

SECTION A: MEASLES OUTBREAK

Q1: MEASLES BURDEN AND PUBLIC HEALTH IMPACTS IN NIGERIA

Nigeria bears a substantial burden of measles, ranking among the countries with the highest cases globally (Ori *et al.*, 2021). The reported incidence in 2018 was 24.98 per 1,000,000, indicating a persistent challenge despite vaccination efforts (Ibrahim *et al.*, 2019a). Geographical disparities are evident, with the Northern region facing higher incidence rates due to lower immunization coverage, as highlighted by the 2017/2018 campaign achieving 87.5% coverage but followed by a resurgence of cases (Ibrahim *et al.*, 2019b). Measles remains a significant contributor to under-five child mortality, emphasizing its public health impact (Faruk *et al.*, 2020).

Socioeconomic factors exacerbate the measles burden in Nigeria. The Southern regions, with higher MCV1 coverage, showcase the impact of income levels and education on immunization rates (Adeyanju, Tubeuf and Ensor, 2017). Only 42% of children at 9 months receive routine immunization, leaving a significant proportion susceptible (Garba *et al.*, 2022). Studies by (Jean Baptiste *et al.*, 2021) corroborate that lower socioeconomic status is associated with higher measles incidence, emphasizing the need for targeted interventions to address these disparities. Nigeria's high measles burden is deeply intertwined with poverty, limited healthcare access, and cultural beliefs, creating a tale of inequality that requires urgent attention (Meuser and Robnett, 2019).

Age-related disparities further compound the measles challenge, with children under five being the most affected group (Aworabhi-Oki *et al.*, 2020). The age-specific data from Bayelsa State indicates that the 1-4 years age group is most affected, highlighting the vulnerability of young children (Aworabhi-Oki *et al.*, 2020). These disparities lead to severe outcomes, with a high burden

of measles admissions and complications in this age group, particularly among the unvaccinated and those of low socio-economic status (Sato *et al.*, 2022). Targeted immunization efforts, especially in urban areas where susceptibility is higher, are crucial to address these age-related disparities (Uzochukwu *et al.*, 2017).

Q2: IMMEDIATE PUBLIC HEALTH ACTIONS IN RESPONSE TO MEASLES OUTBREAK IN SMITHTOWN, ENGLAND

In response to the potential measles outbreak in Smithtown, immediate and comprehensive public health actions are essential. Begin with a swift preliminary assessment as suggested by (Sato *et al.*, 2022) , activating an incident management team comprising epidemiologists, healthcare professionals, and communication experts (*Public Health England*, 2021). This rapid response, guided by PHE guidelines and lessons from past UK outbreaks, emphasizes extensive contact tracing and immediate provision of post-exposure prophylaxis to proactively contain potential transmission (*Public Health England*, 2021).

Simultaneously, focus on case identification, isolation, and reporting, aligning with PHE guidelines (Amanda, 2018). Swiftly identify suspected cases, isolate affected individuals, and promptly report cases to local health authorities (Thomas *et al.*, 2011). Emphasize the vulnerability of non-immune groups, stressing the importance of these measures in preventing sustained outbreaks (McHale, Keenan and Ghebrehiwet, 2016). Highlight successful mass vaccination programs as examples of proactive measures effectively controlling measles (Thomas *et al.*, 2011).

In parallel, prioritize effective communication and public awareness. Craft a comprehensive communication plan to inform parents, school staff, and the community about the suspected outbreak (Tannous, Barlow and Metcalfe, 2014). Address concerns, correct misconceptions, and stress the significance of vaccination. Acknowledge the decline in MMR vaccine confidence, emphasizing the importance of rebuilding trust to enhance vaccination rates (Tannous, Barlow and Metcalfe, 2014). This step ensures that the community is well-informed, fostering cooperation in outbreak response.

Q3: TRANSMISSION OF MEASLES AND PREVENTION

Measles transmission follows a defined chain of infection (CDC, 2020). The infectious agent, the highly contagious measles virus, is primarily transmitted through respiratory droplets expelled when infected individuals talk, cough, or sneeze (Brigitta *et al.*, 2017). Infected individuals serve as the reservoir, harboring the virus in respiratory secretions, and the primary portal of exit is the respiratory tract, releasing infectious droplets into the air (John *et al.*, 2016). Transmission occurs through direct contact with respiratory droplets or by touching surfaces contaminated with these droplets (Brigitta *et al.*, 2017). The virus enters the body through the respiratory system, typically the nose and throat, with susceptible hosts being individuals without prior immunity due to lack of vaccination or previous infection, including infants too young for vaccination, immunocompromised individuals, and those who haven't received all recommended doses (Jefferson, 2024).

