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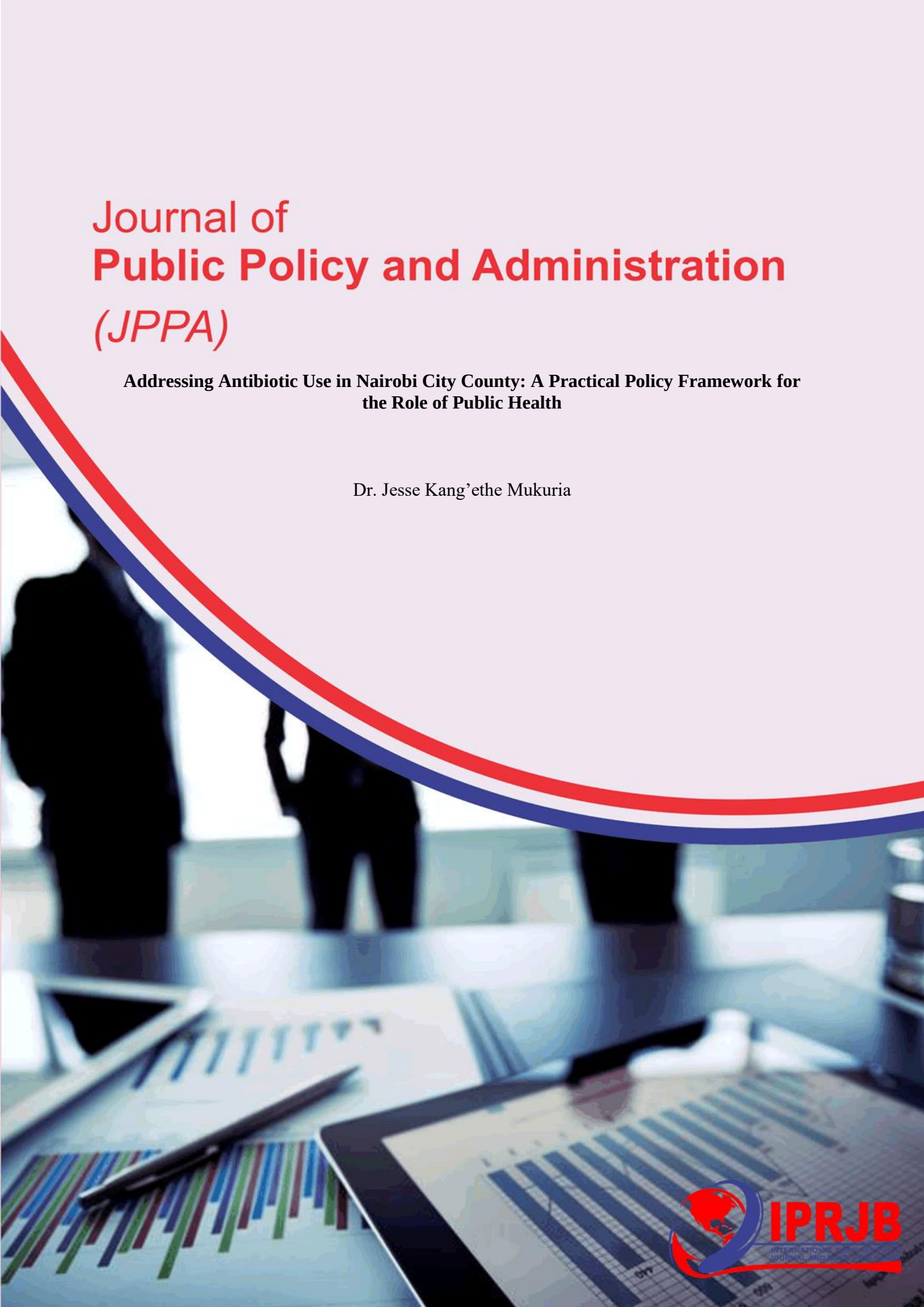
Addressing Antibiotic Use in Nairobi City County: A Practical Policy Framework for the Role of Public Health

Dr. Jesse Kang'ethe Mukuria



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Abstract

Purpose: This policy paper provides a practical framework for the role of public health in addressing antibiotic use in Nairobi City County.

Methodology: This study adopts a descriptive, analytical, and comparative policy research design, combining secondary data analysis with a public health systems perspective. The approach is intentionally policy-oriented, focusing on synthesizing existing evidence to inform practical and preventive interventions rather than generating new clinical or laboratory data.

Findings: Findings from research demonstrates that cleaner cities experience lower infection rates and reduced dependence on antibiotics. In contrast, poor urban hygiene and environmental health conditions create settings in which infections recur frequently, normalizing repeated antibiotic use among households. In Nairobi City County, respiratory diseases are among the leading causes of outpatient visits and mortality, reflecting the combined effects of population density, air pollution, and uneven access to basic services. This persistent burden places sustained pressure on health facilities and households, often resulting in frequent antibiotic use as a routine response to illness rather than a targeted clinical intervention. Furthermore, comparative analysis shows that clean developed cities exhibit substantially lower burdens of both communicable and non-communicable respiratory, gastrointestinal, and skin infections**,** reflecting strong sanitation systems, clean urban environments, effective air quality control, and robust preventive public health infrastructure. Nairobi City County registers the highest burden, reflecting dense population, air pollution, informal settlements, sanitation gaps, and waste management challenges typical of large urban centres.

Unique Contribution to Theory, Practice and Policy: The policy paper recommends regular and well-managed water-based street and public-space cleaning to remove dust, organic waste, faecal matter, food residue, and other contaminants from streets, markets, transport hubs, and pedestrian areas. This reduces the environmental load of pathogens and airborne particulates lowering the incidence of respiratory, gastrointestinal, and skin infections which are the key drivers of antibiotic use in urban populations.

Keywords: *Public Health, Policy Framework, Antibiotic Use, Nairobi City County*

JEL Codes: *118, 118, 112, H75*

INTRODUCTION

Antibiotics are a cornerstone of modern medicine and play a critical role in the treatment of bacterial infections. However, their effectiveness is increasingly threatened by overuse and misuse, particularly in urban settings where public health and environmental conditions heighten exposure to infectious diseases. In Kenya—and especially in Nairobi City County—rising antibiotic consumption reflects not only clinical practice patterns but also deeper structural challenges in urban public health.

Nairobi's rapid urbanization has produced conditions marked by high population density, traffic congestion, air pollution, informal settlements, and uneven access to clean water, sanitation, and waste management services. These conditions contribute significantly to the burden of respiratory, gastrointestinal, and skin infections, which are among the most common reasons for outpatient visits and self-medication. In many cases, antibiotics are used as a first-line response to illness, often without laboratory confirmation and sometimes without prescription.

