SECTION A: MEASLES OUTBREAK

Q1: MEASLES BURDEN AND PUBLIC HEALTH IMPACTS IN NIGERIA

Nigeria has one of the highest measles incidences globally (Ori *et al*., 2021). The 2018 incidence was 24.98 per 1,000,000, indicating a persistent challenge despite vaccination efforts (Ibrahim *et al*., 2019a). There are clear geographical disparities, with the Northern region experiencing higher incidence rates due to lower immunization coverage, as demonstrated by the 2017/2018 campaign, which achieved 87.5% coverage but then saw a resurgence (Ibrahim *et al*., 2019b). In addition to contributing to under-five child mortality (Faruk *et al*., 2020), measles continues to have a significant public health impact.

The Southern regions of Nigeria, where MCV1 coverage is higher, illustrate the impact of income level and education on immunization rates (Adeyanju, Tubeuf and Ensor, 2017). Only 42% of children receive routine immunization at 9 months, leaving a significant proportion susceptible (Garba *et al*., 2022). (Jean Baptiste *et al*., 2021) confirm that measles incidence is higher in areas with lower socioeconomic status, emphasizing the need for targeted interventions.

In addition, age-related disparities make measles more challenging for children under five (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). A high burden of unhealthy admissions and complications is associated with these disparities, particularly among the unvaccinated and the low socio-economic status in this age group (Sato *et al*., 2022).

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

There must be immediate and comprehensive public health measures taken to prevent a measles outbreak in Smithtown. As suggested by (Sato *et al*., 2022), initiate a rapid preliminary assessment and form an incident management team with epidemiologists, healthcare professionals, and communication experts (Public Health England, 2021). As a result of lessons learned from past outbreaks in the UK, PHE emphasizes extensive contact tracing and immediate post-exposure prophylaxis to prevent potential transmission (Public Health England 2021).

In accordance with PHE guidelines, focus on identifying, isolating, and reporting cases simultaneously (Amanda, 2018). It is important to identify suspected cases immediately, isolate affected individuals, and notify local health authorities promptly (Thomas *et al*., 2011). Highlight the vulnerability of non-immune groups as shown by (McHale, Keenan and Ghebrehiwet, 2016) and emphasize the importance of these measures in preventing sustained outbreaks. Vaccination programs are effective proactive measures in controlling measles (Thomas *et al*., 2011).

Create a comprehensive communication plan to inform parents, school staff, and the community about the suspected outbreak in parallel. Address concerns, correct misconceptions, and emphasize vaccination's importance (Tannous, Barlow and Metcalfe, 2014). (Tannous, Barlow and Metcalfe, 2014) noticed that there is a decline in confidence in the MMR vaccine which must be acknowledged, while also emphasizing the need to rebuild trust with the immediate public in order to increase vaccination rates as a result of this step, the community is well-informed, which promotes cooperation during outbreaks.

Q3: TRANSMISSION OF MEASLES AND PREVENTION

The highly contagious measles virus is transmitted primarily through respiratory droplets expelled when people talk, cough, or sneeze (CDC, 2020). As the virus is harbored in respiratory secretions by infected individuals, the respiratory tract is the primary conduit through which it exits, releasing infectious droplets into the air (John *et al*., 2016). Direct contact with respiratory droplets or touching surfaces contaminated with these droplets results in transmission (Brigitta *et al*., 2017). As a result of lack of vaccination or previous infections, individuals without prior immunity are susceptible to the virus. Vaccines are not effective for infants too young for vaccination, immunocompromised individuals, or those who have not received all recommended doses (Jefferson, 2024).

Vaccination is one way to prevent measles transmission. MMR vaccine offers long-term protection against measles, mumps, and rubella (John *et al*., 2016). According to (Peter, Athol & Gisli, 2020), high vaccination coverage in communities (over 95%) is critical for establishing herd immunity, protecting even the unvaccinated. Additionally, respiratory hygiene measures such as coughing and sneezing etiquette, frequent handwashing, and environment cleaning and disinfection can reduce the spread of infectious droplets (Abdullah *et al*., 2022). To prevent further transmission, it is essential to isolate infected individuals early, especially in schools and healthcare facilities (Wang *et al*., 2023).

