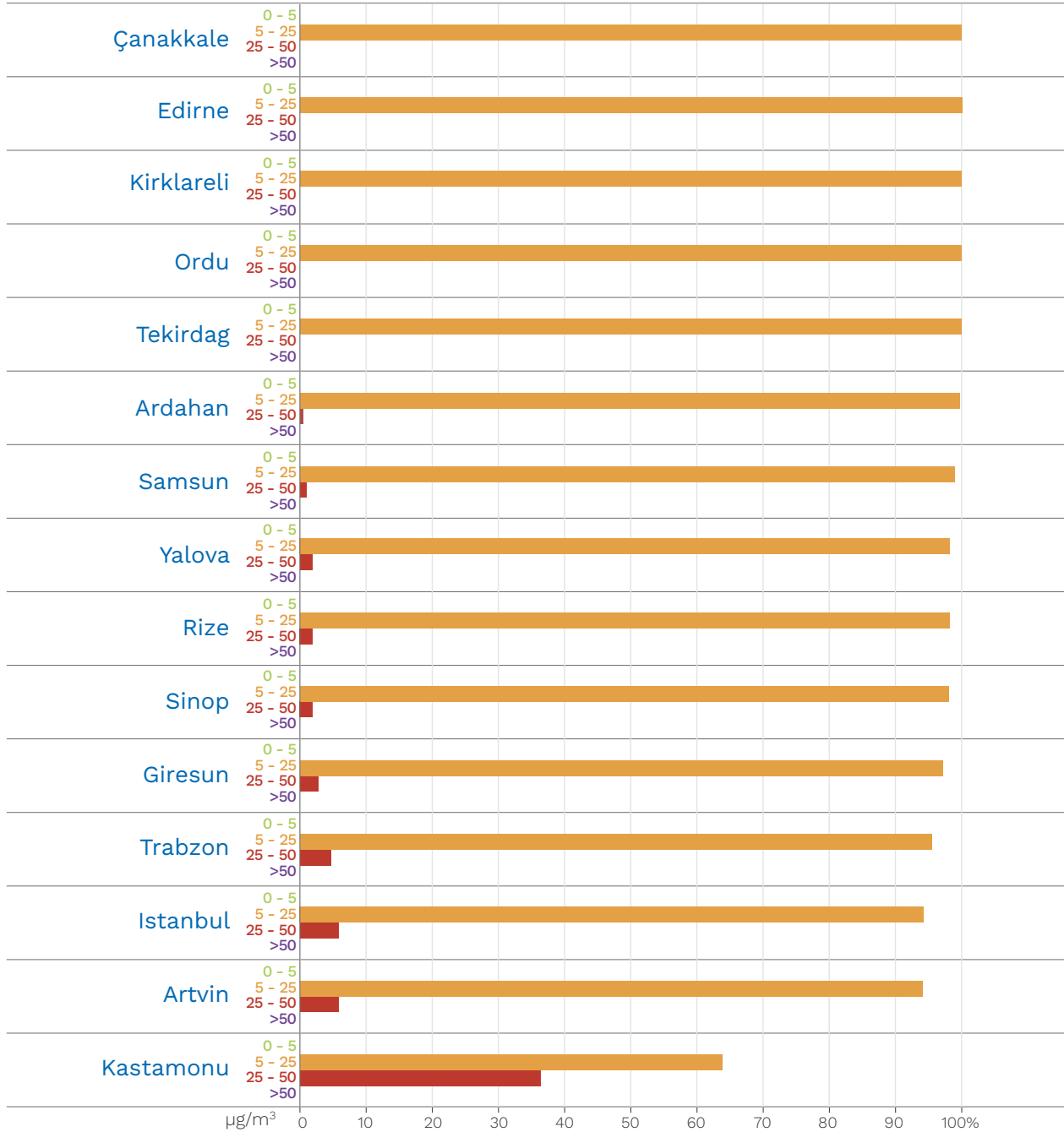
Even people in the cities with the lowest exposure to pollution were breathing air that is estimated to exceed WHO health-based guidelines with respect to PM$_{2.5}$

In

36%[54]

of cities studied, it is estimated that almost the whole population was exposed to annual average PM$_{2.5}$ concentrations greater than 25 µg/m³.

TÜRKIYE

Vulnerable Groups

Older adults

It is estimated that:

100%

of older adults in Türkiye were exposed to annual average PM$_{2.5}$ concentrations over 5 µg/m^3.

66%

were exposed to annual average PM$_{2.5}$ concentrations of more than 25 µg/m^3.
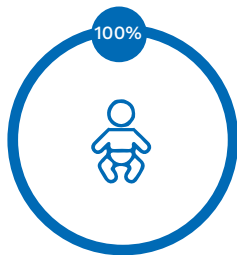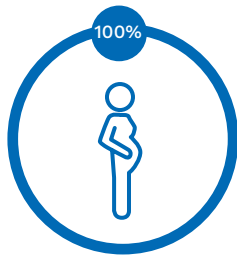
Infants

It is estimated that:

100%

of infants were exposed to air with annual average PM$_{2.5}$ concentrations over 5 µg/m^3.

70%

were exposed to annual average PM$_{2.5}$ concentrations of more than 25 µg/m^3. This is a higher proportion than in the total population.
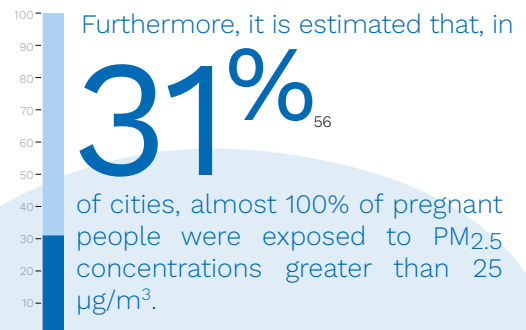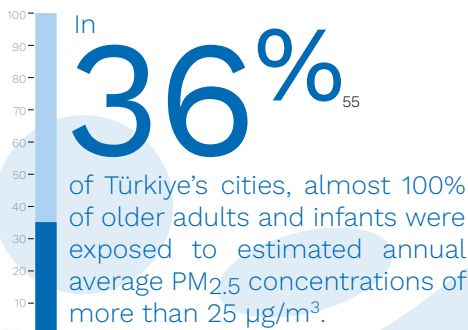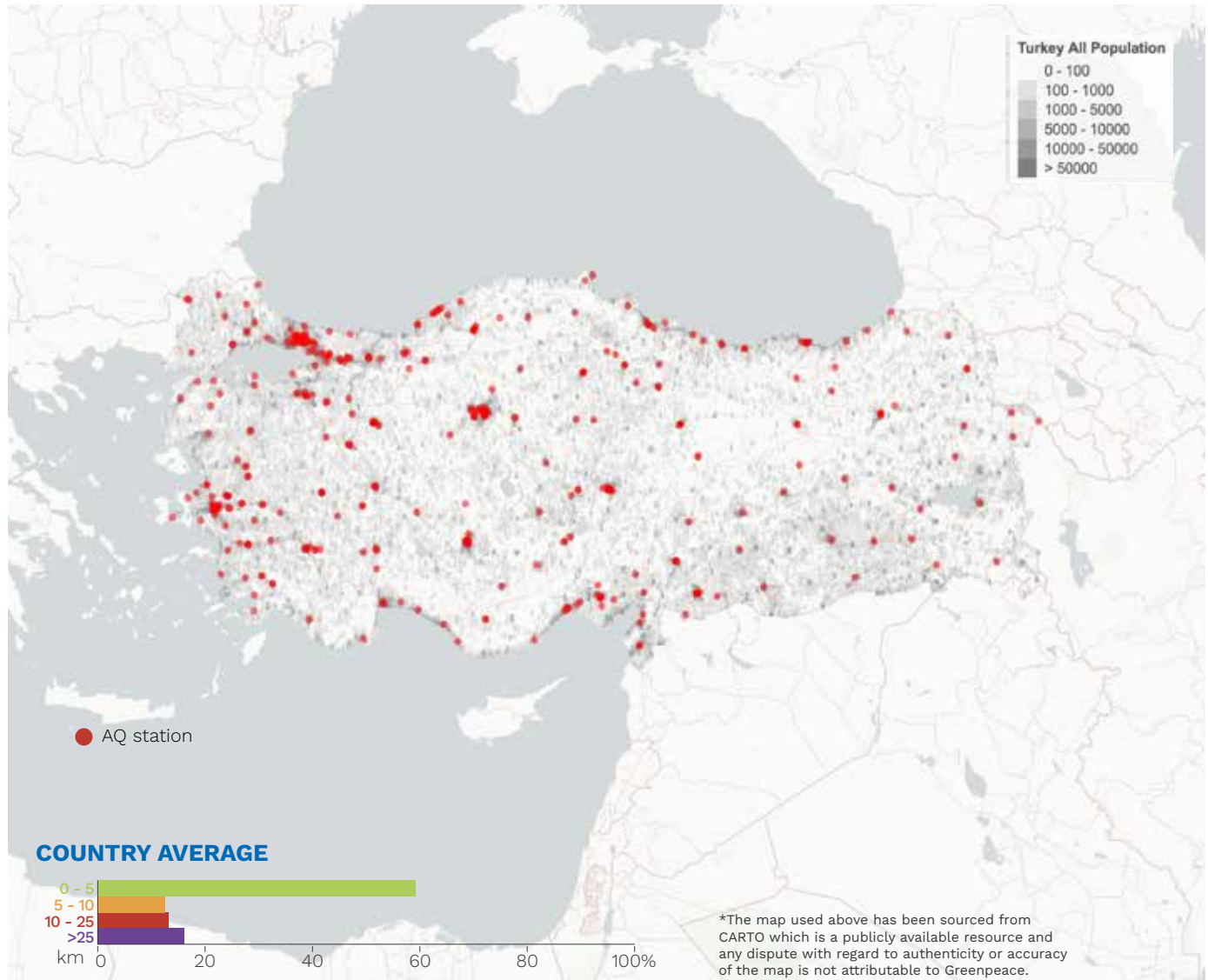
Pregnant People

It is estimated that:

100%

of pregnant people were exposed to annual average PM$_{2.5}$ concentrations over 5 µg/m^3.