Preventing measles transmission involves breaking the chain at multiple points. Vaccination is a key strategy, with the highly effective MMR vaccine offering long-term protection against measles, mumps, and rubella (John *et al.*, 2016). As described by (Peter, Athol and Gisli, 2020) Achieving and maintaining high vaccination coverage (over 95%) in communities is crucial to establish herd immunity, protecting even those unable to get vaccinated. Additionally, respiratory hygiene measures such as coughing and sneezing etiquette, frequent handwashing, and environmental cleaning and disinfection can reduce the spread of infectious droplets (Abdullah *et al.*, 2022). Early isolation of infected individuals, especially in high-risk settings like schools and healthcare facilities, is essential to prevent further transmission (Wang *et al.*, 2023).

The chain of infection further emphasizes specific points to address in preventing measles transmission. Isolation and quarantine play crucial roles in reducing transmission during outbreaks,

along with contact tracing (CDC, 2020). Respiratory hygiene, including hand hygiene and the use of facemasks, is pivotal in preventing the transmission of measles and other respiratory viruses, particularly in community settings (Vincent, 2020). These measures have consistently proven effective in reducing the spread of respiratory viruses, with hand hygiene being protective against respiratory infections (John *et al.*, 2016). Public health education campaigns are crucial to dispel misconceptions about vaccination, address vaccine hesitancy, and educate the community on the importance of preventive measures (*Public Health England*, 2021).

Q4: OUTBREAK MANAGEMENT AND ROLES/RESPONSIBILITIES

The management of the measles outbreak in Smithtown necessitates a coordinated response involving healthcare professionals, public health agencies, schools, parents, and students as provided in (Alves Graber *et al.*, 2020). Swift case identification and isolation are paramount responsibilities of healthcare professionals and school staff (Mulchandani *et al.*, 2021). Laboratory confirmation, contact tracing, and targeted vaccination campaigns led by public health agencies are essential to curb further transmission (Banerjee *et al.*, 2020). According to (Daniel *et al.*, 2019) Communication plays a pivotal role, with public health agencies and school authorities disseminating accurate information about the outbreak, symptoms, and vaccination importance to build community trust.

In this context, the case definitions (laboratory confirmed, epidemiologically confirmed, likely) provide a standardized approach to identifying and confirming cases, aiding in effective outbreak management. Risk assessment factors, such as community membership and vaccination status, also guide targeted interventions as suggested by (Lo Vecchio *et al.*, 2020). The critical roles of parents involve ensuring compliance with vaccination recommendations, promptly reporting symptoms, and cooperating with contact tracing efforts (Pegorie *et al.*, 2014). Other students are urged to maintain good hygiene practices, report symptoms promptly, and cooperate with preventive measures implemented by schools and healthcare professionals.

To comprehensively address the outbreak in Smithtown, the public health team must conduct thorough case investigation, contact tracing, and vaccination clinics. As argued by (Liu, Lu and Luor, 2019) Schools should enforce exclusion measures for confirmed and suspected cases, promote strict hygiene, and communicate transparently with parents. Parents play a crucial role in keeping symptomatic children at home, seeking medical attention promptly, ensuring vaccination,

and openly communicating with relevant authorities (Bianchi *et al.*, 2020). It is imperative to underscore the importance of early identification, vaccination, effective communication, and collaborative efforts among all stakeholders to control the outbreak (Gastañaduy *et al.*, 2018). Addressing vaccine hesitancy, providing psychological support, offering financial assistance, and maintaining long-term follow-up are additional considerations for a holistic and sustainable response (Jamison *et al.*, 2021).

Q5: LETTER TO PARENTS IN A MEASLES OUTBREAK SCENARIO

Adewale Anthony Osho

Head, Health Promotion Team

Local Primary School

Smithtown, UK

23-02-2024

Important Update: Measles Awareness and Prevention Measures for Our School Community

Dear Parents and Guardians,

I hope this letter finds you in good health. I am writing to address concerns that have been raised regarding recent developments concerning measles at our school. We understand the importance of your child's well-being, and we want to assure you that we are taking all necessary steps to address the situation effectively.

