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COGITO, ERGO SUM

Forum: World Health Organization (WHO)

Issue: Bridging the Antibiotic Access Gap in the Less Economically Developed Countries(LEDCs)

Student Officer: Marialena Sarimvei

Position: President

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Introduction:

Antibiotics play a vital role in modern day medicine as they are vital for the treatment and prevention of many infectious diseases. Despite their importance, access to antibiotics is still very limited in many LEDC's. This has created a significant antibiotic access gap, where millions of people are unable to receive treatment for diseases just because of were they live.

Definition of key terms

Essential Medicines[1]

"Essential medicines are those that effectively and safely treat the priority healthcare needs of the population. They are selected by taking into consideration public health relevance, evidence of benefits and harms, and with consideration of costs, affordability and other relevant factors. In addition, essential medicines should always be available within functioning health systems, in

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[1] World Health Organization. "Essential Medicines." *Who.int*, World Health Organization: WHO, 25 Sept. 2024, www.who.int/news-room/fact-sheets/detail/essential-medicines.

sufficient quantities to meet patient needs. They should be available in appropriate dosage forms for the intended uses and patients, be of assured quality, and be affordable for both individuals and the health system.

While essential medicines cover a wide range of global health needs, they represent only a small proportion of the total number of medicines available globally. The use of a limited number of carefully selected medicines can lead to improved supply, better prescribing practices and lower costs."

Antibiotic Stewardship[2]

"Improving antibiotic prescribing and use is critical to effectively treat infections, protect patients from harms caused by unnecessary antibiotic use, and combat antibiotic resistance.

These frameworks complement existing guidelines and standards from key healthcare partner organizations, including the Infectious Diseases Society of America, Society for Healthcare Epidemiology of America, American Society of Health System Pharmacists, Society of Infectious Diseases Pharmacists, and The Joint Commission."

Health Equity [3]

"Equity is the absence of unfair, avoidable or remediable differences among groups of people, whether those groups are defined socially, economically, demographically, or geographically or by other dimensions of inequality (e.g. sex, gender, ethnicity, disability, or sexual orientation). Health is a fundamental human right. Health equity is achieved when everyone can attain their full potential for health and well-being.**"**

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[2] "Improving Antibiotic Prescribing and Use Is Critical to Effectively Treat Infections, Protect Patients from Harms..." *Coursehero.com*, 8 Aug. 2025, www.coursehero.com/student-questions/79170878-Improving-antibiotic-prescribing-and-use-is-critical-to/. Accessed 8 Sept. 2025.

[3] World Health Organization. "Health Equity." *World Health Organization*, 2025, www.who.int/health-topics/health-equity#tab=tab_1.

Antimicrobial Resistance (AMR)[4]

"Antimicrobials – including antibiotics, antivirals, antifungals, and antiparasitics – are medicines used to prevent and treat infectious diseases in humans, animals and plants.

Antimicrobial Resistance (AMR) occurs when bacteria, viruses, fungi and parasites no longer respond to antimicrobial medicines. As a result of drug resistance, antibiotics and other antimicrobial medicines become ineffective and infections become difficult or impossible to treat, increasing the risk of disease spread, severe illness, disability and death.

AMR is a natural process that happens over time through genetic changes in pathogens. Its emergence and spread is accelerated by human activity, mainly the misuse and overuse of antimicrobials to treat, prevent or control infections in humans, animals and plants."

Substandard and Falsified Medicines[5]

"Substandard and Falsified (SF) medical products are a significant global health threat where substandard products fail to meet quality standards, often due to poor manufacturing or storage, while falsified products deliberately misrepresent their identity, composition, or source to deceive consumers.These products can be ineffective, contain dangerous contaminants, and lead to issues like antimicrobial, causing harm to patients and undermining health systems worldwide."

Timeline of events

Date	Description of event

[4] World Health Organization. "Antimicrobial Resistance." *World Health Organization*, 21 Nov. 2023, www.who.int/news-room/fact-sheets/detail/antimicrobial-resistance.

[5] WHO. "Substandard and Falsified Medical Products." *Who.int*, World Health Organization: WHO, 3 Dec. 2024, www.who.int/news-room/fact-sheets/detail/substandard-and-falsified-medical-products.