Reports and surveillance data from international organizations, including the World Health Organization (WHO) and global AMR surveillance platforms shows that cleaner cities experience lower infection rates and reduced dependence on antibiotics, while poor urban hygiene and environmental health lead to recurrent infections and normalized antibiotic use. This trend is particularly concerning because many respiratory and diarrhoeal illnesses are viral or environmentally induced, meaning antibiotics offer little or no therapeutic benefit. The public health consequence is the rapid emergence and spread of antimicrobial resistance (AMR), which increases healthcare costs, prolongs illness, and raises the risk of preventable deaths. The objective of this policy paper is to provide a practical framework for the role of public health in addressing antibiotic use in Nairobi City County.

METHODOLOGY

Study Design

This study adopts a descriptive, analytical, and comparative policy research design, combining secondary data analysis with a public health systems perspective. The approach is intentionally policy-oriented, focusing on synthesizing existing evidence to inform practical and preventive interventions rather than generating new clinical or laboratory data.

Data Sources

The analysis draws exclusively on secondary data and published evidence, including:

- National and county-level health statistics from the Government of Kenya and Nairobi City County.
- Peer-reviewed studies on disease burden, antibiotic prescribing patterns, inappropriate antibiotic use, and antimicrobial resistance in Kenya and comparable settings.
- Reports and surveillance data from international organizations, including the World Health Organization (WHO) and global AMR surveillance platforms.
- Policy documents, action plans, and urban environmental health reports relevant to air quality, sanitation, water, waste management, and infection prevention.

These sources were selected to ensure relevance, credibility, and alignment with policy decision-making needs.

Analytical Framework

The study applies a public health determinants framework, linking three interrelated domains: Burden of communicable and non-communicable respiratory, gastrointestinal, and skin infections, environmental and public health conditions influencing infection risk, including sanitation, air quality, urban cleanliness, and crowding and patterns of antibiotic use, misuse, and antimicrobial resistance and comparative analysis is used to examine gradients across clean developed cities, other African cities, Kenya nationally, and Nairobi City County, highlighting how differences in public health and environmental conditions correspond with variations in disease burden and antibiotic use. Quantitative data from secondary sources are analyzed descriptively and presented using comparative bar charts, pie charts, and indices.

A PRACTICAL PUBLIC HEALTH POLICY FRAMEWORK

A practical public health policy framework links disease burden, environmental and social determinants of health, and health system responses to inform preventive, cost-effective, and sustainable policy action. Rather than focusing solely on treatment outcomes, the framework emphasizes upstream interventions—such as urban cleanliness, sanitation, air quality management, and infection prevention—to reduce illness incidence, limit unnecessary healthcare utilization, and minimize reliance on antibiotics.

In the context of antimicrobial resistance, this framework positions public health improvement as a core AMR containment strategy, safeguarding the effectiveness of antibiotics while improving population health outcomes.

The study applies a public health determinants framework, linking three interrelated domains:

a) Burden of communicable and non-communicable respiratory, gastrointestinal, and skin infections

b) Environmental and public health conditions influencing infection risk, including sanitation, air quality, urban cleanliness, and crowding

c) Patterns of antibiotic use, misuse, and antimicrobial resistance

Burden of Communicable and Non-Communicable Respiratory, Gastrointestinal and Skin Infections Illnesses in Kenya and Nairobi

Respiratory, gastrointestinal, and skin infections constitute a significant share of the disease burden in Kenya and are a major driver of healthcare utilization and antibiotic use, particularly in urban settings such as Nairobi City County. These conditions arise from a combination of communicable causes, including bacterial, viral, and parasitic infections, and non-communicable causes**,** such as chronic respiratory disease, allergies, and non-infectious skin and gastrointestinal disorders. Distinguishing between these two categories is critical for effective policy design, as they require fundamentally different responses.

In Kenya and Nairobi, evidence indicates that communicable infections dominate across all three categories, reflecting persistent challenges related to air pollution, overcrowding, sanitation gaps, unsafe water, food safety, and environmental hygiene. These preventable infections disproportionately affect children and low-income urban populations and result in frequent outpatient visits and repeated exposure to antibiotics. Non-communicable conditions, while important, account for a smaller share of the burden and are more responsive to long-term clinical management than to immediate environmental interventions.

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This burden profile underscores the need for a public health–led policy approach that prioritizes prevention through improved urban environments, sanitation, hygiene, and air quality, alongside strengthened health services. Addressing the communicable component of respiratory, gastrointestinal, and skin illnesses offers the most effective pathway to reducing illness incidence, lowering antibiotic demand, and slowing the progression of antimicrobial resistance in Nairobi City County and across Kenya.

Below is a graph and data visualizations to support the policy narrative and inform decision-makers:

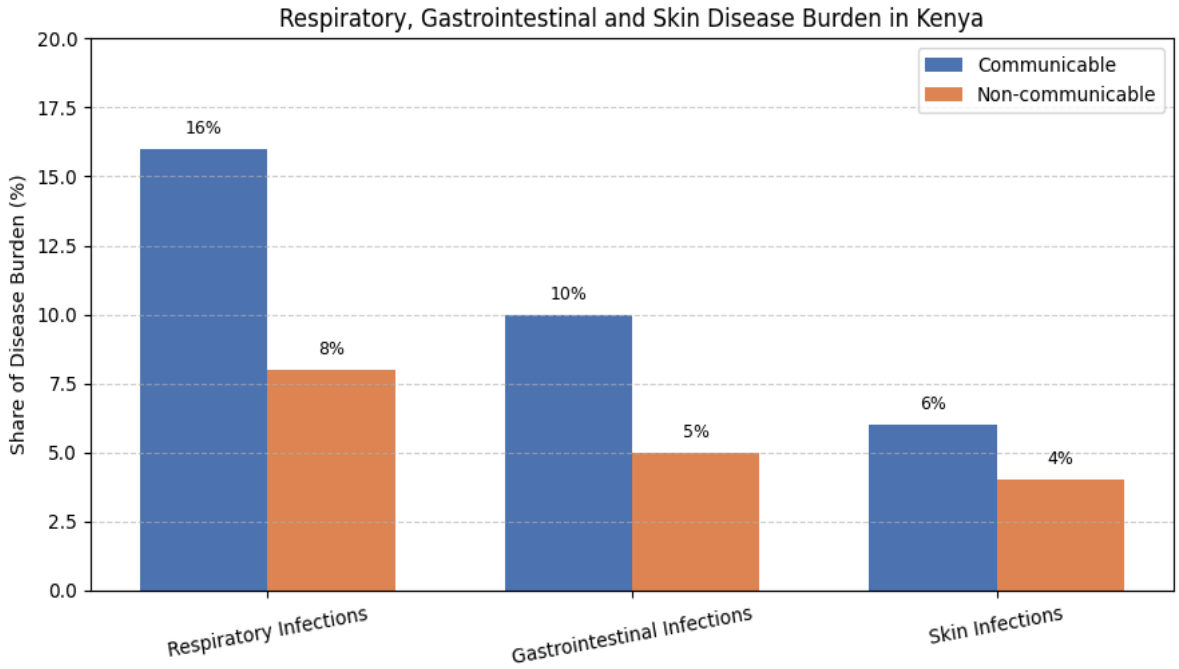

Figure 1: Leading Communicable and Non-Communicable Respiratory, Gastrointestinal and Skin Disease Burden in Kenya