The CDC 2020 report stresses isolation and quarantine as essential to preventing measles transmission. To prevent measles and other respiratory viruses, respiratory hygiene is key (Vincent, 2020). These measures are consistently effective in reducing the spread of respiratory viruses, with hand hygiene being protective against respiratory infections (John *et al*., 2016). Public health

campaigns must be conducted on vaccinations, vaccine hesitancy, and preventive measures to dispel misconceptions and address vaccine hesitancy (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 by (Alves Graber *et al.*, 2020). Swift case identification and isolation are paramount responsibilities of healthcare professionals and school staff (Mulchandani *et al.*, 2021). To curb further transmission, public health agencies should conduct laboratory confirmation, contact tracing, and vaccination campaigns. School authorities and public health agencies play a key role in communicating information about these outbreaks, symptoms, and vaccination importance to build community trust (Daniel *et al*., 2019).

In this context, the case definitions (laboratory confirmed, epidemiologically confirmed, likely) provide a standardized approach to identifying and confirming cases, allowing effective outbreak management. According to (Lo Vecchio *et al*., 2020), community membership and vaccination status also guide targeted interventions. In addition to ensuring vaccination compliance, parents must report symptoms promptly and cooperate with contact tracing efforts (Pegorie et al., 2014).

An exhaustive case investigation, contact tracing, and vaccination clinics will be necessary to address the outbreak in Smithtown. Schools should enforce exclusions for confirmed and suspected cases, promote strict hygiene, and communicate transparently with parents, according to (Liu, Lu, and Luor, 2019). Children with symptoms should be kept at home, sought medical attention promptly, vaccinated, and communicated openly with authorities (Bianchi *et al*., 2020).

To control the outbreak, it is imperative to emphasize the importance of early identification, vaccinations, effective communication, and collaborative efforts among all stakeholders. (Jamison *et al*., 2021): In addition to vaccine hesitancy, psychological support, financial assistance, and long-term follow-up are other step and measure necessary for the management of measles outbreak.

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. This letter is to address concerns raised regarding recent developments at our school related to measles. Our team understands the importance of your child's well-being, and we are taking all necessary steps to address the situation.

We are aware of a recent measles outbreak in our community, and we are working closely with health authorities to manage the situation. Measles is indeed a contagious viral infection, and occasional outbreaks occur worldwide, including the United Kingdom.

There are several clinical features of measles, including fever, rash, conjunctivitis, cough, and coryza. It is equally important to stay calm, even if the symptoms are severe, especially in unvaccinated individuals. Risk factors include age, vaccination status, and exposure.

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: Children in the UK are vaccinated against measles, which is highly contagious. The vaccine is very effective in preventing serious illnesses. Public health officials are taking swift action to identify and manage potential exposures, and transmission risks are low.

What You Can Do:

- 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 health support or Public Health England with numbers attached to this letter if you have any questions or concerns.