64%

were exposed to PM$_{2.5}$ concentrations of more than 25 µg/m^3.

In **36%** [55] of Türkiye's cities, almost 100% of older adults and infants were exposed to estimated annual average PM$_{2.5}$ concentrations of more than 25 µg/m^3.

Furthermore, it is estimated that, in **31%** [56] of cities, almost 100% of pregnant people were exposed to PM$_{2.5}$ concentrations greater than 25 µg/m^3.

*

*

Map of AQ stations and population distribution

Turkey All Population
0 - 100
100 - 1000
1000 - 5000
5000 - 10000
10000 - 50000
> 50000

● AQ station

COUNTRY AVERAGE

0 – 5
5 – 10
10 – 25
>25
km   0   20   40   60   80   100%

*The map used above has been sourced from CARTO which is a publicly available resource and any dispute with regard to authenticity or accuracy of the map is not attributable to Greenpeace.

AQ station data are made available to the public by Türkiye's Ministry of Environment, Urbanization and Climate Change.[57] Overall, about

16%

of the total population do not have access to AQ stations within 25 km.

About

59%

of the population have access to AQ stations within 5 km.

However in Türkiye, relatively few AQ Stations measure $PM_{2.5}$ pollution meaning that this pollutant may be underreported.

AQ Station Accessibility Analysis

Cities with the best access to AQ stations (km)
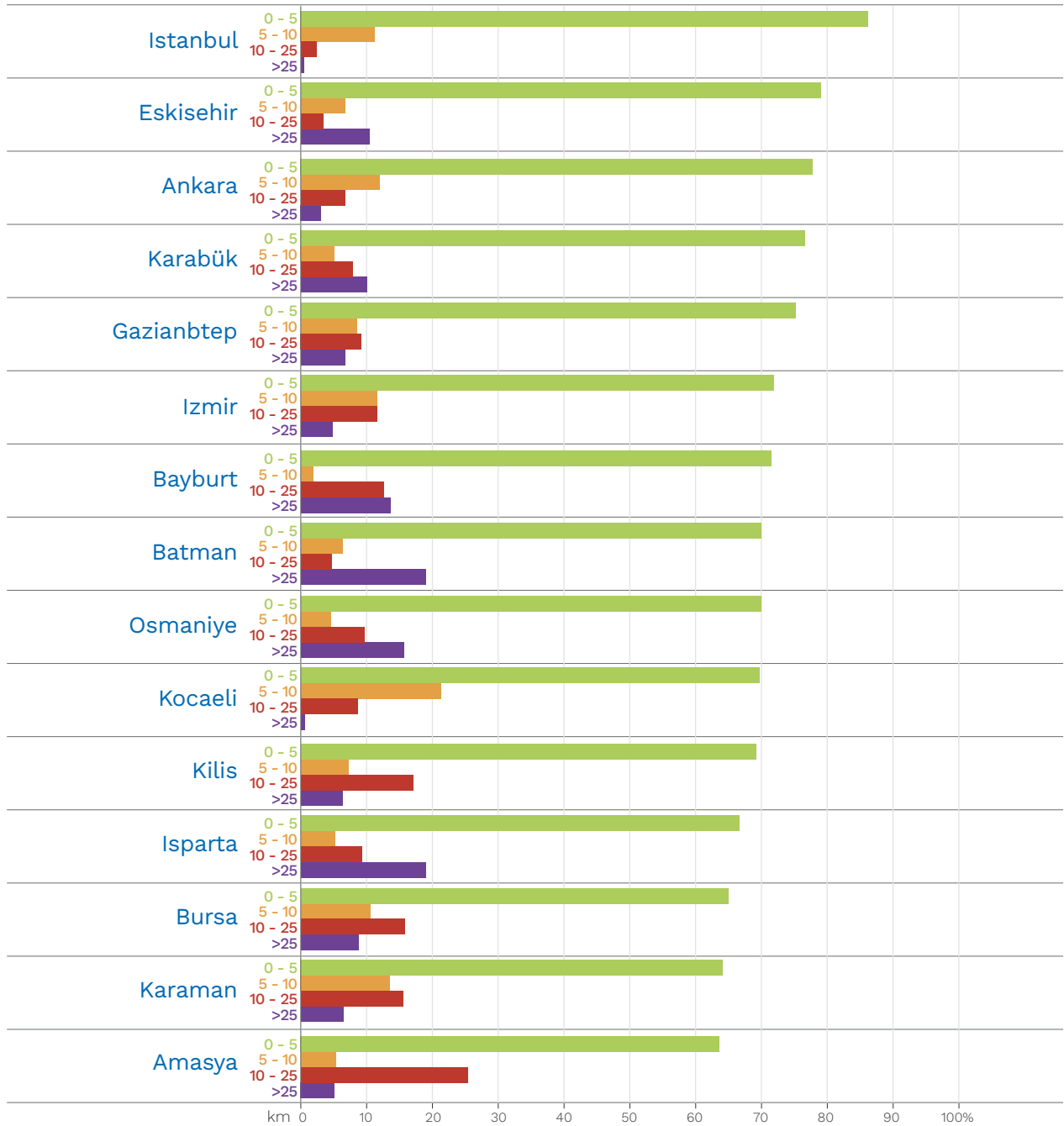
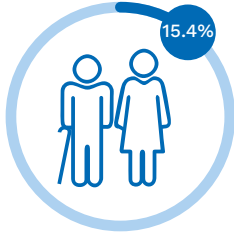Over half of Türkiye's cities have populations where more than

50%

of people have access to an AQ station within 5 km.

However, in around

10%[58]

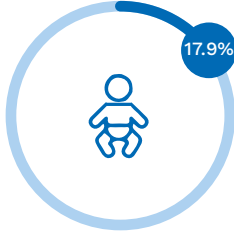of cities over 50% of the entire population have no access to an AQ station within 25 km.

TÜRKIYE

Vulnerable Groups

Older adults
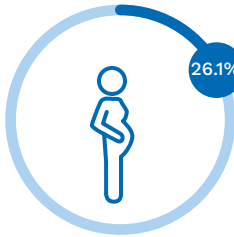
15.4%

About **15%**

of older adults in Türkiye do not have access to AQ stations within 25 km, slightly lower than the total population.

Infants

17.9%

About **18%**

of infants in Türkiye do not have access to AQ stations within 25 km, higher than the total population.

Pregnant People

26.1%

About **26%**

of pregnant people in Türkiye do not have access to AQ stations within 25 km, higher than other groups.

TÜRKIYE

Highlights

Analysis of AQ station accessibility in Türkiye found that over 80% of the total population have access to a station within 25 km. However, many stations do not work reliably and often do not monitor the key air pollutant, $PM_{2.5}$.[59]

Solutions & Actions

Authorities in Türkiye can take some immediate steps to improve air quality and reduce exposure. Nationally, limit values for annual average and 24-hour average $PM_{2.5}$ concentration should be set out in regulations with legally binding target dates by which the limit must be achieved.

As a minimum, these limit values along with those for gaseous air pollutants should achieve the same standards that are required within the EU. However, greater health benefits could be achieved by setting more ambitious targets that are aligned with the WHO's guidelines. Türkiye is strongly encouraged to work towards achieving the WHO's air quality guidelines in the shortest time possible.

Measures must be taken to ensure continuous improvements in air quality and regions where pollution breached national regulations should be targeted for additional measures that cut emissions from polluting activities.

HUMAN STORY

"We experience recurring upper respiratory tract ailments. My son and I have to take our lung-strengthening medication."

MEHMET DALKANAT

is over 65 years old. He lives with his son in Kahramanmaraşi in Turkey.

I was born and raised in Elbistan, Kahramanmaraşi, Turkey, where I still live.

Air pollution in our region is caused by coal power plants. In operation for 38 years, the 'Afşin-Elbistan A' coal power plant is still active with unqualified filters. 'Afşin-Elbistan B' has been active since 2004. We can see the harm the coal power plants has done to our health and to the environment.

Our family's vineyard can no longer be harvested because of the change in local climate caused by the coal power plants. Along with other people living in the region, we experience recurring upper respiratory tract ailments. My son and I have to take lung-strengthening medication. We don't have an air purifier. We can only afford simple cloth masks.