3 September 1928	Alexander Fleming discovered penicillin when he noticed that a mold contamination in a culture dish of Staphylococcus bacteria inhibited bacterial growth. He identified that the mold, a penicillium fungus, produced a substance he named penicillin that could kill bacteria.[6]
12 February 1941	On February 12, 1941, a 43-year-old policeman named Albert Alexander was the the first ever recipient of the Oxford penicillin. He had scratched the side of his mouth while pruning roses, and had developed a life-threatening infection with huge abscesses affecting his eyes, face, and lungs. Penicillin was injected and within days he made a remarkable recovery. But supplies of the drug ran out and he died a few days later. Better results followed with other patients though and soon there were plans to make penicillin available for British troops on the battlefield.[7]
14 March 1942	Penensullin was first used in a commercial level.
1981	The Alliance for the Prude Use of Antibiotics (APUA) was founded, a non-profit organization that promotes the appropriate use of antimicrobials and works to combat antibiotic resistance.[8]
2000	The World Health Organization(WHO) publishes the Global Strategy for Containment of Antimicrobial Resistance, which was first published in 2001 but had contributed to its establishment since 2000.
2008	The APUA begun conducting any field studies, including a more comprehensive assessment and situation analysis, specifically in Uganda and in Zambia.[9]

[6] Science Museum. "How Was Penicillin Developed?" *Science Museum*, 23 Feb. 2021, www.sciencemuseum.org.uk/objects-and-stories/how-was-penicillin-developed.

[7] American Chemical Society. "Alexander Fleming Discovery and Development of Penicillin - Landmark." *American Chemical Society*, 19 Nov. 1999, www.acs.org/education/whatischemistry/landmarks/flemingpenicillin.html.

[8] "ALLIANCE for the PRUDENT USE of ANTIBIOTICS." *ALLIANCE for the PRUDENT USE of ANTIBIOTICS*, apua.org.

[9] "Redirect Notice." *Google.com*, 2025, www.google.com/url?sa=t&source=web&rct=j&opi=89978449&url=documents1.worldbank.

2011	The Joint Programming Initiative on Antimicrobial Resistance (JPIAMR) engaged 29 nations in order to curb Antimicrobial Resistance (AMR) through a global collaborative organization and platform.[10]
May 2015	The World Health Assembly adopted the Global Action Plan on Antimicrobial Resistance (AMR) in May 2015, establishing a framework for countries to develop and implement national action plans to address the growing public health threat of AMR. [11]
25 September 2015	The 2030 Agenda on Sustainable Development was adopted by all the United Nations Member States.[12]
2017	The WHO introduced the AWaRe classification in order to promote antibiotic stewardship and combat antimicrobial resistance (AMR).Antibiotics are categorized into Access, Watch, and Reserve groups, based on their potential impact on resistance and medical importance.[13]
April 2020	GARDP partnered with Venatorx in April 2020 to accelerate the development of the new antibiotic cefepime-taniborbactam. The organizations announced this

org/curated/en/296161639430085363/pdf/Uganda-Systematic-Country-Diagnostic-Update.pdf&ved=2ahUKEwjFgcDprryPAxVG9bsIHZJqHJsQFnoECBoQAQ&usg=AOvVaw1sTaiOFSgERmiTh. Accessed 7 Sept. 2025.

[10] *Google.com*, 2025, www.google.com/url?sa=t&source=web&rct=j&opi=89978449&url=www.jpiamr.eu/&ved=2ahUKEwiase2Gr7yPAxWXgf0HHaHYGAcQFnoECB8QAQ&usg=AOvVaw1u9wUnsE5ZSxrJ3wo3oil8.

[11] "*Google.com*, 2025, www.google.com/url?sa=t&source=web&rct=j&opi=89978449&url=www.who.int/publications/i/item/9789241509763&ved=2ahUKEwint9XKr7yPAxUKg_0HHf0EDRgQFnoECBkQAQ&usg=AOvVaw2qR9Kh0lr9ec3lusOzVfcE. Accessed 8 Sept. 2025.

[12] United Nations. "Sustainable Development Goals." *Sdgs.un.org*, United Nations, 2015, sdgs.un.org.