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

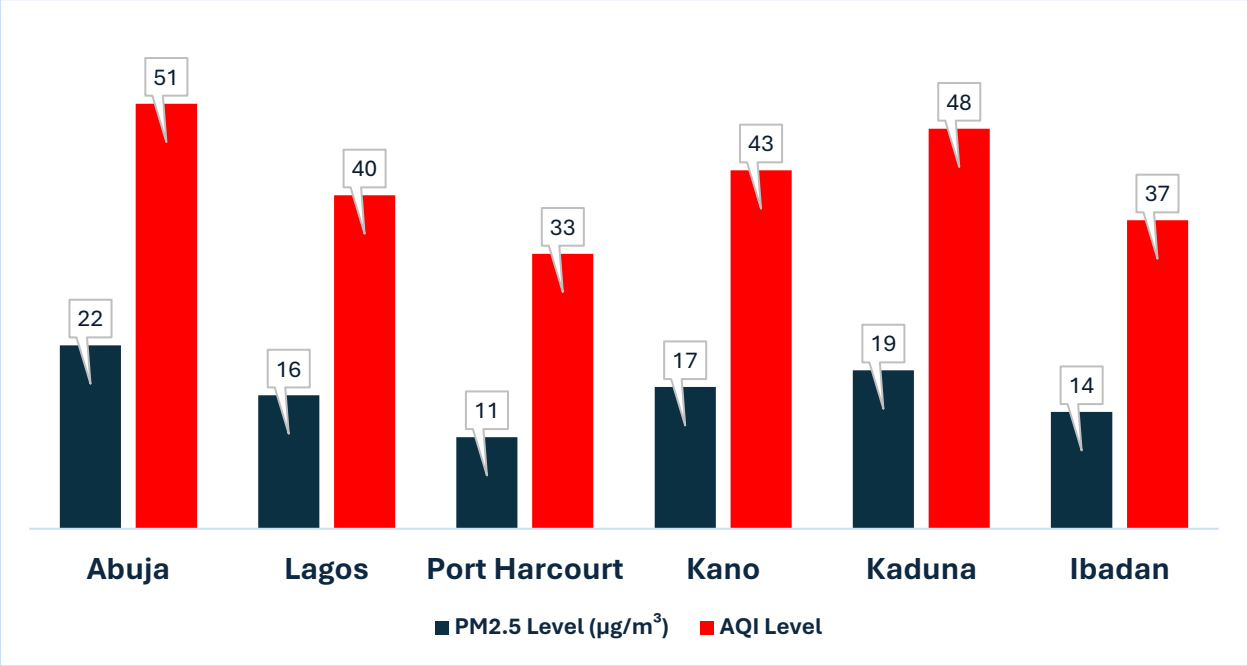
Sincerely,

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

According to the (*Nigeria Air Quality Index (AQI) and Air Pollution information | IQAir, 2024*), Nigeria ranked 18th out of 131 countries in 2022 when it came to air pollution, emphasizing the importance of air quality, especially in major urban areas like Ibadan and Lagos. Despite a national average that may not be alarming, there are significant variations, particularly in PM2.5 levels that exceed WHO guidelines (Obanya et al., 2018).