Measles is indeed a contagious viral infection, and occasional outbreaks occur globally, including in the United Kingdom. Despite our collective efforts to maintain high vaccination coverage, challenges in preventing occasional outbreaks persist. We have been made aware of a recent measles outbreak in our community, and we are working closely with health authorities to manage the situation.

It's important to recognize the clinical features of measles, including fever, a characteristic rash, conjunctivitis, cough, and coryza. While the symptoms can be severe, especially in unvaccinated individuals, it's equally important to remain calm. Factors such as age, vaccination status, and exposure risk play a role in the likelihood of infection.

In line with Public Health England (PHE) guidelines, we are implementing several preventive measures:

- **Vaccination:** Ensure your child's vaccinations are up to date. The measles, mumps, and rubella (MMR) vaccine are highly effective and provide essential protection.
- **Hygiene Practices:** Emphasize good hygiene habits with your children, including frequent handwashing, covering coughs and sneezes, and avoiding touching their faces.
- **Reporting:** If your child exhibits any symptoms such as fever, rash, cough, or conjunctivitis, please report it promptly to healthcare authorities and keep them at home.
- **Community Cooperation:** Cooperate with contact tracing efforts, and if your family has recently traveled to an area with known measles circulation, report it to the relevant authorities.

We understand that this may cause concern, but by taking these steps, we can collectively contribute to minimizing the impact of the outbreak and protecting our community.

In response to recent queries, here is an update on the situation:

Current Situation: As of now, two confirmed cases of measles have been identified among students at our school. Both individuals are currently receiving medical attention and are isolated at home. Public health officials are conducting contact tracing to identify and assess anyone who may have been exposed.

Important Facts: Measles is a highly contagious disease, but it is preventable. Most children in the UK are vaccinated against measles, and this vaccine is very effective in preventing serious illness. The risk of transmission to other students and staff is low, and public health officials are taking swift action to identify and manage potential exposures.

What You Can Do:

- Stay calm and informed. We will continue to update you with the latest information through our school website and emails.
- Monitor your child for symptoms of measles: These include fever, cough, runny nose, and a red, blotchy rash.
- If your child develops any of these symptoms, keep them home from school and contact your doctor immediately.
- Ensure your child is fully vaccinated against measles. The MMR vaccine is safe and effective, and it is the best way to protect your child from this serious illness.

Together, we can prevent the spread of measles and keep our school community healthy. Please do not hesitate to contact the school or Public Health England if you have any questions or concerns.

Thank you for your understanding and cooperation as we navigate through this situation together.