Every employee who retires from working at the facility dies before the age of 70, especially from cancer. Some children have been diagnosed with cancer at birth.

Our access to air quality information is not enough. The data published by the ministry is not accurate. We applied for access to real-time emissions information but our applications were denied because that information was classified as a "commercial secret". We had to resort to legal means to reach the information. The case continues.

The only solution to the problem is to close the coal power plants. For energy needs, renewable energy solutions should be preferred.
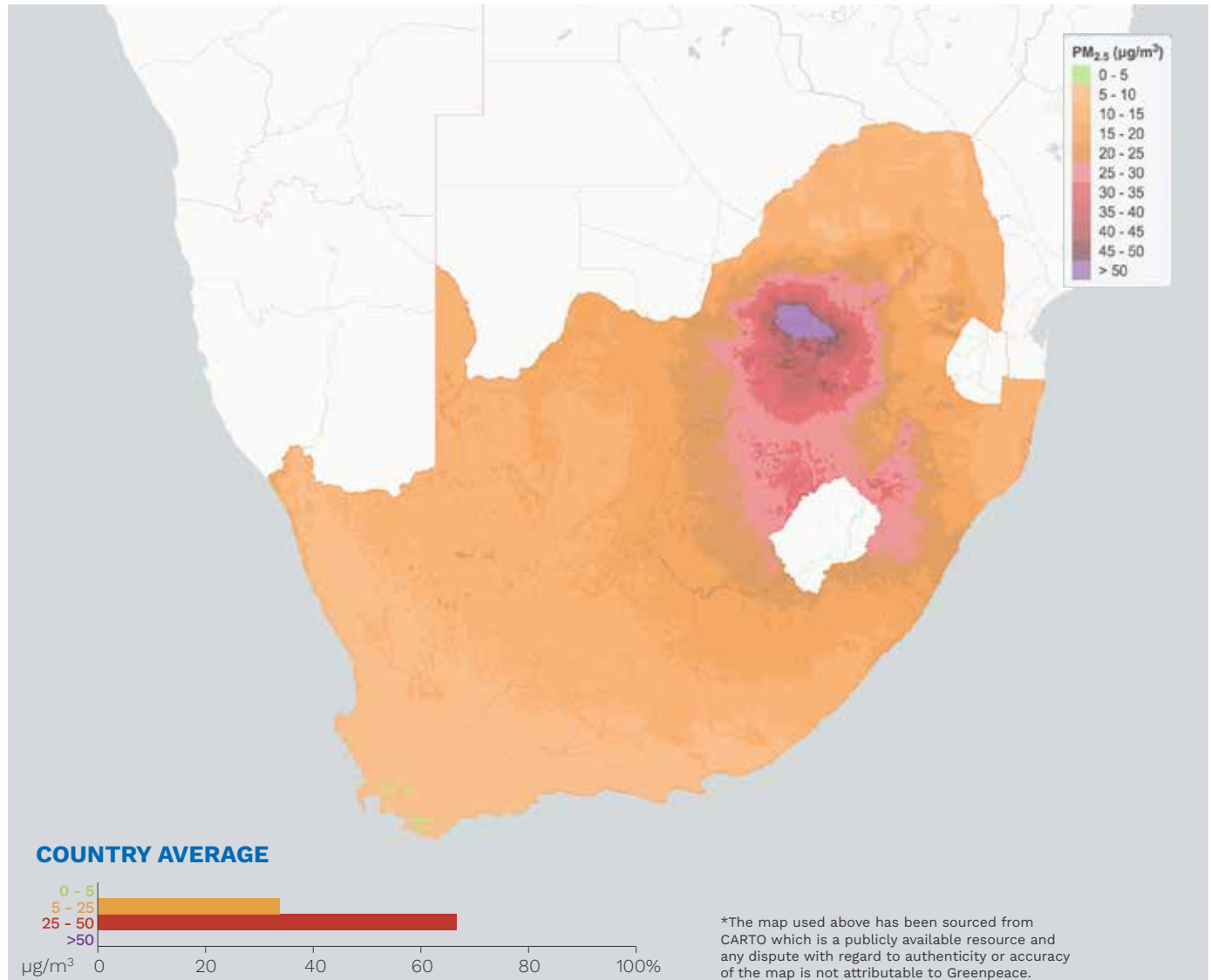
SOUTH AFRICA

SOUTH AFRICA

Map of PM$_{2.5}$ concentration in 2020

PM$_{2.5}$ (µg/m³)
- 0 – 5
- 5 – 10
- 10 – 15
- 15 – 20
- 20 – 25
- 25 – 30
- 30 – 35
- 35 – 40
- 40 – 45
- 45 – 50
- > 50

COUNTRY AVERAGE

0 – 5
5 – 25
25 – 50
>50
µg/m³   0   20   40   60   80   100%

*The map used above has been sourced from CARTO which is a publicly available resource and any dispute with regard to authenticity or accuracy of the map is not attributable to Greenpeace.

100%
of the total population in South Africa were exposed to estimated annual average PM$_{2.5}$ concentrations over 5 µg/m³, i.e. almost everyone was breathing air that doesn't meet WHO guidelines.
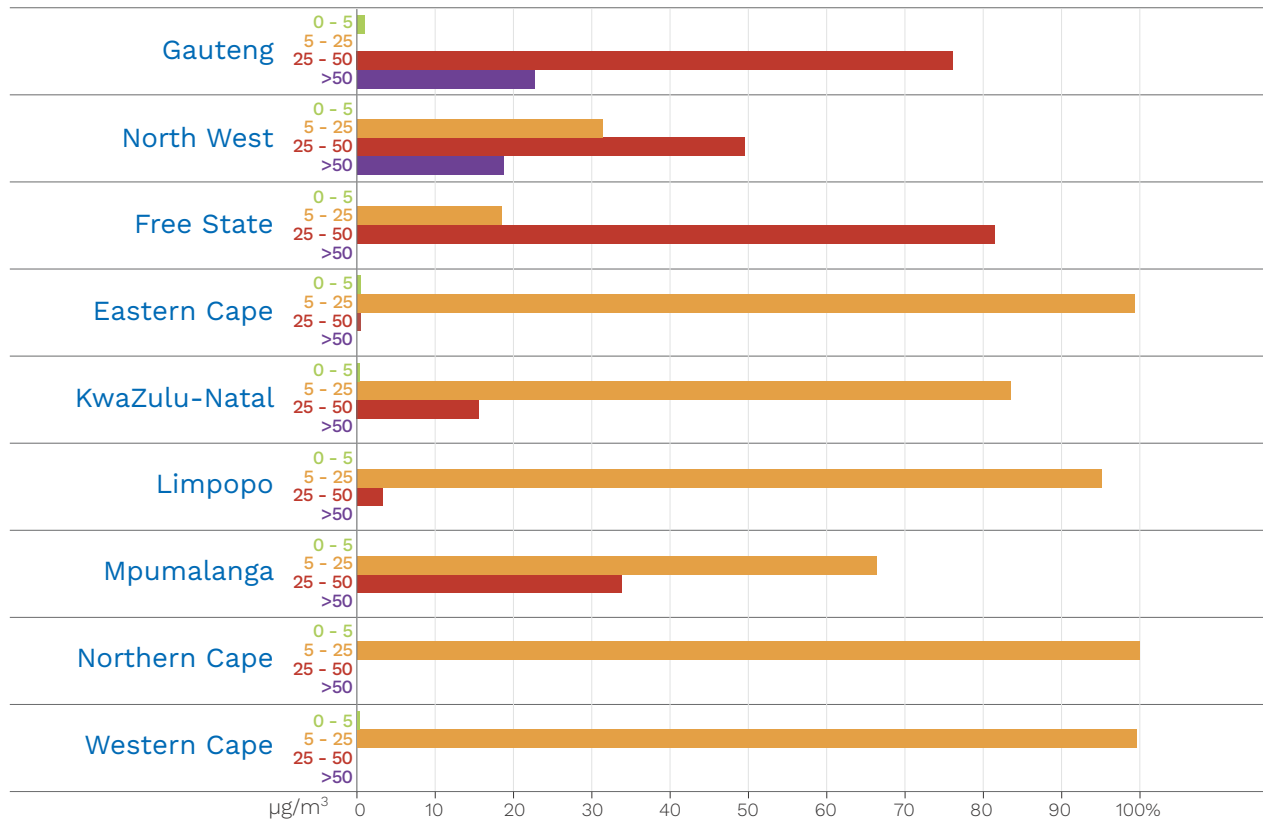
41%
of the total population were exposed to annual average PM$_{2.5}$ concentrations over 25 µg/m³

7%
of the total population were exposed to annual average PM$_{2.5}$ concentrations over 50 µg/m³

SOUTH AFRICA

Annual average PM$_{2.5}$ exposure analysis

Provinces with the highest exposure to pollution (µg/m³)

At province level, it is estimated that

almost the whole population of Gauteng

were exposed to annual average PM$_{2.5}$ concentrations over 25 µg/m³.

