Summary brief **JUNE 2021**

High levels of antimicrobial resistant bacteria in the air we breathe in Accra: the urgent need to strengthen surveillance[1]

[1]Azaglo GSK, *et al*. Bacteria and their antibiotic resistance profiles in ambient air in Accra, Ghana, February 2020: a cross-sectional study. Tropical Medicine and Infectious Disease 2021; 6: 110. https://doi.org/10.3390/tropicalmed6030110

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Coarse particles (PM_{10}): particulate matter whose size is 10 microns or less

Key Messages

- There is growing evidence that bacteria in ambient air may be a public health threat, and yet there is no published information on this subject in Ghana. Our study, therefore, aimed to assess meteorological characteristics, the presence of bacteria and their antimicrobial resistance (AMR) profiles in ambient air from 12 sites (roadside, industrial and residential) in Accra, Ghana.
- Pathogenic bacteria were identified in all sites, with 50% showing resistance to commonly used antibiotics in Ghana. There was a strong association between air pollution levels and airborne bacterial counts, with roadside sites being the most highly affected.
- These are preliminary findings which strongly suggest the need to sustain surveillance of ambient air antimicrobial resistance in the current sites in Accra and expand to additional urban areas in Ghana.

What is the problem and why is it important?

A number of pathogenic bacteria (e.g., *E. coli*, *streptococci* species, and *staphylococci* species) can affect human health through the inhalation of ambient air. The survival of bacteria in air is influenced by meteorological factors and air pollutants, such as particulate matter. There is growing evidence that urban air is being contaminated by antibiotic resistant genes, and ambient air may therefore be a vehicle that can facilitate the spread of AMR.

Despite a few studies from other countries, there is no published information from Ghana about airborne bacteria or their antibiotic resistance profiles in ambient air. Clean air, however, is a public good. Indeed, no other resource exhibits the same degree of publicness. If water is polluted, we can filter or treat it. However, we have no choice but to breathe the air around us.

How did we measure it?

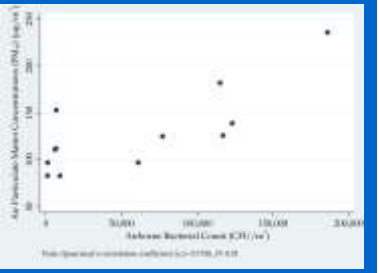
We conducted this study in Accra, Ghana, in February 2020. We selected 12 active air quality monitoring sites monitored by the Environmental Protection Agency (seven roadside, two industrial and three residential). From each site, we took a single air sample and measured meteorological characteristics, including particulate matter (PM_{10}), a course particle with

aerodynamic size of less than 10 microns, and the presence of selected bacteria and their antibiotic resistance profiles.

What did we find?

- Roadside sites had the highest temperature, relative humidity, wind speeds and PM_{10} concentrations as well as the highest airborne bacteria counts compared with the industrial and residential sites.
- Pathogenic bacteria were identified in all sites, with 50% of the bacteria showing mono- or multi-drug resistance to four commonly used antibiotics in Ghana (penicillin, ampicillin, ciprofloxacin and ceftriaxone).
- There was a strong correlation between PM_{10} concentrations and airborne bacteria counts (Figure 1).

Figure 1: Association between airborne bacterial counts and PM_{10} concentrations in ambient air in Accra



Implications

- These preliminary findings strongly suggest the need to improve the routine surveillance of ambient air for bacteria and their antimicrobial resistance profiles and particularly to expand to additional urban areas in Ghana.

- Air pollution is associated with higher bacterial counts making ambient air potentially harmful for both humans and animals. This particularly applies to roadside sites which have the highest air pollution levels. The Government of Ghana needs to escalate efforts to address air pollution levels, particularly in relation to traffic and roadside vendors in urban areas.

- Our study suggests that there is a risk of transmission through ambient air and a public health threat of spreading antimicrobial resistance. The Environmental Protection Agency (EPA), the Centre for Scientific and Industrial Research (CSIR) and academic institutions need to support additional research to better understand the reasons why pathogenic bacteria are present in ambient air and the optimal ways to reduce or eliminate them or protect ourselves from them.