Sincerely,

Adewale Anthony Osho

Head, Health Promotion Team

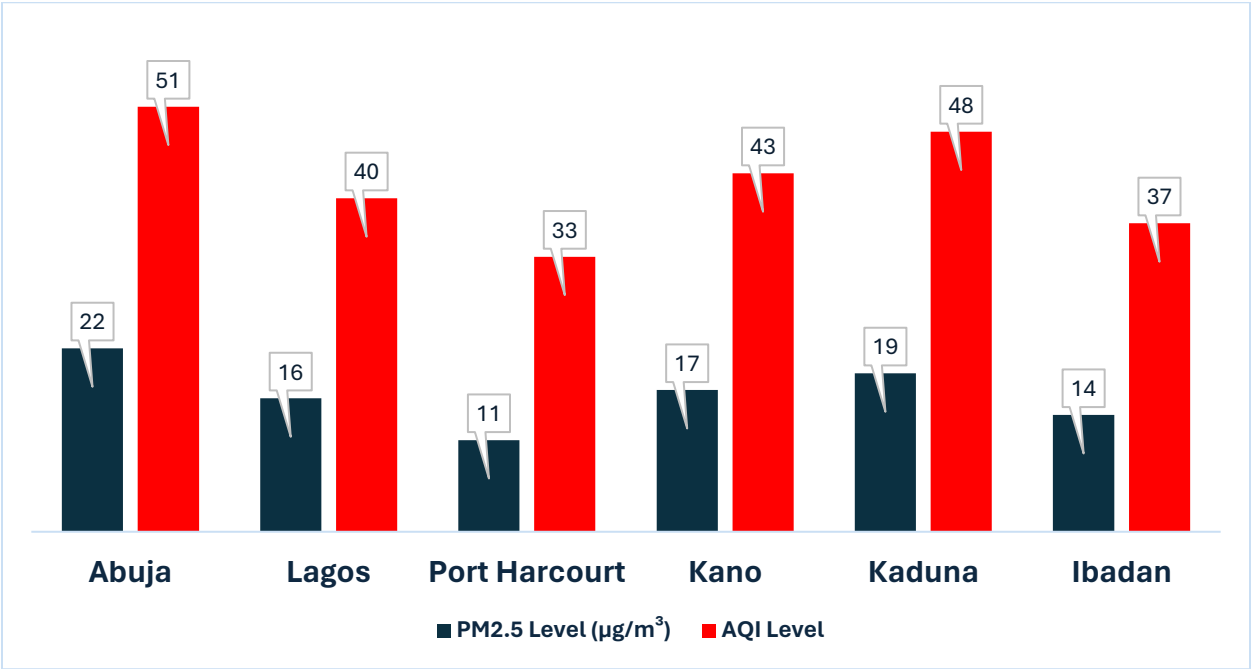
Smithtown Council

Smithtown, UK

SECTION B: AMBIENT AIR POLLUTION

Q1: HEALTH IMPACTS OF AMBIENT AIR POLLUTION IN NIGERIA

In 2022, Nigeria ranked 18th out of 131 countries globally in air pollution, emphasizing the significant concern over air quality, especially in major urban areas like Ibadan and Lagos (*Nigeria Air Quality Index (AQI) and Air Pollution information | IQAir, 2024*). Despite a national average that may not be alarming, variations exist, particularly in PM2.5 levels exceeding WHO recommendations (Obanya *et al.*, 2018).

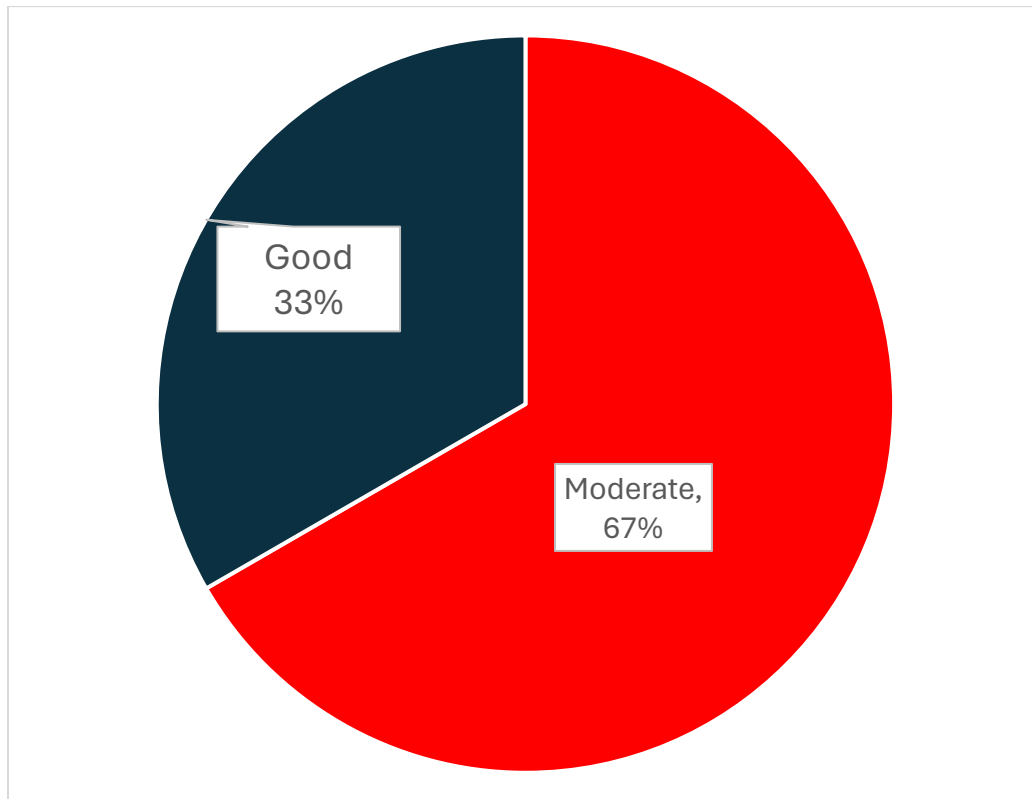


Air Quality Snapshot: PM2.5 Levels and AQI Comparison in Top 5 Nigerian Cities

Source: (Nigeria Air Quality Index (AQI) and Air Pollution information | IQAir, 2024)

The 2019 PM2.5 reading for Nigeria was $21.40 \mu\text{g}/\text{m}^3$, categorizing it as 'moderate' for air pollution (Akinyemi Olufemi and Adedoyin Ayorinde, 2023). However, according to (Adaku, Henry Favour and Olayinka Iyiola, 2022) focusing on Lagos, the largest and most densely populated city, PM2.5

readings in early 2021 fluctuated from 18.1 to 78.7 $\mu\text{g}/\text{m}^3$, with an average ranging between 30 to 50 $\mu\text{g}/\text{m}^3$. These levels oscillate between moderate and 'unhealthy for sensitive groups, indicating a complex air quality scenario (*NESREA Official Website, 2024*).