Furthermore, it is estimated that over

70%

of the populations of North West & Free State were exposed to annual average PM$_{2.5}$ concentrations over 25 µg/m³.

SOUTH AFRICA

Vulnerable Groups

Older adults

100%
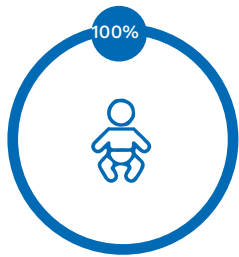of older adults in South Africa were exposed to annual average $PM_{2.5}$ concentrations over 5 μg/m^3.

It is estimated that:

36%
of older adults were exposed to annual average $PM_{2.5}$ concentrations over 25 μg/m^3

6%
of this subgroup were exposed to annual average $PM_{2.5}$ concentrations over 50 μg/m^3.

Infants

It is estimated that:

100%
of infants in South Africa were exposed to annual average $PM_{2.5}$ concentrations over 5 μg/m^3.

38%
of infants were exposed to annual average $PM_{2.5}$ concentrations over 25 μg/m^3

7%
of this subgroup were exposed to annual average $PM_{2.5}$ concentrations over 50 μg/m^3.

Pregnant people

It is estimated that:

100%
of pregnant people were exposed to annual average $PM_{2.5}$ concentrations over 5 μg/m^3.
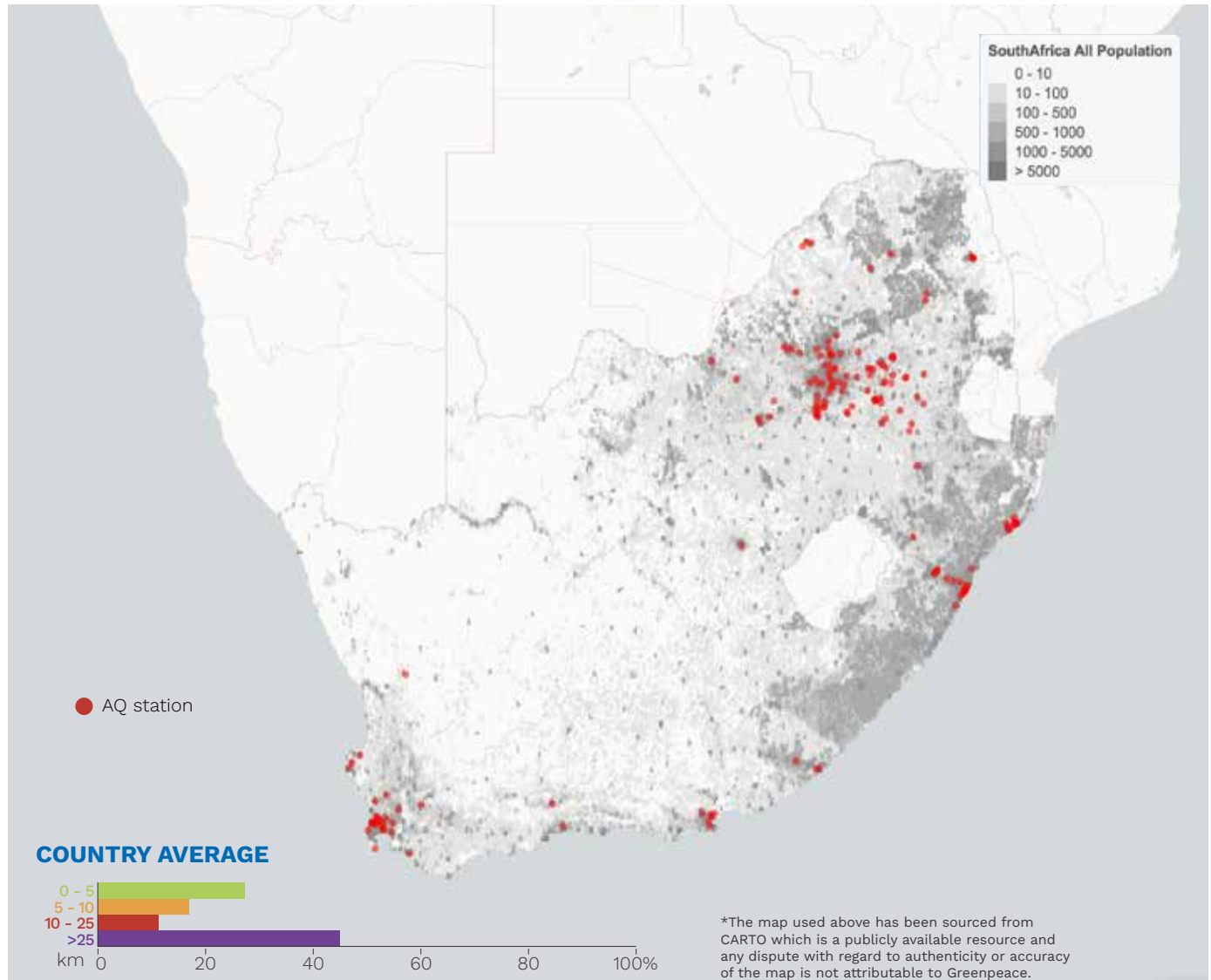
36%
of pregnant people were exposed to annual average $PM_{2.5}$ concentrations over 25 μg/m^3

6%
of this subgroup were exposed to annual average $PM_{2.5}$ concentrations over 50 μg/m^3.

SOUTH AFRICA

Map of AQ stations and population distribution

SouthAfrica All Population
0 - 10
10 - 100
100 - 500
500 - 1000
1000 - 5000
> 5000

● AQ station

COUNTRY AVERAGE

0 – 5
5 – 10
10 – 25
>25
km   0   20   40   60   80   100%

*The map used above has been sourced from CARTO which is a publicly available resource and any dispute with regard to authenticity or accuracy of the map is not attributable to Greenpeace.

AQ stations in South Africa are mainly managed by the
South Africa Air Quality Information System[60]
(SAAQIS). On the other hand, Sasol[61] also has a few air quality monitoring stations in the area of Secunda[62] that are fed into the SAAQIS system.

About
40%
of the total population do not have access to an AQ station within 25 km, worse than all of the comparator territories of Germany, Japan, the US & mainland China.
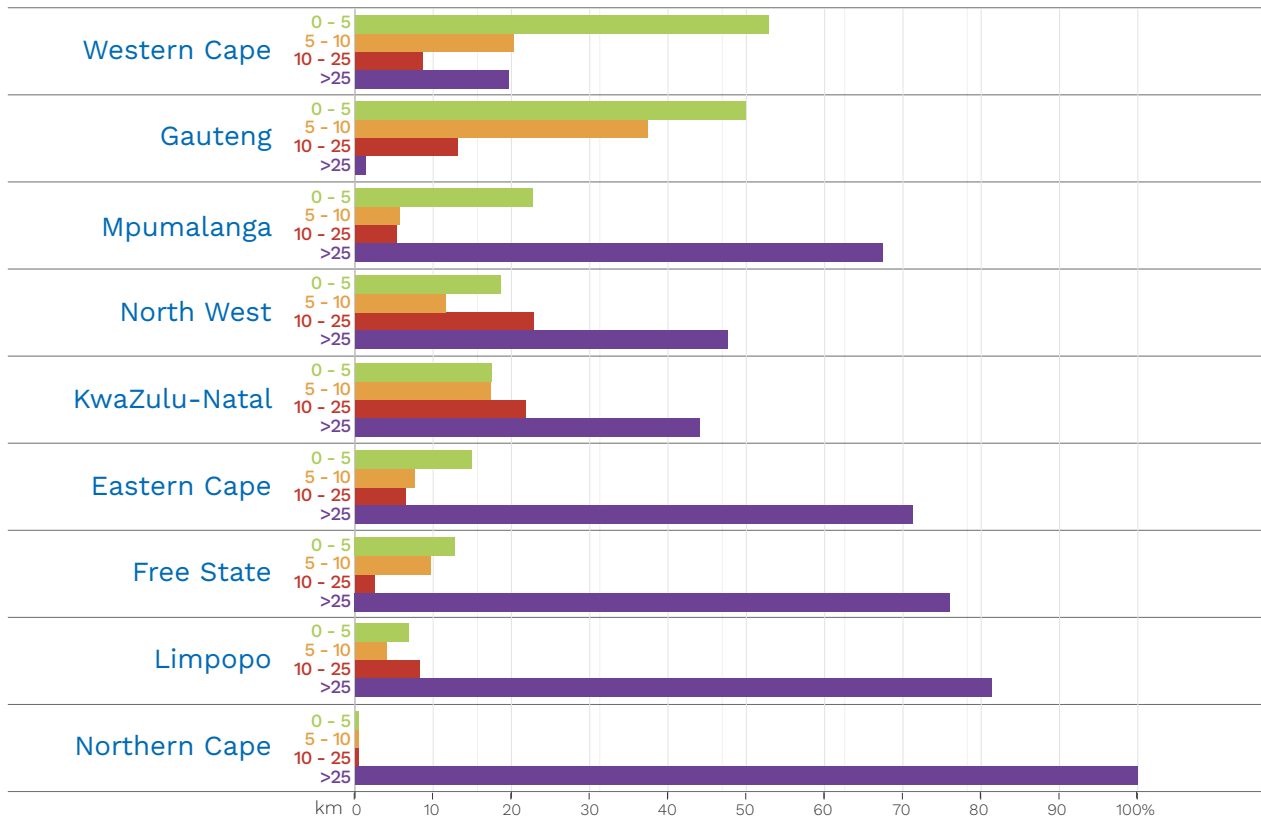
30%
of the population lives within 5 km of an AQ station, a similar figure to mainland China.