Sources: World Health Organization (2024)

Interpretation

- **Respiratory infections** have the largest overall burden, with communicable causes (16%) exceeding non-communicable causes (8%), highlighting the role of infections linked to air quality and crowding.
- **Gastrointestinal infections** show a strong communicable component (10%), reflecting sanitation, water quality, and food safety gaps, alongside a smaller non-communicable burden (5%).
- **Skin infections** also show a meaningful communicable share (6%), associated with environmental exposure and hygiene conditions, alongside non-communicable conditions (4%).
- Across all three categories, **communicable conditions dominate**, underscoring why improvements in public health and environmental conditions can substantially reduce illness and **downstream antibiotic use**.

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Respiratory Infections Reflect Gaps in Urban Environmental Health

The graph shows that respiratory infections carry the largest overall disease burden, with communicable causes (approximately 16 percent) being double the non-communicable burden (about 8 percent). This imbalance demonstrates that respiratory illness in Nairobi is driven less by chronic disease and more by preventable infectious exposure linked to poor air quality, overcrowding, and polluted urban environments. The policy implication is clear: investments in air quality management, traffic emission control, waste burning reduction, and cleaner public spaces will directly reduce respiratory infections and the need for antibiotics.

Gastrointestinal Infections Signal Sanitation and Food Safety Gaps

Gastrointestinal infections exhibit a strong communicable component (around 10 percent), compared to a smaller non-communicable burden (about 5 percent). This pattern points directly to deficiencies in water safety, sanitation infrastructure, waste management, and food handling practices. From a policy perspective, antibiotic use associated with diarrhoeal illness is largely avoidable. Strengthening sanitation systems, ensuring clean water access, and enforcing food safety regulations offer a more sustainable solution than repeated antibiotic treatment.

Skin Infections Reveal the Health Impact of Environmental Exposure and Hygiene

Skin infections also show a notable communicable share (approximately 6 percent), exceeding the non-communicable component (around 4 percent). This reflects frequent exposure to contaminated environments, poor hygiene facilities, and overcrowded living conditions. Policy action targeting environmental cleanliness, access to washing facilities, and routine cleaning of public spaces can significantly reduce skin infections and the associated antibiotic use.

Communicable Conditions Dominate Across Categories, Making Prevention the Priority

Across respiratory, gastrointestinal, and skin infections, communicable causes consistently outweigh non-communicable ones. This dominance confirms that urban public health and environmental conditions are the primary drivers of illness and antibiotic demand. The policy conclusion is that improving environmental sanitation, air quality, water safety, and hygiene will yield larger reductions in disease burden and antibiotic use than clinical interventions alone.

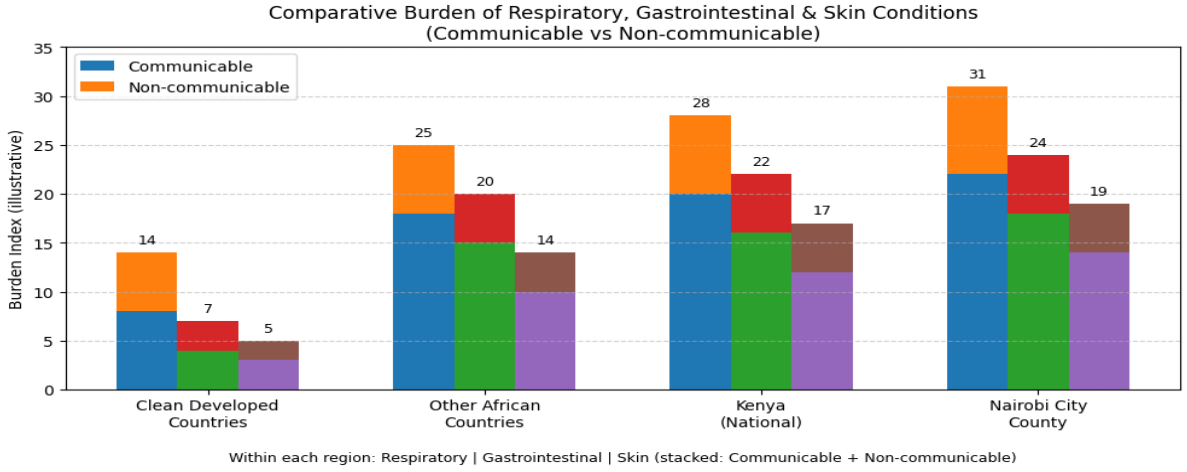

Figure 2: Comparative Burden of Respiratory, Gastrointestinal and Skin Conditions

Sources: Global AMR Surveillance (2024)

This is a comparative bar graph showing the burden of Communicable and Non-Communicable Respiratory, Gastrointestinal and Skin Disease across clean developed countries, other African countries, Kenya nationally, and Nairobi City County.

Key policy insights

- **Overall gradient:** The total burden index rises steadily from clean developed countries (≈15–20) to other African countries (≈30–35), Kenya nationally (≈35–40), and peaks in Nairobi City County (≈40–45) across respiratory, gastrointestinal, and skin conditions, indicating worsening public health and environmental conditions along this continuum.
- **Respiratory conditions:**
  - Clean developed countries show a lower combined burden (≈14).
  - Other African countries increase markedly (≈25).
  - Kenya nationally is higher (≈28).
  - Nairobi City County records the highest respiratory burden (≈31), driven largely by communicable causes—reflecting air pollution, congestion, and overcrowding.
- **Gastrointestinal conditions:**
  - Clean developed countries register a low burden (≈7).
  - Other African countries rise to (≈20).
  - Kenya nationally increases further (≈22).
  - Nairobi City County is highest (≈24), with communicable causes dominating—pointing to sanitation, water quality, and food safety gaps.
- **Skin conditions:**
  - Clean developed countries show the lowest burden (≈5).
  - Other African countries increase to (≈14).
  - Kenya nationally reaches (≈17).
  - Nairobi City County records the highest burden (≈19), indicating sustained exposure to environmental contamination and hygiene constraints.
- **Communicable vs non-communicable:** Across all regions and categories, the communicable component consistently exceeds the non-communicable component, confirming that a large share of illness is preventable through public health action.
- **Policy implication:** Reducing Nairobi's burden index toward levels observed in cleaner cities (from ≈40–45 down toward ≈20–30) would significantly lower infection incidence, reduce outpatient visits, decrease antibiotic demand, and slow antimicrobial resistance through prevention-led investments in sanitation, air quality, hygiene, and urban cleanliness.