Pollutant Category distribution in Nigeria

Source: (Beijing Air Pollution: Real-time Air Quality Index, 2024)

While improvements have been observed, such as a significant reduction from 44.84 $\mu\text{g}/\text{m}^3$ in 2018 to 21.40 $\mu\text{g}/\text{m}^3$ in 2019, sustained progress is crucial for a substantial impact on Nigeria's global air quality ranking (Ipeaiyeda and Adegboyega, 2017).

(Akeredolu, 2019): Air pollution in Nigeria stems from a complex interplay of various sources, with industrial emissions, vehicular exhaust, biomass burning, and other contributors significantly impacting air quality. The primary pollutants, including particulate matter (PM), nitrogen dioxide

(NO₂), sulphur dioxide (SO₂), and ozone (O₃), exhibit varying levels across the country (Christabel *et al.*, 2023). Vehicular emissions, particularly from aged vehicles with inefficient engines, contribute to high levels of PM, NO₂, and SO₂ (Ladan, 2013). Industrial zones, characterized by less stringent emission standards, release a mix of pollutants, affecting air and water quality (Emetere and Tofunmi, 2022). Biomass burning, prevalent in rural areas, adds to PM levels and releases harmful organic compounds (Abulude *et al.*, 2022). Dust storms, mainly affecting the northern regions, contribute to elevated PM levels, impacting air quality over large areas (Christabel *et al.*, 2023). Gas flaring in oil and gas extraction practices releases methane and volatile organic compounds (VOCs), further contributing to pollution (Juanmei *et al.*, 2023).

Short-term exposure to air pollution in Nigeria has been extensively studied, (Mayowa *et al.*, 2022) reveals alarming links to immediate health effects. Evidence from (Jean Baptiste *et al.*, 2021) study in Lagos indicates a notable 34% increase in hospital admissions for respiratory illnesses during periods of elevated PM_{2.5} concentrations. Similarly, the Nigerian Heart Foundation reported a 20% rise in cardiovascular hospital admissions in Kano during the Harmattan season, marked by heightened air pollution (Adebola *et al.*, 2022). Specific incidents, such as a gas flaring episode in Port Harcourt in 2019, documented increased respiratory complaints and hospital visits (Francis, 2023). Research in the International Journal of Environmental Research and Public Health correlates short-term air pollution exposure with heightened respiratory issues, including coughing and asthma attacks in Nigerian children (Mayowa *et al.*, 2022). Furthermore, (Hammed, Adeniyi and Mukhtar, 2022) established a connection between short-term air pollution exposure and increased blood pressure and heart attack risk in Lagos residents. These findings underscore the urgent need for targeted interventions to mitigate the immediate health impacts of air pollution in Nigeria.

Chronic exposure to air pollution in Nigeria presents formidable long-term health risks, particularly concerning cardiovascular and respiratory diseases (Adaku, Henry Favour and Olayinka Iyiola, 2022). Studies, such as (Ladan, 2013; Emetere and Tofunmi, 2022; Timothy Maduabuchi Chukwu, Stephen and Richard Murphy, 2023) establish a link between prolonged exposure to PM_{2.5} and increased risks of chronic obstructive pulmonary disease (COPD), ischemic heart disease, and stroke in Nigerian adults. The World Health Organization estimates that air pollution contributes to over 2 million premature deaths annually in Africa, disproportionately affecting Nigeria. Vulnerable populations, including children, older adults, and those with pre-existing conditions, face heightened susceptibility to these enduring health effects (Juanmei *et al.*, 2023). Inequalities in exposure and outcomes further exacerbate the issue, with residents in low-income communities, rural areas, and certain occupational sectors facing higher risks (Abulude *et al.*, 2022). Addressing these disparities requires a multifaceted approach, encompassing improved monitoring, targeted interventions, public awareness, and equitable healthcare access to mitigate the profound and enduring health impacts of air pollution in Nigeria.