SOUTH AFRICA

AQ station accessibility analysis

Provinces with the best access to AQ stations (km)

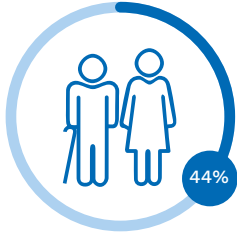Only 2 provinces, Western Cape and Gauteng, have populations where at least

50%

of people live within 5 km of an AQ station.

Almost the entire population in Northern Cape have no access to an AQ station within
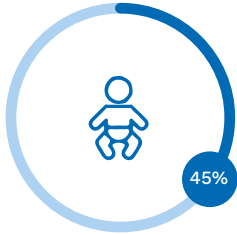
25km

SOUTH AFRICA

Vulnerable Groups

Older adults

About **44%** of older adults in South Africa have no access to an AQ station within 25 km, a slightly higher proportion than in the total population.
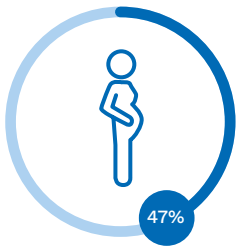
44%

Infants

About **45%** of infants in South Africa have no access to an AQ station within 25 km, a slightly higher proportion than in the total population.

45%

Pregnant People

About **47%** of pregnant people in South Africa have no access to an AQ station within 25 km, a slightly higher proportion than in the total population.

47%

Compared to total population, vulnerable groups are

less likely to live within 25 km of an AQ station. Almost all the vulnerable groups in the Northern Cape have no access to an AQ station within 25 km.

SOUTH AFRICA

Highlights

Gauteng, North West, Free State and Mpumalanga (comprising almost 50% of South Africa's population) were the four provinces with the worst exposure to PM2.5 air pollution. Over 80% of the population in Free State and over 60% in Mpumalanga do not have access to an AQ station within 25 km of where they live.

On the other hand, although Sasol has a few air quality monitoring stations in the area of Secunda in Mpumalanga, the data are not publicly available to locals.

Solutions & Actions

South Africa's Minimum Emissions Standards (MES) are regulated air quality standards that require fossil fuel polluters to adhere to standards that are not harmful to people and detrimental to the environment. However, the implementation of this regulation is the biggest challenge in the country because the government does not ensure adequate and appropriate compliance with MES. Proper monitoring, evaluation and compliance with MES standards will go a long way in ensuring that the country's air quality standards are in line with the international benchmark set by the World Health Organization to ensure a healthy standard for all.

Awareness through adequately dispersed air monitors would go a long way in ensuring that communities in South Africa are better informed when it comes to air pollution dispersion in the country. Therefore, the government ought to prioritize and make these tools available for information and for the protection of people's health and the environment.

HUMAN STORY

" *Clean air and a healthy environment are constitutional rights of every citizen.* "

FANA ISAAC SIBANYONI

is a community activist who grew up in the area near to Sasol's synfuelplant in Secunda, South Africa. He works tirelessly to challenge the authorities and the stakeholders.

I live in Embalenhle, Mpumalanga Province, South Africa, in an area that has been declared a Highveld Priority Area because of the many industries that produce power and petroleum products from coal.
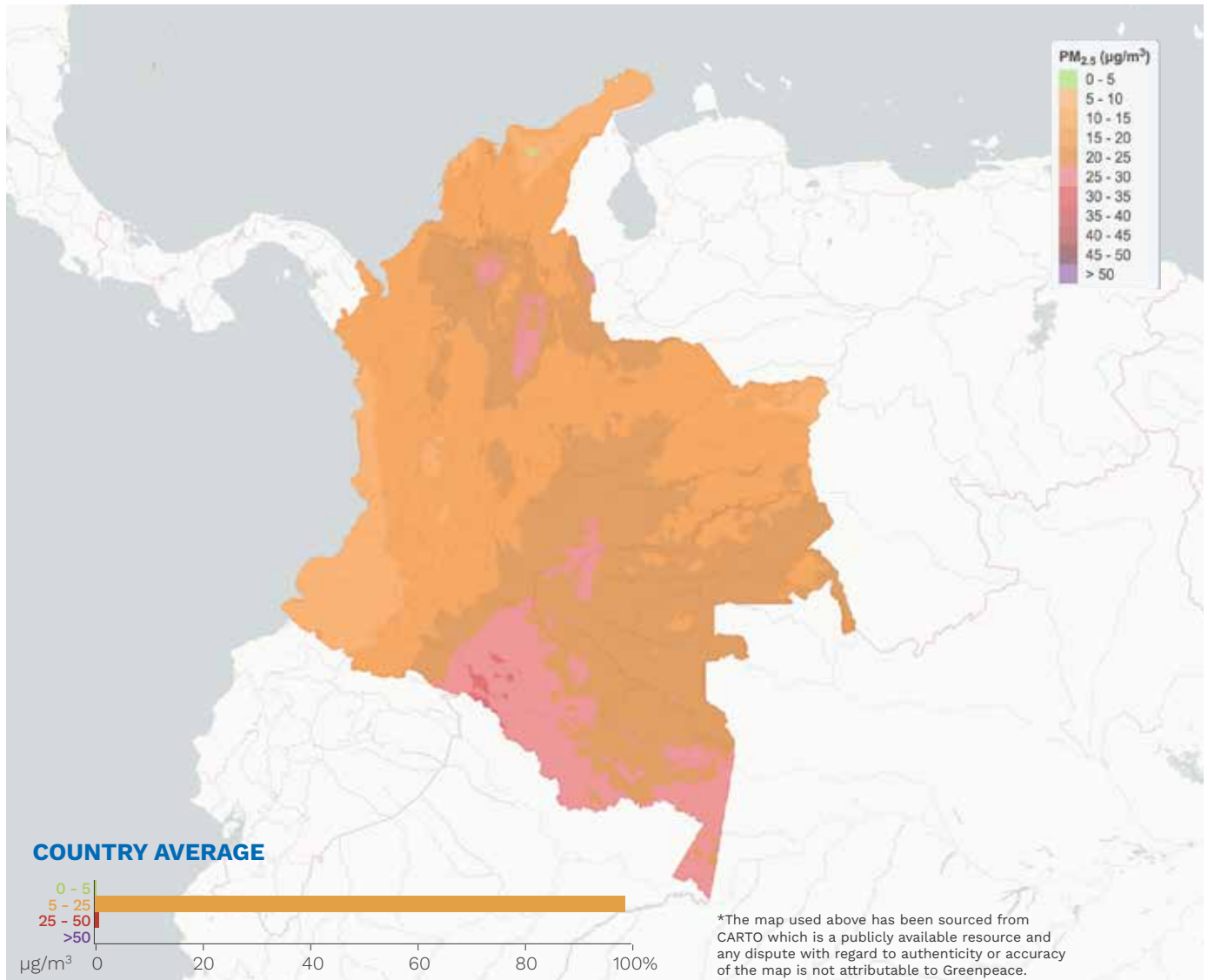
Besides these industries, several coal and gold mines in the area create waste such as fine ash and gold tailings that pollute the air and negatively impact the community during windy days, especially during the Autumn season.

There is a high unemployment rate in the area as most people living in the area usually fail the health requirements for these industries due to respiratory problems. Sadly, the government and companies don't want to invest in improving the health of people who work for them in the community. Instead, they tend to hire people from outside the area, which leads to a higher unemployment situation in the community.

As an activist, I tried to address the air quality problem in the community. Education and raising the awareness of the community are the keys to holding the government and companies accountable. Clean air and a healthy environment are constitutional rights of every citizen.