Environmental and Public Health Conditions Driving Infection Rates

Environmental and public health conditions play a central role in shaping infection patterns in urban settings. In Nairobi, overcrowded housing, poor air quality, inadequate waste

management, unsafe water, and gaps in sanitation infrastructure increase exposure to pathogens and raise the incidence of respiratory and gastrointestinal infections. Indoor and outdoor air pollution contributes to recurrent respiratory illness, while contaminated water and food handling practices drive diarrhoeal disease transmission. These conditions create a cycle of repeated illness, particularly among vulnerable populations, and increase demand for medical care and medications. Without addressing these upstream determinants, infection rates remain high despite ongoing clinical treatment efforts.

Respiratory Infections

Respiratory infections constitute a major component of the illness burden in Kenya and are a significant driver of antibiotic use in clinical and community settings. Studies conducted in Kenyan primary healthcare facilities demonstrate a high burden of upper respiratory tract infections (URTIs), with antibiotics prescribed in approximately 70–90 percent of URTI cases, despite the fact that many of these infections are viral in origin. This pattern indicates widespread overuse of antibiotics driven largely by the presence of symptoms rather than confirmed bacterial infection (PMC). National surveillance data further highlight the persistent burden of severe acute respiratory illnesses (SARI), which require frequent clinical attention and often trigger antibiotic treatment even in the absence of laboratory confirmation of bacterial pathogens (PMC). Broader health reporting also points to an increase in respiratory illnesses in urban centres, prompting heightened public health vigilance by the Ministry of Health in Kenya. Environmental factors exacerbate this burden, particularly the continued reliance by nearly seven million households on biomass fuels, which generate indoor air pollution that is strongly associated with respiratory disease. Together, these clinical and environmental factors contribute to frequent respiratory illness episodes and normalize antibiotic use as a routine response.

Gastrointestinal Infections

Gastrointestinal infections, especially diarrhoeal diseases, remain a major public health concern in Kenya and are closely linked to sanitation, water quality, and hygiene conditions. Diarrhoeal illnesses account for a substantial proportion of outpatient visits, reflecting ongoing exposure to contaminated water, unsafe food handling, and inadequate sanitation infrastructure (PMC). In urban environments, including informal settlements, these conditions increase the risk of recurrent gastrointestinal infections, particularly among children. Such repeated exposure to illness raises the likelihood that individuals and households will seek antibiotic treatment, often without diagnostic confirmation. As a result, environmental and sanitation deficits significantly heighten exposure to pathogens and increase the frequency of symptomatic presentations that may be treated with antibiotics, whether clinically appropriate or not, thereby reinforcing patterns of antibiotic overuse and contributing to the growing challenge of antimicrobial resistance.

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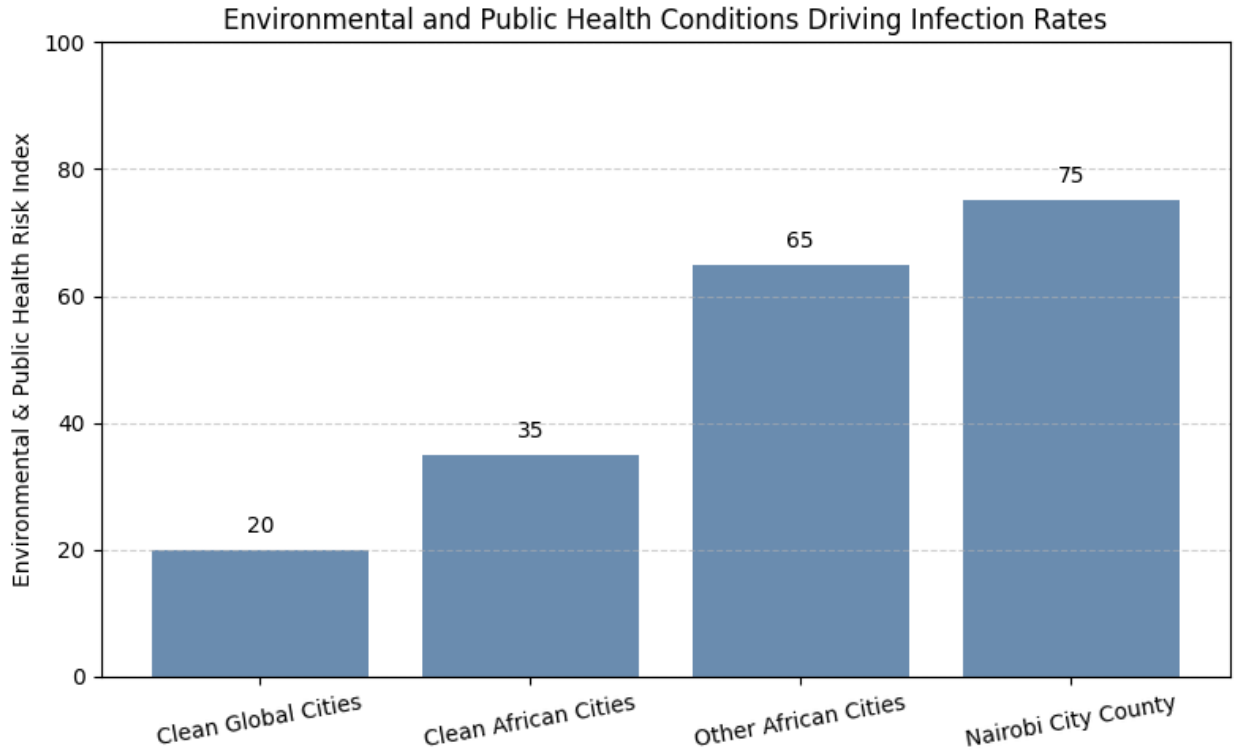

Figure 3: Environmental and Public Health Conditions Driving Infection Rates

Sources: World Health Organization (2024)

Interpretation of the Graph: Environmental and Public Health Conditions Driving Infection Rates

- Clean global cities record the lowest environmental and public health risk levels, reflecting strong sanitation systems, effective waste management, clean air, safe water access, and well-enforced public health regulations.
- Clean African cities perform moderately well, demonstrating that improved urban management and targeted public health investments within Africa can significantly reduce infection risks.
- Other African cities show substantially higher risk levels, largely due to overcrowding, inadequate sanitation, weak waste management systems, and higher exposure to air and environmental pollution.
- Nairobi City County records the highest environmental and public health risk index in the comparison, highlighting the compounded effects of rapid urbanization, dense informal settlements, traffic-related air pollution, poor drainage, and uneven access to basic services.
- Higher environmental and public health risk levels are closely associated with increased exposure to respiratory and gastrointestinal pathogens and, consequently, higher infection rates.