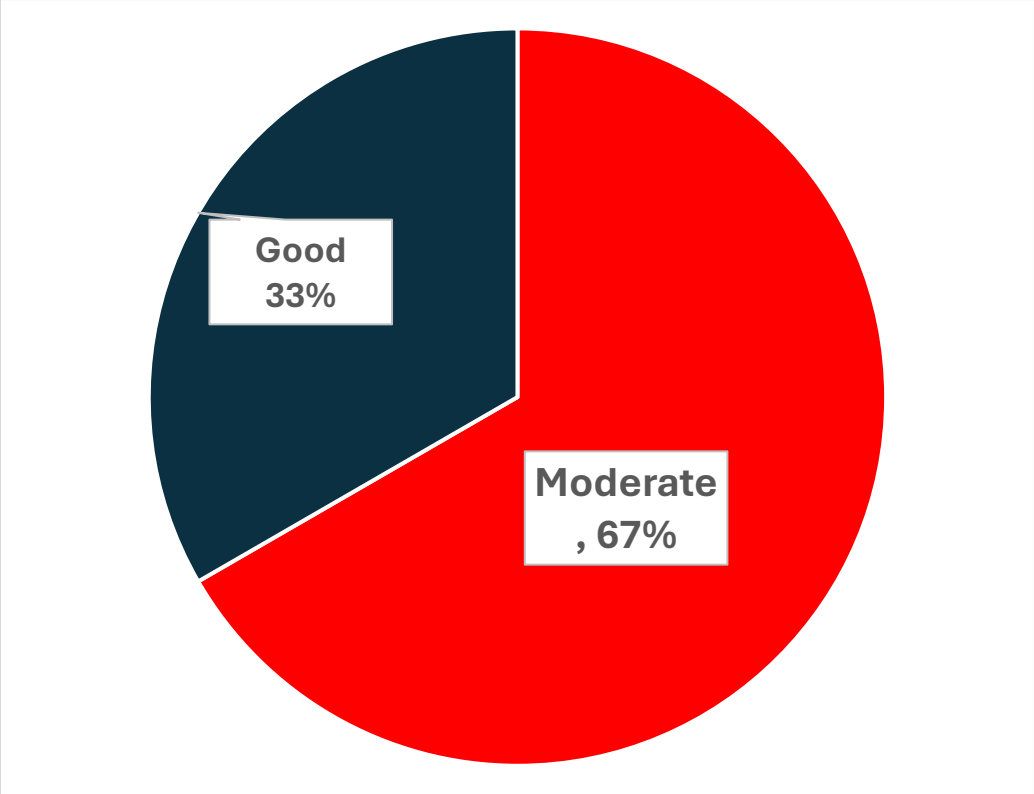


Air Quality Snapshot: PM2.5 Levels and AQI Comparison in Top 5 Nigerian Cities

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

The 2019 PM2.5 reading for Nigeria was 21.40 µg/m³, 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 µg/m³, with an average ranging between 30 to 50 µg/m³. As a result, the air quality oscillates between moderate and 'unhealthy for sensitive groups', indicating a complex air quality scenario (NESREA Official Website, 2022).



Pollutant Category distribution in Nigeria

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

Despite improvements, such as reducing 44.84 g/m3 in 2018 to 21.40 g/m3 in 2019, sustained progress is necessary to improve Nigeria's global air quality rankings (Ipeaiyeda and Adegboyega, 2017).

Akeredolu (2019): Air pollution in Nigeria is caused by a complex interplay of various sources, including industrial emissions, vehicular exhaust, biomass burning, and others. There are varying levels of primary pollutants, including particulate matter, nitrogen dioxide, sulfur dioxide, and

ozone (Christabel *et al*., 2023). Vehicular emissions, particularly from aged vehicles with inefficient engines, contribute to high levels of PM, NO2, and SO2 (Ladan, 2013). As a result of a lack of strict emission standards, a mix of pollutants is released into the air and water of industrial zones (Emetere and Tofunmi, 2022). In rural areas, biomass burning contributes to PM levels and releases harmful organic compounds (Abulude *et al*., 2022). As a result of dust storms, which most affect northern areas, elevated PM levels result in poor air quality (Christabel *et al*., 20223). Oil and gas extraction practices release methane and volatile organic compounds (VOCs), which contribute 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 PM2.5 concentrations. In Kano, the Nigerian Heart Foundation reported an increase in cardiovascular hospital admissions of 20% during Harmattan season, when air pollution is elevated (Adebola *et al*., 2022). As a result of gas flaring in Port Harcourt in 2019, respiratory complaints and hospital visits increased (Francis, 2023). According to a study published in the International Journal of Environmental Research and Public Health, children who are exposed to short-term air pollution develop respiratory problems, including coughing and asthma attacks (Mayowa *et al*., 2022). A connection has also been established between short-term air pollution exposure and elevated blood pressure and heart attack risk in Lagos residents (Hammed, Adeniyi and Mukhtar, 2022). Considering these findings, targeted interventions are urgently needed in Nigeria to mitigate the immediate health effects of air pollution.

There are formidable long-term health risks associated with air pollution in Nigeria, especially in the areas of cardiovascular and respiratory disease (Adaku, Henry Favour, and Olayinka Iyiola,

2022). In Nigerian adults, prolonged exposure to PM2.5 can increase the risk of chronic obstructive pulmonary disease (COPD), ischemic heart disease, and stroke (Ladan, 2013; Emetere and Tofunmi, 2022; Timothy Maduabuchi Chukwu, Stephen and Richard Murphy, 2023). Nigeria is disproportionately affected by air pollution, which contributes to over 2 million premature deaths each year in Africa, according to the World Health Organization. Children, older adults, and those with pre-existing conditions (Juanmei et al., 2023) are at greater risk of these enduring health effects. Low-income communities, rural areas, and certain occupations are more likely to be affected by this issue due to inequalities in exposure and outcomes (Abulude et al., 2022). To mitigate air pollution's profound and enduring health impacts in Nigeria, a multifaceted approach is required, including improved monitoring, targeted interventions, public awareness, and equitable healthcare access.