COLOMBIA

COLOMBIA

Map of PM$_{2.5}$ concentration in 2020

PM$_{2.5}$ (μg/m³)
- 0 - 5
- 5 - 10
- 10 - 15
- 15 - 20
- 20 - 25
- 25 - 30
- 30 - 35
- 35 - 40
- 40 - 45
- 45 - 50
- > 50

COUNTRY AVERAGE

0 - 5
5 - 25
25 - 50
>50

μg/m³   0   20   40   60   80   100%

*The map used above has been sourced from CARTO which is a publicly available resource and any dispute with regard to authenticity or accuracy of the map is not attributable to Greenpeace.
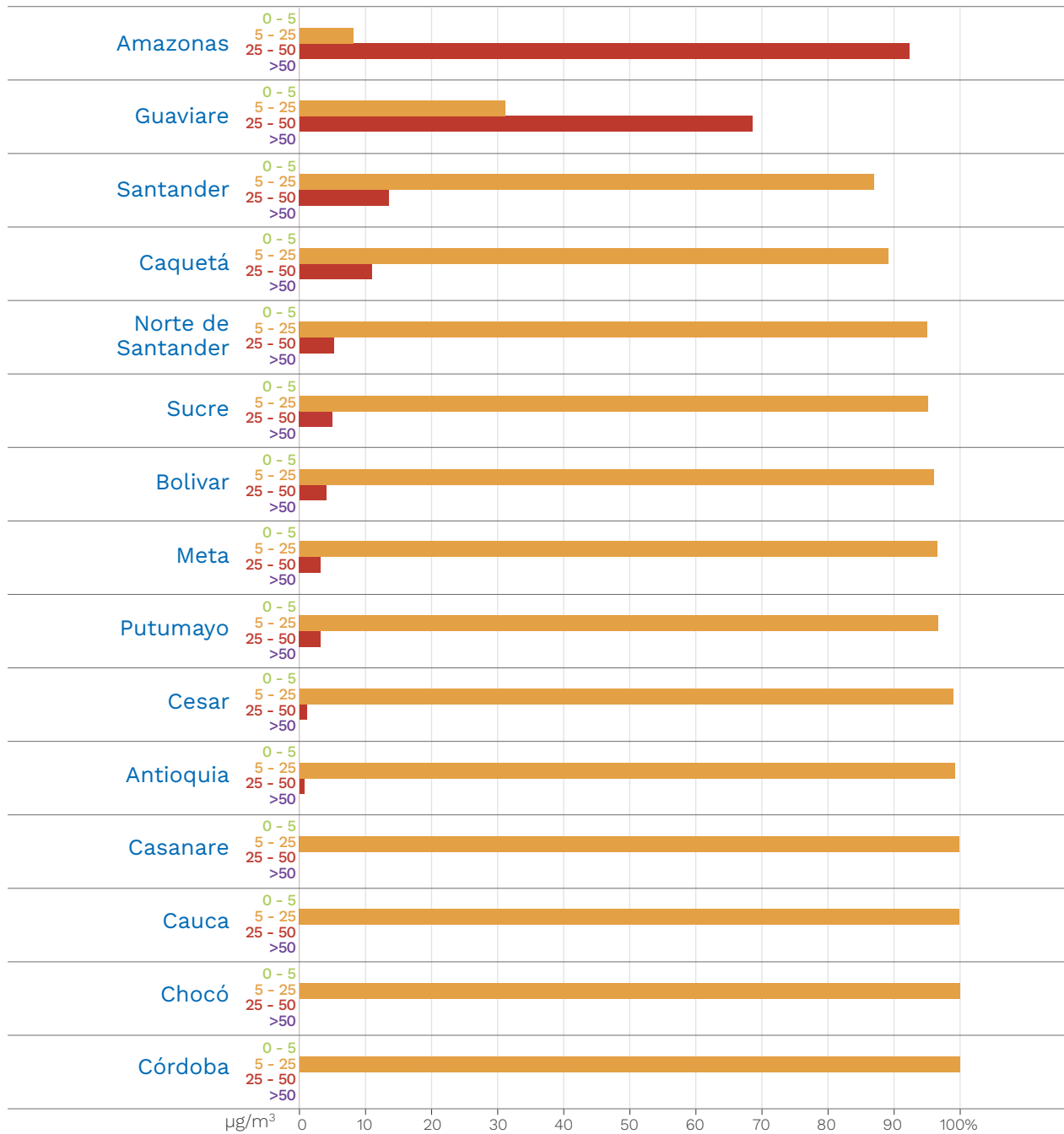
It is estimated that:

100%

of older adults were exposed to annual average PM$_{2.5}$ concentrations over 5 μg/m³.

2%

were exposed to annual average PM$_{2.5}$ concentrations over 25 μg/m³.

Annual average PM$_{2.5}$ exposure analysis

Departments with the highest exposure to pollution (µg/m^3)

It is estimated that
Amazonas and Guaviare in the south
are exposed to the worst pollution,

With over

70%

of their total population exposed to annual average PM$_{2.5}$ concentrations over 25 µg/m^3.
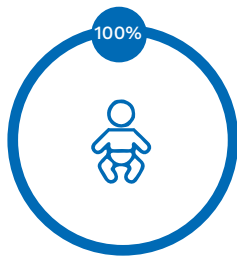
COLOMBIA

Vulnerable Groups

Older adults

It is estimated that:

100%

of older adults were exposed to annual average PM$_{2.5}$ concentrations over 5 μg/m^3.

2%

were exposed to annual average PM$_{2.5}$ concentrations over 25 μg/m^3.

Infants

It is estimated that:

100%

of infants were exposed to annual average PM$_{2.5}$ concentrations over 5 μg/m^3.

2%

were exposed to annual average PM$_{2.5}$ concentrations over 25 μg/m^3.

Pregnant People

It is estimated that:

100%

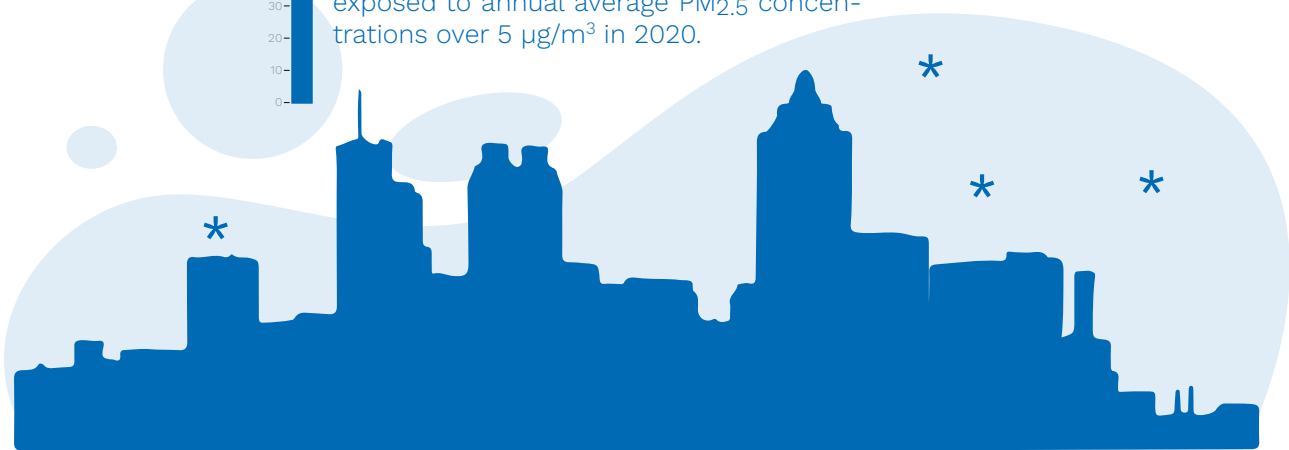of pregnant people were exposed to annual average PM$_{2.5}$ concentrations over 5 μg/m^3.

2%

were exposed to annual average PM$_{2.5}$ concentrations over 25 μg/m^3.
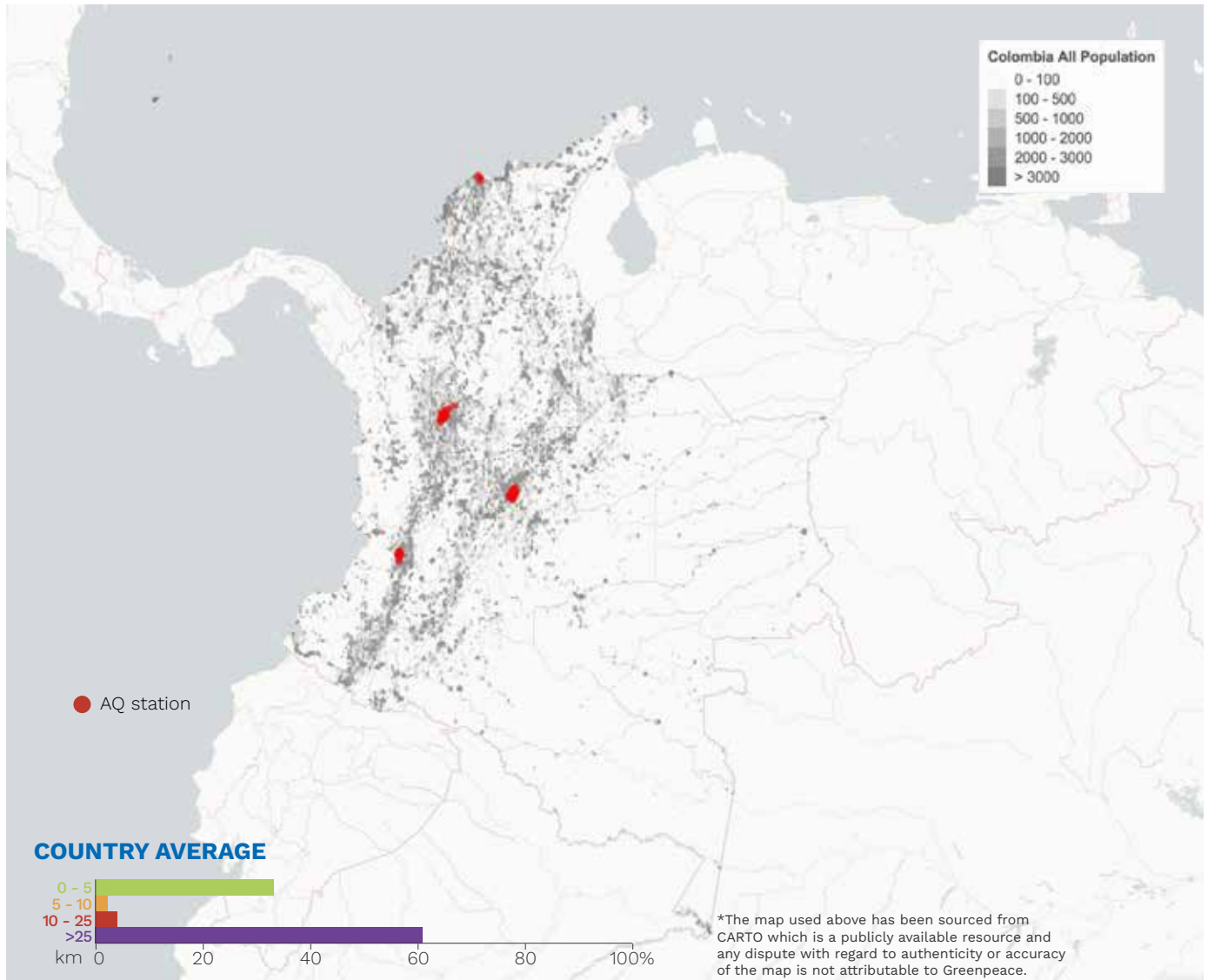
In summary, it is estimated that