[13] World Health Organization. "2021 AWaRe Classification." *Www.who.int*, 30 Sept. 2021, www.who.int/publications/i/item/2021-aware-classification.

	collaboration to bring the investigational treatment for multidrug-resistant bacterial infections to patients. [14]
2022	The SECURE initiative joined the Global Research and Development Partenership(GARDP).[15]
January 2025	The New York Times publishes major editorial on "How we Abused the Miricle of Antibiotics).
May 2025	The JPIAR ended and has been succeeded by the European Partenership on One Health AMR.[16]

Background information

The Global Importance of Antibiotics

Antibiotics are important to a national and international level. From the countries that research them and manufacture them to countries that are in need of them. A huge example includes the Less Economically developed Countries, which are the countries that show the need for change in everything, including following the Sustainable Development Goals and achieving equal distribution of medicine, as mentioned in Goal number 3.

[14] "Venatorx Pharmaceuticals and GARDP Partner to Develop New Antibiotic for Hospital Acquired Infections with Limited Treatment Options." *GARDP*, 29 Apr. 2020, gardp.org/venatorx-pharmaceuticals-and-gardp-partner-to-develop-new-antibiotic-for-hospital-acquired-infections-with-limited-treatment-options/.

[15] Auld, Aleida. "GARDP." *GARDP*, 24 Feb. 2022, gardp.org/secure/.

[16] *JPIAMR – Joint Programming Initiative on Antimicrobial Resistance*. www.jpiamr.eu.

Role of antibiotics in modern medicine

According to the Premier Family Network, antibiotics have managed to revolutionize all of modern healthcare. Ever since they were first developed, they created a pivotal era change in the whole of the healthcare industry as they are often seen as a powerful weapon that can be used to cure millions or billions of people. In order, though, to understand and take advantage of this tool it is crucial for an individual to understand the role of antibiotics, that varies from specific antibiotics to broader spectrum.

Treating Infections

Antibiotics can assist in different sectors and one them is in the treatment of infections. They act as the primary treatment for serious bacterial, viral, fungal and parasitic infections that cause serious diseases such as pneumonia or to some extents in legionnaires disease and they are meant for combating the disease and preventing complications that might occur in the future, specifically to more vulnerable patients. They work by killing the bacteria or making it hard for the bacteria to continue multiply or grow at all.

Enabling Surgeries

Antibiotics also make it possible to perform surgeries without major risk of infections or spreading infections by preventing them during and after operations. Without their use, procedures such as organ transplants, joint replacements or even the cesarean section (c-sections) would carry a much higher risk of severe complications. So ultimately by reducing the chance of infection, those antibiotics allow the doctors to carry out complex surgeries that save or change lives.

Cancer Care

Cancer care is also another sector that antibiotics have a very critical role. Many treatments such as chemotherapy and radiation can and will severely weaken the immune system, leaving patients with a high risk of vulnerable infections. Even small and minor infections can because life threatening during that period and so to prevent that antibiotics allow many patients to feel safer and continue their cancer therapies and improve recovery rates and reduce the treatment interruptions.

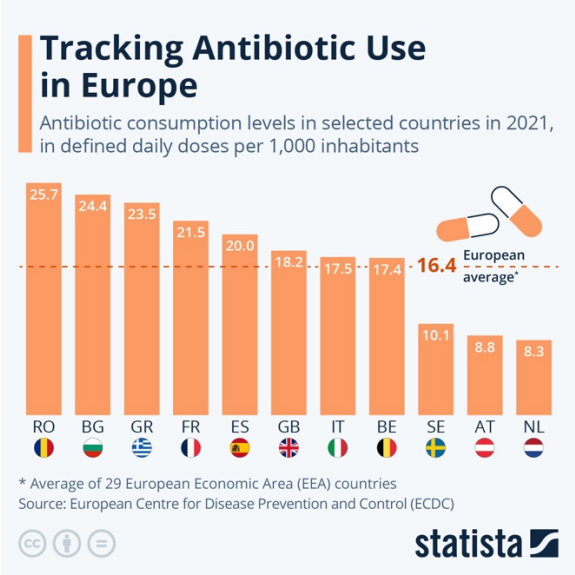
The Antibiotic Access Gap

Statistics on availability VS the demand in LEDCs.