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

To address Sunford's increasing respiratory concerns, industrial upgrades need to be prioritized. Because of implementing advanced emission control technologies industrial emissions can be drastically reduced by 20% (Henschel *et al*., 2012). A decrease in respiratory-related hospital admissions correlates directly with this reduction, as shown by (Saleh *et al*., 2020). Further, (Namrata, Archana and Rajat, 2023) determined that collaboration with local industries can improve public health as well as create an economically beneficial situation, establishing a win-win situation for the industrial sector and the community at large.

To reduce traffic emissions, particularly those caused by goods vehicles and long car journeys, strict traffic management strategies are needed (Barnes and Chatterton, 2016). According to (Francesa *et al*., 2017), a 10% increase in public transportation usage can result in a 2% reduction in traffic emissions, as outlined in (Henschel *et al*., 2012). According to (Almeida *et al*., 2014), implementation of low-traffic neighbourhoods has proved to be highly effective worldwide, with notable instances demonstrating a substantial 15% reduction in nitrogen dioxide levels within a year. Aside from the environmental benefits of cycling infrastructure, promoting walking contributes strongly to the overall livability index of a city, improving urban well-being holistically (Douglas *et al*., 2022).

Adding green spaces to urban fabric provides a comprehensive solution that offers a variety of benefits (Pannullo *et al*., 2017). According to (Rabia *et al*., 2021), strategically planting trees and shrubs along high-traffic areas results in a 15% reduction in particulate matter concentrations. Furthermore, by allocating 10% of the urban landscape to green infrastructure, (Zhang, Liu, and Li, 2021) found that respiratory-related hospital admissions can be reduced by 5%. Beyond the quantifiable impact on pollution reduction and public health, (Rabia *et al*., 2021; Harshal *et al*., 2022) indicates that incorporating green spaces improves psychological well-being, improving mental and emotional health and well-being in communities.

It is essential that the community is actively engaged in any air quality improvement plan. Involving residents in decision-making processes and awareness campaigns can result in substantial improvements, with a 20% increase in public participation (Henschel et al., 2012; Burns et al., 2020; Harshal et al., 2022). It has also been shown by (Kopal, Alex and Rishee, 2023) study that community-driven initiatives can result in a 15% reduction in individual carbon footprints by adopting sustainable practices policies— a testament to their transformative power.

By fostering a sense of shared responsibility among community members and collective well-being, this participatory approach not only addresses immediate concerns but also prepares the groundwork for a sustainable and resilient urban environment.

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

Introduction:

- Expressing particular concern for the health of vulnerable groups such as young children and the elderly as a result of rising air pollution in Sunford.
- Stress Sunford Council's commitment to addressing the problem and ensuring public health.

Risks to Public Health:

- Provide an overview of particulate matter (PM) pollution's 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:

- Outline in brief the types of interventions that are currently underway and those that are planned, including:

    - Identifying monitoring methods and ensuring data access for the monitoring of air quality.
    - Communication strategies for the public, such as awareness campaigns and information resources, can be very effective.
    - Involvement of local health organizations and businesses in collaborative efforts.
    - A future action plan involving cleaner public transportation, green spaces, and initiatives to reduce emissions.
- The limitations of the problem and the ongoing efforts to find an effective solution.

Social Context:

- Describe any financial assistance programs for low-income residents to access air purifiers or cleaner fuel sources as part of proposed interventions.
- Provide resources for individuals to check local air quality and take protective measures, when necessary, in response to public concerns.

Next Steps:

- Upcoming events, such as council meetings, public consultations, and air quality improvement initiatives.
- Promoting active public engagement, emphasizing collective action as the best way to address the problem.

Conclusion:

- Reaffirm that the Council is actively working towards an environmentally cleaner and healthier future.
- Offer a message of hope, expressing optimism for a future in which collaborative efforts improve air quality significantly.

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