100%

of vulnerable groups in Colombia were exposed to annual average PM$_{2.5}$ concentrations over 5 μg/m^3 in 2020.

COLOMBIA

Map of AQ stations and population distribution

Colombia All Population
0 - 100
100 - 500
500 - 1000
1000 - 2000
2000 - 3000
> 3000

● AQ station

COUNTRY AVERAGE

0 – 5
5 – 10
10 – 25
>25

km 0   20   40   60   80   100%

*The map used above has been sourced from CARTO which is a publicly available resource and any dispute with regard to authenticity or accuracy of the map is not attributable to Greenpeace.

0 – 5
5 – 10
10 – 25
>25

In Colombia, pollution monitoring is provided by regional authorities.[63,64,65,66]
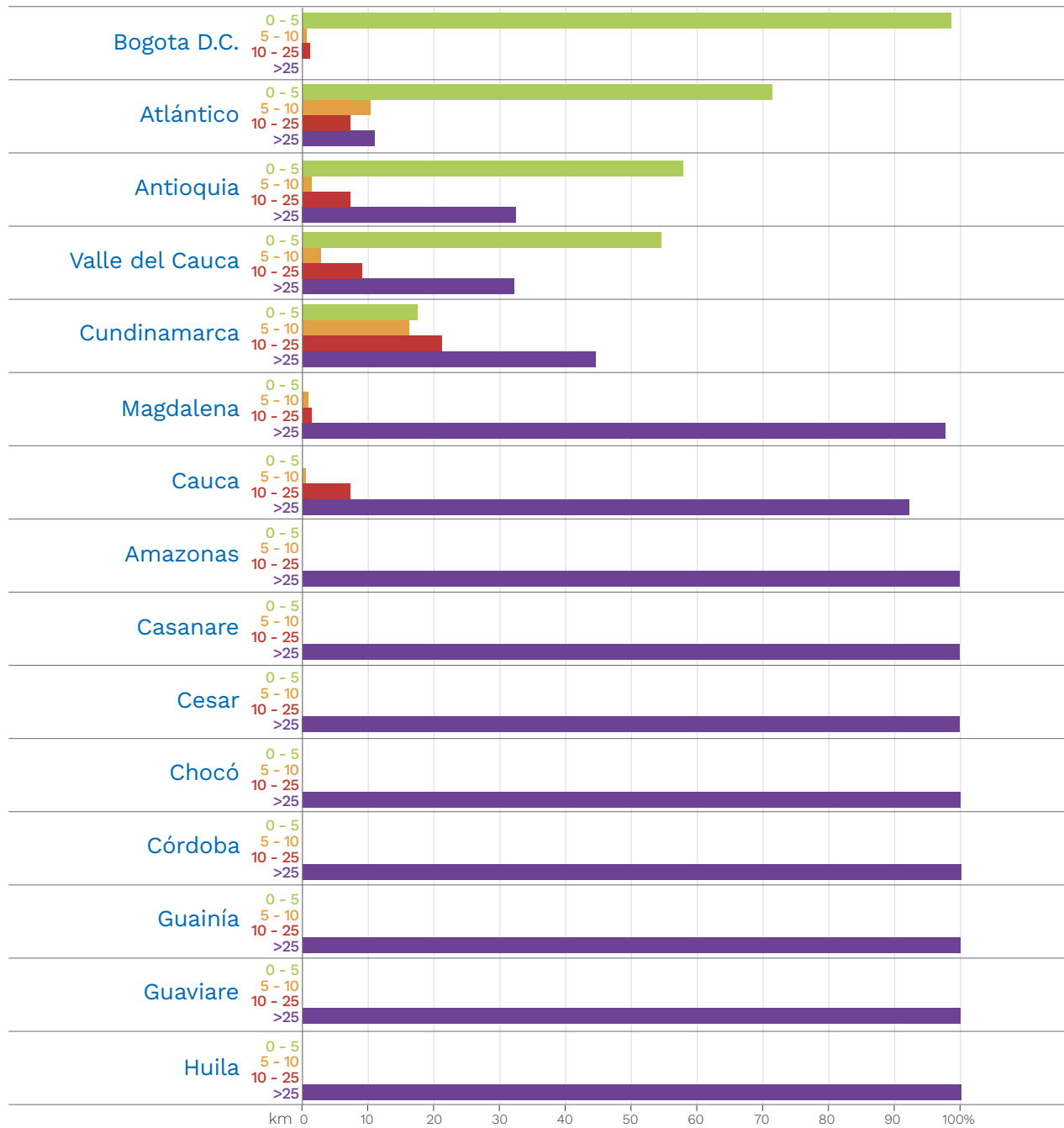
Overall, about

61%

of the total population do not have access to an AQ station within 25 km.

33%

of the population have access to AQ stations within 5 km, mainly in populated areas Bogota D.C., Atlantico, Antioquia and Valle del Cauca.

COLOMBIA

AQ Station Accessibility Analysis

Departments with the best access to AQ stations (km)

Bogota D.C.	0 – 5 / 5 – 10 / 10 – 25 / >25	
Atlántico	0 – 5 / 5 – 10 / 10 – 25 / >25	
Antioquia	0 – 5 / 5 – 10 / 10 – 25 / >25	
Valle del Cauca	0 – 5 / 5 – 10 / 10 – 25 / >25	
Cundinamarca	0 – 5 / 5 – 10 / 10 – 25 / >25	
Magdalena	0 – 5 / 5 – 10 / 10 – 25 / >25	
Cauca	0 – 5 / 5 – 10 / 10 – 25 / >25	
Amazonas	0 – 5 / 5 – 10 / 10 – 25 / >25	
Casanare	0 – 5 / 5 – 10 / 10 – 25 / >25	
Cesar	0 – 5 / 5 – 10 / 10 – 25 / >25	
Chocó	0 – 5 / 5 – 10 / 10 – 25 / >25	
Córdoba	0 – 5 / 5 – 10 / 10 – 25 / >25	
Guainía	0 – 5 / 5 – 10 / 10 – 25 / >25	
Guaviare	0 – 5 / 5 – 10 / 10 – 25 / >25	
Huila	0 – 5 / 5 – 10 / 10 – 25 / >25	

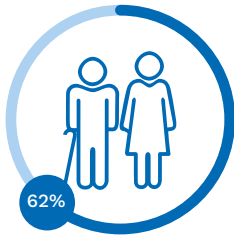km 0   10   20   30   40   50   60   70   80   90   100%

In

33

departments, only 5 of them have part of their population covered by AQ stations within 10 km.

In

78%[67]

of departments, the entire population has no access to an AQ station within 25 km, showing huge disparities.
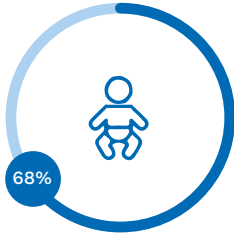
COLOMBIA

Vulnerable Groups

Older adults

About **62%** of older adults in Colombia have no access to an AQ station within 25 km.

62%

Infants

About **68%** of infants in Colombia have no access to an AQ station within 25 km. Higher than total population.

68%

Pregnant People

About **68%** of pregnant people in Colombia have no access to an AQ station within 25 km.

68%

Vulnerable groups in Colombia

tend to live in areas with poorer access to AQ stations compared to the total population.

COLOMBIA

Highlights

Nationally, a larger proportion of the population is located over 25 km from an AQ station, worse than in Germany, Japan, mainland China or the USA. In particular, departments with poor air quality lack access to AQ stations.

Solutions & Actions

Every citizen has the right to breathe clean air and to know the quality of the air they are breathing. The Colombian government must commit to improving air quality through a combination of strategies directed towards the largest emitters of fine particles (PM$_{2.5}$), including the reduction of the use of private vehicles, control of industrial sources, the promotion of low and zero emissions transportation, and road cleaning systems. These actions will help achieve good air quality in the short and long term.