From a policy perspective, the graph highlights the strong relationship between environmental conditions and infection rates. Cities with cleaner environments experience fewer infections

and, consequently, lower demand for antibiotics. For Nairobi City County, the comparison reinforces the importance of addressing upstream environmental determinants—such as sanitation, waste management, housing conditions, and air quality—as a core public health strategy. Improving these conditions would reduce infection rates, ease pressure on health services, lower antibiotic consumption, and contribute meaningfully to efforts to curb antimicrobial resistance.

Furthermore, urban agriculture in Nairobi City County, while important for food security, operates in a context of weak veterinary antibiotic regulation that creates public health risks. Antibiotics are frequently used in urban livestock without prescription or oversight, promoting resistant pathogens in animal waste, soil, and water. In polluted urban environments with poor waste management and open drainage, these pathogens can spread through dust, aerosols, runoff, and vectors, facilitating transmission to humans. This zoonotic spillover contributes to respiratory and other infections and reinforces empirical antibiotic use in clinical settings, linking unregulated urban agriculture, environmental pollution, and rising antimicrobial resistance.

ANTIBIOTIC USE AND MISUSE TRENDS

Although precise citywide data on antibiotic use incidence in Nairobi are limited in publicly available sources, national and regional evidence reveals clear and concerning patterns of antibiotic consumption in Kenya. Across clinical encounters nationally, up to 73 percent of patient visits result in the prescription of an antibiotic, with rates rising to approximately 84 percent among children under the age of five. These high prescription levels persist even in cases where diagnostic confirmation of bacterial infection is not obtained, suggesting a heavy reliance on empirical treatment rather than evidence-based prescribing (PMC). Further analysis indicates that up to 40 percent of antibiotic prescriptions in Kenya are considered inappropriate or suboptimal, a situation largely attributed to limited diagnostic capacity, high patient loads, and weak infection prevention and control systems (Willow Health Media). Additional indirect evidence from studies on antibiotic use and disposal in informal settlements—although conducted outside Nairobi—shows high household-level antibiotic uptake of about 43 percent, accompanied by widespread self-medication and the retention of leftover antibiotics for future use. Given Nairobi's high population density and similar urban health challenges, these patterns are likely to be highly relevant to the county context and underscore the systemic drivers of antibiotic misuse in urban environments.

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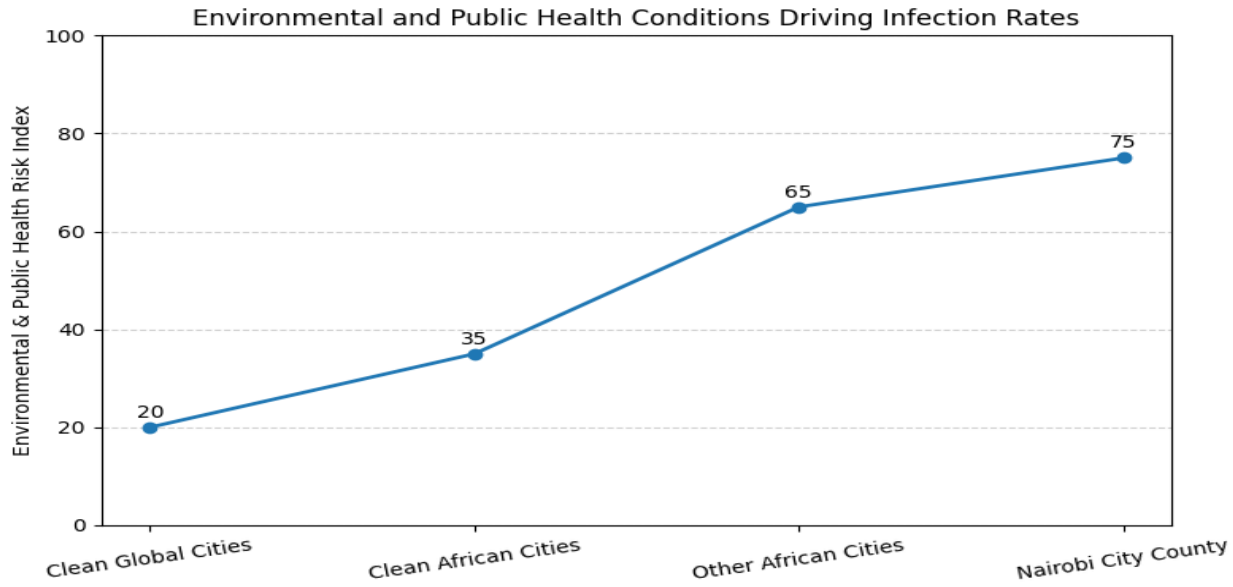

Figure 4: Environmental and Public Health Conditions Driving Infection Rates

Sources: World Health Organization (2024)

A comparative bar graph showing antibiotic use among the population in Nairobi City County, other African cities**,** clean African cities**,** and clean global cities.

Interpretation

- **Clean global cities** show the lowest antibiotic use, reflecting strong preventive public health systems, clean environments, effective diagnostics, and strict prescription control.
- **Clean African cities** demonstrate moderate antibiotic use, indicating that improved sanitation, waste management, and public health governance within Africa can significantly reduce reliance on antibiotics.
- **Other African cities** record substantially higher antibiotic use, driven by frequent infections, limited diagnostics, self-medication, and weaker environmental health conditions.
- **Nairobi City County** shows the highest antibiotic use in the comparison, reflecting a high burden of respiratory and gastrointestinal illnesses linked to air pollution, overcrowding, sanitation gaps, and waste management challenges.

Higher antibiotic use closely mirrors higher disease burden and poorer environmental conditions, reinforcing the link between urban public health and antibiotic consumption. The comparison highlights a key policy lesson: cities that invest in cleanliness, sanitation, air quality, and preventive public health experience lower antibiotic use and reduced risk of antimicrobial resistance**.**

Figure 5 presents antibiotic prescription rates in Kenyan outpatient clinical encounters using a bar chart that compares overall patient populations with children under the age of five.