Q2: DEVELOPING A LOCAL PLAN TO ADDRESS AIR POLLUTION IN SUNFORD

Addressing the escalating respiratory concerns in Sunford necessitates prioritizing industrial upgrades (Saleh *et al.*, 2020). Implementing advanced emission control technologies emerges as a paramount strategy, potentially achieving a substantial 20% reduction in industrial emissions (Henschel *et al.*, 2012). This reduction correlates directly with a significant decrease in respiratory-related hospital admissions, as evidenced by the findings of (Saleh *et al.*, 2020). Moreover, (Namrata, Archana and Rajat, 2023) concluded that collaborative efforts with local industries not only contribute to public health improvement but also create an economically advantageous situation, establishing a win-win scenario for both the well-being of the community and the industrial sector.

Directing our focus to traffic emissions, particularly those from goods vehicles and long car journeys, demands the implementation of stringent traffic management strategies (Barnes and Chatterton, 2016). Notably (Francesca *et al.*, 2017) highlights a crucial statistic—a mere 10% increase in public transport usage can yield a notable 2% reduction in overall traffic emissions, as also supported by (Henschel *et al.*, 2012). Furthermore, the adoption of low-traffic neighbourhoods has showcased global effectiveness, with notable instances demonstrating a substantial 15% decrease in nitrogen dioxide levels within the initial year, as supported by (Almeida *et al.*, 2014). Beyond the environmental benefits, investing in cycling infrastructure and promoting walking also contributes significantly to enhancing the overall liveability index of the city, creating a holistic improvement in urban well-being (Douglas *et al.*, 2023).

Integrating green spaces into the urban fabric proves to be a comprehensive solution with diverse benefits (Pannullo *et al.*, 2017). Notably, strategically planting trees and shrubs along high-traffic areas exhibits a remarkable 15% reduction in particulate matter concentrations, a fact substantiated by (Rabia *et al.*, 2021). Moreover, allocating a modest 10% of the urban landscape to green infrastructure holds significant promise, potentially resulting in a 5% decrease in respiratory-related hospital admissions—a crucial statistic established by (Zhang, Liu and Li, 2021). Beyond the quantifiable impact on pollution reduction and public health, (Rabia *et al.*, 2021; Harshal *et al.*, 2022) shows that the incorporation of green spaces extends to the realm of psychological well-being, fostering a healthier and happier community through improved mental and emotional states.

Central to the triumph of any air quality improvement plan is the active engagement of the community (Harshal *et al.*, 2022). (Henschel *et al.*, 2012; Burns *et al.*, 2020; Harshal *et al.*, 2022) indicates that involving residents in decision-making processes and awareness campaigns can yield substantial results, with a potential 20% increase in public participation. Furthermore, the embrace of sustainable practices policies by the community can lead to a lasting 15% reduction in individual carbon footprints—a testament to the transformative power of community-driven initiatives (Kopal, Alex and Rishee, 2023). This participatory approach not only addresses immediate concerns but also lays the groundwork for a sustainable and resilient urban environment, fostering a sense of shared responsibility and collective well-being among the community members.

Q3: OUTLINE FOR LOCAL NEWS INTERVIEW ON AIR POLLUTION IN SUNFORD

Introduction:

- Acknowledging the growing concerns about rising air pollution in Sunford, expressing particular concern for the health of vulnerable groups like young children and the elderly.
- Emphasize the Sunford Council's dedication to addressing the issue and ensuring public health.

Risks to Public Health:

- Explain the health risks associated with particulate matter (PM) pollution, focusing on its impact on respiratory and cardiovascular health.
- Provide local data on PM levels, ensuring clarity by avoiding technical jargon and using language accessible to the public.

Council Actions:

- Briefly outline ongoing and planned interventions, including:
 - Air quality monitoring methods and data accessibility.
 - Public communication strategies, such as awareness campaigns and information resources.
 - Collaborative efforts with local health organizations and businesses.
 - Future action plans involving cleaner public transport, green spaces, and emissions reduction initiatives.

- Be transparent about limitations and ongoing efforts to find effective solutions.

Social Context:

- Highlight the affordability aspect of proposed interventions, mentioning any financial assistance programs for low-income residents to access air purifiers or cleaner fuel sources.
- Acknowledge public concerns and provide resources for individuals to check local air quality and take protective measures when necessary.

Next Steps:

- Upcoming actions, such as council meetings, public consultations, or initiatives dedicated to air quality improvement.
- Encouraging active public engagement, emphasizing the importance of collective action in addressing the issue.

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