HUMAN STORY

" *My family has been affected with babies having respiratory diseases such as bronchitis and colds.* "

JOHN MARIO MORENO AVELLANEDA

is a father of 4 children, two of them under 4 years of age. He lives in Bogotá.

I'm From Bogotá, Colombia. I live in the Tintal neighborhood in zone 5 of the Kennedy district, with the highest population and worst air quality in Bogotá.

My family has been affected with babies having respiratory diseases such as bronchitisand colds. We have also been financially affected by the care of the disease.

The worst experience with the effects of air pollution is that I can occasionally smell bad odors. In my neighborhood, the contamination and odors come from the sewers.

I don't have access to air quality information, I feel that 20% of the air I breathe is bad air and I would like to know the real data.

For the government, the maintenance of drainage networks and canals is the solution to this problem.

CONCLUSIONS & RECOMMENDATIONS

In general terms, this study has highlighted the extent to which human populations in many countries around the world, especially in the Global South, are likely being exposed to harmful particulate air pollution at levels in excess of the recently established health-based Air Quality Guideline set by the WHO, and in some cases exceeding that guideline by some considerable margin. Analysis of population density and AQ Station distributions has also revealed variations in pollution exposure and the availability of environmental data for different populations. Groups known to be particularly at-risk from air pollution are more likely to have been exposed to high pollutant concentrations than the population as a whole, and/or to have less access to local air quality data when compared to the total population, though this was not the case in all countries studied.

PM$_{2.5}$ Exposure

Annual average PM$_{2.5}$ concentrations and population distributions in India, Malaysia, Thailand, Philippines, Indonesia, Türkiye, South Africa and Colombia were analyzed with specific reference to infants, pregnant people and older adults.

The analysis in this report suggests that more than 99% of the population in these countries live in areas where the WHO guideline for annual average concentrations of PM$_{2.5}$ was breached. This means that almost all people were likely to be breathing air that exceeds WHO health-based guidelines with respect to PM$_{2.5}$. The country with the greatest proportion of people exposed to PM$_{2.5}$ concentrations that was more than five times the WHO annual average guideline is India, followed by Türkiye and Thailand and South Africa (Figure 5). In India, 95% were exposed to PM$_{2.5}$ concentrations over 25 μg/m^3 and 57% were exposed to PM$_{2.5}$ concentrations over ten times the WHO guideline. The WHO has previously reported that the greatest burden of disease relating to air pollution is found in low-and middle-income countries.68

Relatively small differences in exposure were detected when the at-risk groups were considered. In India, 62% of pregnant people live in the worst PM$_{2.5}$
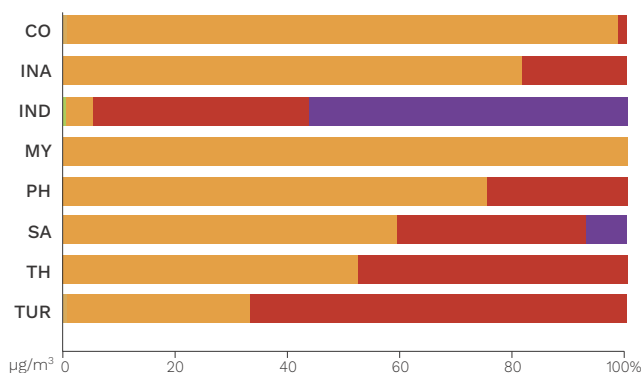
Figure 5. Proportion of total population who are exposed to annual average PM2.5 pollution of under 5 μg/m3 (Green), 5-25 μg/m3 (Orange), 25-50 μg/m3 (Red) or over 50 μg/m3 in Colombia (CO), Indonesia (INA), India (IND), Malaysia (MY), Philippines (PH), South Africa (SA), Thailand (TH) and Türkiye (TUR).

pollution category considered in this study (Annual mean PM2.5 of more than 10 times WHO guideline concentration), compared to 57% in the whole population. In Thailand, infants and older adults were more likely to live in the most polluted category. In the Philippines and South Africa, the at-risk groups were less likely to live in the most polluted category.

AQ Stations

Air quality data provide a means to understand our environment and the risks to our health that might be posed by pollution. Data can be a tool that empowers a community affected by pollution and a means for driving environmental improvements, making data access an important issue for environmental and social justice.

Some inter-regional disparities in the availability of local air pollution data are the result of practical and logistical challenges. For example, in regions which are urbanized and which have dense population centers, authorities can provide local access to air pollution observations to more people using fewer AQ Stations than in regions with widely distributed populations. Regardless, all people deserve to have access to air quality data, whether they live in a large metropolis, a small community, a wealthy nation or a lower-income country.

The analysis completed in this investigation has identified places where populations have little or no access to local air quality data and has further identified that in some cases populations groups that are known to be particularly at-risk from air pollution are more likely to live further from an AQ Station.

Except for Türkiye and Malaysia, at least 40% of the populations of the countries investigated in this research live in places that are more than 25 km from the nearest AQ station (Figure 6). In most of the countries, a significant proportion of the total population live more than 25 km from the nearest AQ station, 61% in Colombia, 70% in India, 64% in Indonesia, 45% in the Philippines, 40% in South Africa, 43% in Thailand and 20% in Malaysia, 16% in Türkiye.

In every country the proportion of pregnant people living over 25 km from an AQ station was greater than the population average (67% in Colombia, 75% in India, 67% in Indonesia, 25% in Malaysia, 53% in the Philippines, 47% in South Africa, 45% in Thailand and 26% in Türkiye). Similarly the proportion of pregnant people living within 5 km of an AQ station was smaller than in the whole population is most of the counties studied (26% in Colombia, 7% in India, 9% in Indonesia, 26% in Malaysia, 19% in the Philippines, 18% in South Africa, 27% in Thailand and 24% in Türkiye)

In some countries the proportion of infants and older adults living over 25 km from an AQ station was greater than the population average, for example this is the case in Indonesia (Total population 64%, infants 77% and older adults 79%).

CONCLUSIONS & RECOMMENDATIONS

The location of AQ stations is only part of a more complicated landscape. For example, in Türkiye, over 80% of the total population have access to an AQ Station within 25 km, however many stations do not measure $PM_{2.5}$. A historical focus on coarse particulate matter means that there is insufficient data in the country describing $PM_{2.5}$ concentrations. This makes health impact assessment difficult in Türkiye because much of our knowledge of the health risks posed by air pollution has focused on the risks posed by $PM_{2.5}$. In Indonesia, AQ station data are reported by the authorities using an air pollutant index that differs from internationally recognised indexes and does not reveal absolute pollutant concentrations.

The health impacts of air pollution are not felt equally by all in society, meaning that the potential to benefit from ready access to AQ data are largest in the most at-risk groups. Infants, pregnant people, older people and many marginalized groups are at particular risk and stand to benefit most should the air they breathe be monitored, understood and improved. This makes the availability of air pollution data not an issue of equality but one of equity, where those people most exposed to or at-risk from the hazard have the greatest need and the greatest potential benefit.
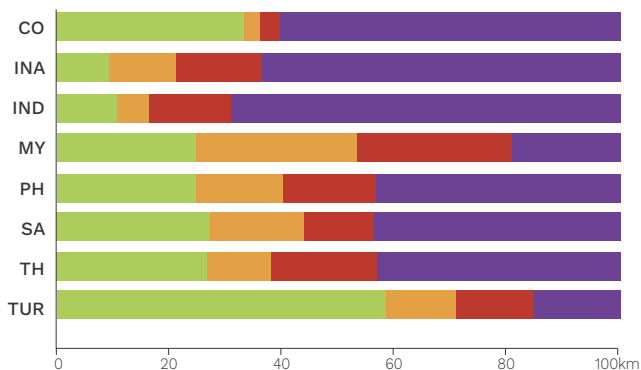
Figure 6. Proportion of total population within 5 km (Green), 5-10 km (Orange), 10-25 km (Red) or over 25 km from an AQ Station in Colombia (CO), Indonesia (INA), India (IND), Malaysia (MY), Philippines (PH), South Africa (SA), Thailand (TH) and Türkiye (TUR).

Recommendations

This report has demonstrated that exposure to air pollution is an issue of equity, and that inequalities exist in the provision of environmental data and exposure to pollution.

The most vulnerable and exposed groups would benefit most from improved air quality but are underrepresented in current research and pollution monitoring. Therefore, authorities responsible for public health must deliver equitable access to air pollution data. Prioritizing the most vulnerable populations will help ensure that the risks they face are understood and can be addressed. Air pollution monitoring networks must be developed and expanded to address this disparity.

A well-designed air quality monitoring network and mitigation interventions can support authorities in meeting air quality targets and ensuring continuous improvement in all places, for all pollutants, and for all people. The data it provides can be used, alongside consultation with citizens, to design air pollution reduction interventions that reduce health inequalities.

Authorities have an obligation to disclose air quality information to the public in order to raise public awareness, help citizens minimize their exposure and empower change that will improve environmental health. Equitable access to AQ data are critical to clean air governance.

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