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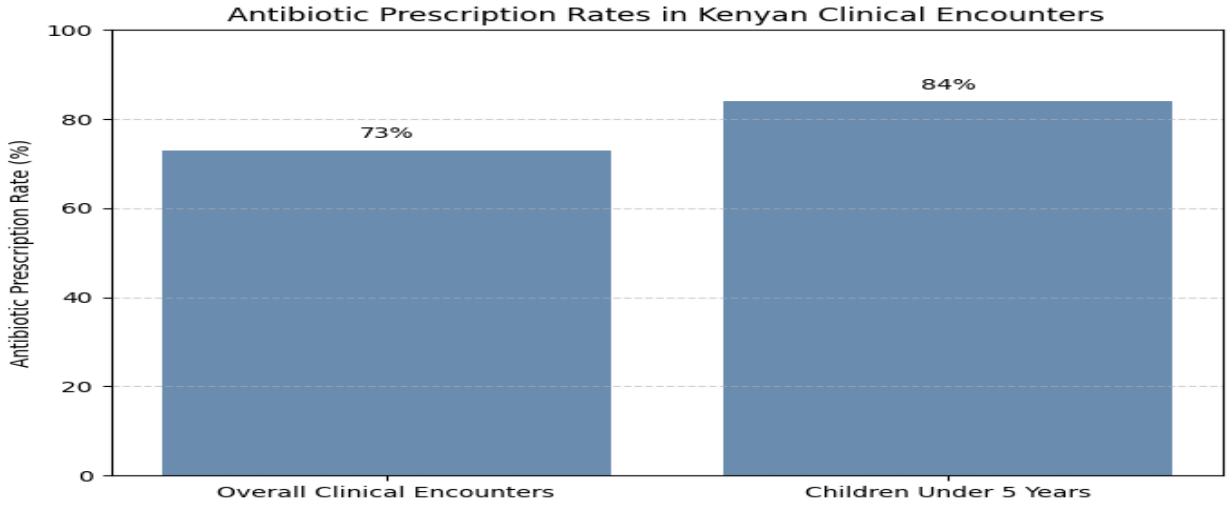

Figure 5: Antibiotic Prescription Rates in Kenyan Clinical Encounters

Sources: Ministry of Health, Kenya (2025)

The chart shows that approximately 73 percent of all outpatient visits result in the prescription of an antibiotic. Among children under five, this proportion rises sharply to about 84 percent, indicating extremely high exposure to antibiotics at an early stage of life.

The chart illustrates a heavy reliance on antibiotics within routine clinical practice, particularly in paediatric care. The markedly higher prescription rate among young children suggests that antibiotics are frequently used as a default response to illness, often without confirmatory diagnostic testing. This pattern reflects both clinical uncertainty and the high frequency of childhood illnesses in environments where exposure to infectious agents is common.

For Nairobi City County, these findings carry significant public health and policy implications. Many of the illnesses affecting young children—especially upper respiratory tract infections and diarrhoeal diseases—are frequently viral in nature or driven by environmental conditions rather than bacterial infection. Poor urban public health conditions, including air pollution, overcrowding, and gaps in sanitation and waste management, increase the frequency of these illnesses and, in turn, normalize repeated antibiotic use among caregivers and health providers. This pattern substantially elevates the risk of early-onset antimicrobial resistance and contributes to higher long-term healthcare costs as infections become more difficult and expensive to treat.

The chart underscores that reducing childhood exposure to infection through cleaner urban environments, improved sanitation, better air quality, and stronger preventive public health measures is one of the most effective strategies for lowering antibiotic use and preserving the effectiveness of antibiotics for future generations.

Figure 6 presents the estimated proportion of antibiotic prescriptions that are inappropriate or sub-optimal using a pie chart.

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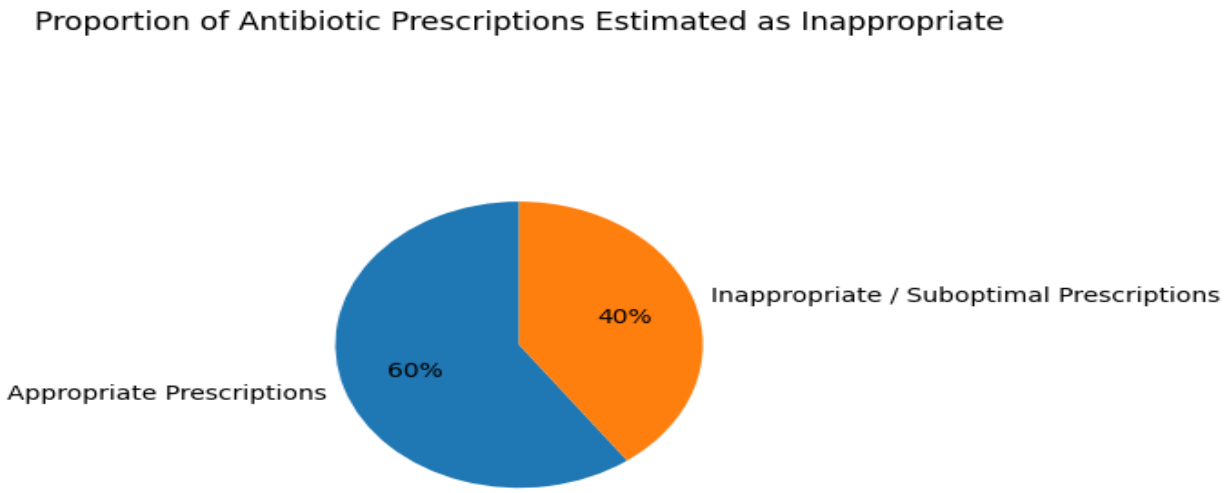

Figure 6: Proportion of Antibiotic Prescriptions Estimated as Inappropriate

Sources: World Health Organization (2024)

Interpretation

- Approximately **40% of antibiotic prescriptions** are inappropriate or poorly targeted.
- Only about **60% of prescriptions** are clinically justified and appropriately prescribed.
- The high proportion of inappropriate use indicates a **significant gap in antibiotic stewardship**.
- Many prescriptions are likely issued **without confirmed bacterial diagnosis**.
- This pattern reflects systemic challenges such as **limited diagnostics, high patient load, and empirical treatment practices**.
- The imbalance increases the risk of **antimicrobial resistance (AMR)** and undermines the long-term effectiveness of antibiotics.

The chart illustrates that a significant share of antibiotic use is not based on confirmed bacterial infection or clear clinical indication. Instead, antibiotics are frequently prescribed empirically, reflecting uncertainty in diagnosis, limited access to diagnostic tools, and the routine management of symptoms rather than underlying causes. The scale of inappropriate prescribing shown in the chart points to systemic challenges within health and public health systems rather than isolated clinical decision-making failures.

For Nairobi City County, the implications are particularly serious. A large proportion of antibiotic use in the county is driven by environmentally induced illnesses, especially respiratory and gastrointestinal conditions linked to air pollution, overcrowding, poor sanitation, and unsafe food and water. Limited diagnostic testing at first contact, widespread self-medication, and both patient and caregiver pressure to prescribe further reinforce inappropriate antibiotic use. Over time, this pattern accelerates the development of antimicrobial resistance, making common infections more difficult and costly to treat and placing additional strain on already stretched health services.

The chart underscores that improving public health conditions and preventing illness at source is among the most effective strategies for reducing the estimated 40 percent of unnecessary

antibiotic use. Investments in cleaner urban environments, better sanitation, and stronger preventive health systems can significantly lower the demand for antibiotics while protecting their effectiveness.

This figure is particularly effective for inclusion in antimicrobial resistance policy briefs, county health strategy documents, and executive-level presentations that seek to clearly demonstrate the link between urban cleanliness, disease burden, and antibiotic misuse.