Statistics show significant antibiotic shortages Less Economically Developed Countries (LEDCs), particularly for most important access group of antibiotics, with availability as

low as 33% and 23% in public facilities in many LEDCs and more specifically in Pakistan.[17] In contrast, demand remains high due to a very disproportionate burden of infectious diseases and poor infrastructure of each country, leading to a substantial access gap and reliance on substandard or counterfeit medicines. Supply chain disruptions, weak health systems, and market disincentives contribute to this mismatch, necessitating a shift toward sustainable and affordable access models.

In addition, from 2016 to 2023, the LEDCs consumption of the antibiotics rose by 18.6% with the mist rapid increase in 2021 that placed them ahead of the MEDCs in the consumption and overuse of them[18].



[17] LMICs, in. "The Antibiotic Access Dilemma: Balancing Availability and Stewardship in LMICs |." *LSHTM*, 18 Mar. 2025, www.lshtm.ac.uk/research/centres/amr/news/451646/antibiotic-access-dilemma-balancing-availability-and-stewardship-lmics. Accessed 10 Sept. 2025.

[18] World. "New Report Addresses Antibiotic Shortages in Low- and Middle-Income Countries." *Who.int*, World Health Organization: WHO, 11 Dec. 2024, www.who.int/news/item/11-12-2024-new-report-addresses-antibiotic-shortages-in-low--and-middle-income-countries.

Figure 1: Tracking Antibiotic Use in Europe[19]

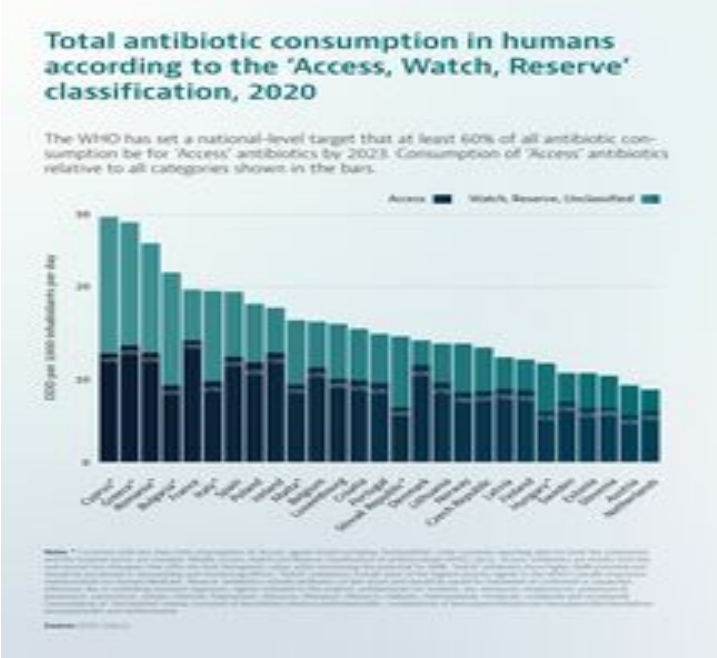


Figure 2: Total antibiotic consumption in humans[20]

<u>Affordability challenges and the role of poverty.</u>

Poverty is a very good excuse for antibiotic misuse, due to the fact that it can fuel each individuals thoughts and resistance by creating structural barriers to proper

[19] Fleck, Anna. "Infographic: Tracking Antibiotic Use in Europe." *Statista Daily Data*, 16 Nov. 2023, www.statista.com/chart/31270/antibiotic-consumption-levels-in-selected-countries/.

[20] "Infographic: Total Antibiotic Consumption in Humans." *European Centre for Disease Prevention and Control*, 7 Mar. 2022, www.ecdc.europa.eu/en/publications-data/infographic-total-antibiotic-consumption-humans. Accessed 10 Sept. 2025.

healthcare, leading to increased self-medication and non-adherence to antibiotic courses. People in poverty may struggle to afford qualified healthcare, increasing their reliance on unqualified practitioners or unregulated antibiotic sources.

Inequities compared to developed countries

In comparison with More Economically Developed (MEDCs), LEDCs are deprived of many "luxuries" that they might have. To begin with, there is unregulated access or poorly regulated to medicine and laboratory facilities for more accurate diagnostics with unreliable microbiology reports. Also, poverty can drive patients to underuse or unknowingly purchase counterfeit medications due to lower prices thinking that they have the same results, and lastly public heath infrastructure is very limited to each country.