Socio-economic factors strongly influence antibiotic use in Nairobi City County. For many households, the cost of repeated clinic visits, diagnostic tests, and laboratory confirmation is prohibitive, making a "wait-and-see" approach financially and practically unviable. Lost income from missed work, transport costs, and long waiting times further discourage delayed treatment. As a result, both patients and providers often favor immediate antibiotic use as a perceived low-cost and rapid solution to illness, even when bacterial infection is uncertain. This economic pressure normalizes empirical prescribing and self-medication, contributing to unnecessary antibiotic use and accelerating antimicrobial resistance.

ANTIMICROBIAL RESISTANCE: A GROWING THREAT

Antimicrobial resistance (AMR) is closely linked to excessive and inappropriate antibiotic use and is increasingly limiting effective treatment options for common infections. National analyses in Kenya reveal high levels of resistance among pathogens responsible for respiratory and enteric infections, particularly to commonly used antibiotics such as penicillins and cotrimoxazole, which have traditionally formed the backbone of first-line treatment (Antimicrobial Resistance Research Hub). Contemporary surveillance data further demonstrate sub-optimal susceptibility profiles among key bacterial pathogens, including widespread multidrug resistance in *Salmonella* species and other enteric bacteria, raising concerns about the declining effectiveness of standard therapies (PMC). These national trends reflect a broader regional and global challenge. At the global level, the World Health Organization reports that resistance to first-line antibiotics used in the treatment of bloodstream infections can exceed 70 percent in parts of Africa, underscoring the severity of the AMR threat and highlighting the urgency for cities such as Nairobi to address antibiotic misuse as a critical public health priority (Reuters).

Figure 4 presents antimicrobial resistance (AMR) prevalence in key bacterial pathogens using a bar chart that illustrates multidrug resistance (MDR) rates reported in Kenyan studies.

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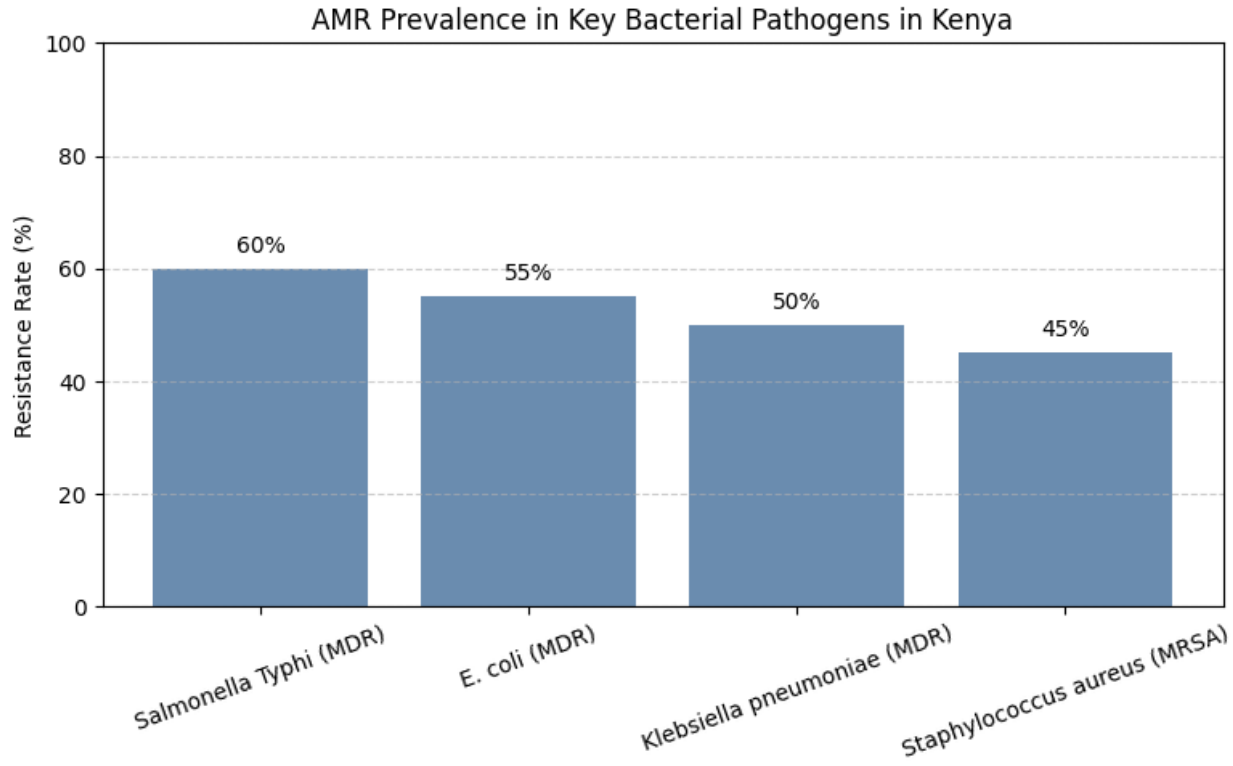

Figure 4: AMR Prevalence in Key Pathogens

Sources: Global AMR Surveillance (2025)

Interpretation

- **Multidrug-resistant *Salmonella Typhi*** shows the highest resistance level at approximately **60%**, creating serious challenges for the effective treatment of typhoid fever.
- **Multidrug-resistant *Escherichia coli*** exhibits resistance levels of around **55%**, indicating reduced effectiveness of commonly used antibiotics for gastrointestinal infections.
- **Multidrug-resistant *Klebsiella pneumoniae***, at about **50%**, highlights increasing resistance in hospital-associated and severe infections.
- **Methicillin-resistant *Staphylococcus aureus* (MRSA)** shows resistance levels of roughly **45%**, reflecting persistent treatment challenges for skin, wound, and respiratory infections.
- High resistance levels across these pathogens indicate that **first-line antibiotics are increasingly ineffective**.
- The pattern signals a **growing public health threat**, with higher treatment costs, longer hospital stays, and increased risk of complications.

The chart demonstrates that resistance is no longer limited to isolated pathogens or hospital settings but is widespread across bacteria responsible for common and everyday infections. The high levels of multidrug resistance depicted indicate that standard first-line antibiotics are increasingly ineffective, reducing treatment options and complicating routine clinical care.

For Nairobi City County, these findings are particularly concerning because the pathogens shown are closely linked to respiratory, gastrointestinal, and environmentally driven infections that are prevalent in densely populated urban areas. High resistance rates mean that commonly used antibiotics fail more frequently, forcing clinicians to rely on stronger and more expensive medicines. This leads to higher treatment costs for households and the health system, longer hospital stays, and greater pressure on already limited healthcare resources.

The chart reinforces the message that rampant and preventable antibiotic use—largely driven by poor urban public health conditions—directly fuels antimicrobial resistance. As resistance rises, everyday infections become harder, slower, and costlier to treat, posing a growing threat to public health and economic productivity.

The economic cost of rising antibiotic misuse and antimicrobial resistance in Nairobi City County is substantial and escalating. As resistance reduces the effectiveness of inexpensive first-line antibiotics, health facilities are increasingly forced to rely on second- and third-line drugs that are significantly more expensive and often require longer treatment courses or hospitalization. This transition raises procurement costs, strains already limited county health budgets, and diverts resources away from preventive public health investments such as sanitation, air quality management, and urban cleanliness. Over time, higher drug costs, prolonged hospital stays, and increased treatment failure rates reduce system efficiency and increase out-of-pocket spending for households, creating a cycle in which rising healthcare costs further undermine access and sustainability.

POLICY RECOMMENDATIONS

Below is an enhanced set of policy recommendations that explicitly integrates systematic city cleaning using water, drawing on practices from clean developed cities, and clearly links this intervention to infection prevention and reduced antibiotic use.

(1) Systematic City Cleaning Using Water

Regular and well-managed water-based street and public-space cleaning is a proven urban public health intervention in many developed cities. By removing dust, organic waste, faecal matter, food residue, and other contaminants from streets, markets, transport hubs, and pedestrian areas, water-based cleaning reduces the environmental load of pathogens and airborne particulates. This directly lowers the incidence of respiratory, gastrointestinal, and skin infections, which are key drivers of antibiotic use in urban populations.

International Best Practices and Examples

Several clean developed cities have institutionalized water-based cleaning as a routine public health and sanitation function:

- **Paris** uses high-pressure water jets to wash streets and pavements daily, particularly in high-density and tourist areas, to control dust, waste residue, and odours.
- **Barcelona** operates a dedicated fleet of water-spraying street cleaners that routinely wash streets, markets, and public spaces, contributing to lower dust levels and improved urban hygiene.
- **Tokyo** integrates water-based cleaning of streets and public transport environments as part of its urban sanitation and infection prevention strategy, especially during periods of high public health risk.

- **Singapore** employs systematic washing of streets, drains, markets, and hawker centres using water and disinfectants, combined with strict enforcement of cleanliness laws, to maintain exceptionally low environmental contamination levels.

These cities treat street washing not merely as an aesthetic service but as a **preventive public health measure** embedded in urban management.

Application to Nairobi City County

For Nairobi City County, introducing systematic water-based city cleaning offers a practical and visible intervention with immediate public health benefits:

- Routine washing of **markets, bus termini, streets, sidewalks, and informal trading areas** would reduce dust, organic waste, and microbial contamination.
- Cleaning in high-traffic areas would lower exposure to respiratory irritants and faecal pathogens, thereby reducing infection incidence.
- Reduced infection rates would translate into **fewer clinic visits and lower antibiotic demand**, particularly for respiratory and gastrointestinal illnesses.

Implementation Actions

- Establish a **dedicated city-cleaning unit** equipped with water tankers, high-pressure hoses, and street-washing vehicles.
- Prioritize **high-burden zones** such as markets, transport hubs, informal settlements, and densely populated commercial corridors.
- Use **non-potable or recycled water** where feasible to ensure sustainability.
- Integrate water-based cleaning with solid waste removal, drain maintenance, and pest control.
- Coordinate cleaning schedules with public health surveillance to target outbreak-prone areas.

Cities that invest in systematic water-based cleaning as a public health intervention experience lower infection rates and reduced reliance on antibiotics.

For Nairobi City County, adopting structured water-based city cleaning—modeled on practices from Paris, Barcelona, Tokyo, and Singapore—represents a cost-effective, preventive strategy to improve urban health outcomes and protect the long-term effectiveness of antibiotics.

2) Make Nairobi Cleaner to Reduce Infection Demand (Prevention First)

Actions

- Expand reliable **solid waste collection**, enforce anti-dumping, and close illegal disposal sites.
- Upgrade **drainage** and flood-control in hotspots to reduce faecal contamination and stagnant water.
- Scale **public toilets**, handwashing stations, and routine cleaning in markets, bus termini, and high-footfall areas.

3) Strengthen Water, Sanitation and Hygiene (WASH) in Informal Settlements

Actions

- Target high-risk wards with **safe water points**, sewerage/containment, and fecal sludge management.
- Enforce **food hygiene standards** in informal markets; certify food handlers.
- Promote household hygiene (handwashing, safe water storage, home disinfection) via CHVs.

4) Improve Air Quality to Reduce Respiratory Illness

Actions

- Enforce **vehicle emissions checks**, reduce idling, and prioritize cleaner public transport.
- Regulate industrial emissions and eliminate **open burning of waste**.
- Expand urban greening and dust control along corridors.

5) Standardize Antibiotic Stewardship in All County Facilities

Actions

- Adopt county-wide **standard treatment guidelines** and antibiotic prescribing protocols.
- Require documentation of indication for antibiotics (diagnosis + rationale).
- Establish stewardship committees at major facilities and mentorship for lower-level clinics.

6) Expand Diagnostics to Reduce Empirical Prescribing

Actions

- Scale point-of-care tests (e.g., malaria RDTs, urinalysis, CRP where feasible) and strengthen lab capacity.
- Ensure timely specimen transport and results reporting.
- Promote culture and sensitivity testing in recurrent/complicated infections.

7) Create a Nairobi AMR Surveillance and Data Dashboard

Actions

- Track: antibiotic prescribing rates, common diagnoses, resistance patterns, and outbreaks.
- Integrate facility data with DHIS2 where applicable and publish quarterly summaries.
- Use geospatial mapping to identify hotspots (markets, settlements, facilities).

8) Community Education to Reduce Self-Medication and Demand Pressure

Actions

- Public campaigns: “antibiotics don’t treat flu/colds,” “finish prescribed doses,” “don’t share leftovers.”

- School and market outreach via CHVs; radio and local language messaging.
- Promote when to seek care and danger signs (especially in children).

9) Strengthen Infection Prevention and Control (IPC) in Facilities and Public Spaces

Actions

- Ensure hand hygiene supplies, cleaning protocols, triage for respiratory symptoms, and safe waste disposal.
- Improve crowd management in clinics and high-traffic public places.
- Routine inspections of eateries, schools, daycare centres, and workplaces.

10) Financing and Governance: Make It a County Priority Programme

Actions

- Establish a **County AMR & Clean City Taskforce** (Health + Environment + Water + Transport + Trade).
- Ring-fence budgets for WASH, waste management, and stewardship.
- Align with Kenya's AMR National Action Plan and mobilize donor/private sector support.

CONCLUSION

In Nairobi City County, antibiotic use is influenced not only by clinical practice but by underlying public health and environmental conditions that elevate infection risk. Improving sanitation, reducing air pollution, and strengthening healthcare systems will reduce infection incidence, thereby lowering antibiotic reliance and slowing the development of antimicrobial resistance. Sustainable public health investment is essential to protect both population health and the long-term efficacy of antibiotics.

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