Barriers to Access

1. Economic Barriers

   High costs of antibiotics and a limited government health budget can restrict access, especially in the LEDCs. Many patients are unable to afford treatments, while healthcare systems usually struggle to provide sufficient supplies.

2. Infrastructural Barriers

   Weak supply chains, inadequate storage facilities, and poor access in rural areas can prevent timely delivery of antibiotics. Even when drugs are available, these infrastructure gaps reduce their effectiveness and reach.

3. Political and Legal barriers

   Intellectual property restrictions, patent laws, and trade barriers can limit the production and distribution of affordable antibiotics. These legal constraints often delay access in countries that need them most.

4. Healthcare system Gaps

   A shortage of trained medical staff and personnel as well as weak antibiotic stewardship programs that can lead to misuse or underuse of antibiotics, which is a

main issue. In addition, by strengthening healthcare systems it will be essential to ensure safe and effective treatment.

Stakeholders

Nigeria

Nigeria represents the Sub-Saharan Africa's high disease burden and limited access to majority of the antibiotics and they are not able to bridge the gap, due to their economic hardships, weak enforcement of the prescription laws and limited access to real healthcare specificaly in rural areas. Due to the lack of the informal healthcare, people in communities there rely on vendors that are not official, who sell unregulated and substandard antibiotics, that often lead to the misuse of antibiotics and so accelerating Antimicrobial Resistance (AMR). In addition, the situation that occurs there has seen efforts that include regulatory reforms, stewardship programs, and public education, but coordinated is urgently needed to ensure affordable, effective, and responsible antibiotic use to combat AMR and protect public health.

India

In India, as well as in most of the Less Economically Developed Countries (LEDCs) there is a strong and complex antibiotic access gap that many of the people either misuse antibiotics, due to the easy availability that they have or generally any lack of access of effective treatments because of the high costs, poor healthcare infrastructure and limited diagnostics. In addition, the overcrowding, poor sanitation, and unregulated use in healthcare and agriculture continue to worsen antimicrobial resistance. Efforts such as the National Action Plan on AMR aim to improve stewardship and diagnostics, but challenges remain in enforcing regulations and ensuring affordable access, especially for marginalized population groups. So finally, India struggles with both excess and lack of access to quality antibiotics, requiring coordinated policy and healthcare improvements.

The United States of America

The United States have over 2.8 million antibiotics - resistant infections occur every year, and ultimately cause more than 35,000 deaths so while antibiotics are available widely, there is a huge case of overuse and misuse that contribute significantly to the access gap[21].Efforts focus on the

[21] CDC. "About Antimicrobial Resistance." *Antimicrobial Resistance*, Centers for Disease Control and Prevention, 22 Apr. 2024, www.cdc.gov/antimicrobial-resistance/about/index.html.

antibiotic stewardship programs that also reduce unnecessary prescriptions and slow resistance. After the COVID-19 pandemic disrupted the progress within the nation, there was an increasing resistant infections and antibiotic use. Ongoing surveillance and targeted interventions are essential to manage this public health challenge.

Global Antibiotic Research & Development Partnership (GARDP)

> "The Global Antibiotic Research & Development Partnership is a not-for-profit global health organization driven to protect people from the rise and spread of drug-resistant infections, one of the biggest threats to us all. By forging the public and private partnerships that matter, GARDP develops and makes accessible antibiotic treatments for people who need them"[22]. It was made to develop new antibiotics to combat drug-resistant infections and ensuring these treatments are accessible and affordable for everyone who needs them, regardless of their location. Founded by the World Health Organization (WHO) and Drugs for Neglected Diseases Initiative (DNDi) and the GARDP works with public, private, and non-profit partners to accelerate the development of life-saving medicines[23].

Médecins Sans Frontières (MSF)[24]

"Médecins Sans Frontières (MSF), or Doctors Without Borders, is an international medical organization that its highest goal is to provide emergency medical care to people affected by conflict, epidemics, natural disasters, and healthcare exclusion. The MSF's independent teams deliver a range of services, including treating infectious diseases, performing surgeries, offering maternal and child healthcare, alleviating malnutrition, and providing mental health support, regardless of race, religion, or political affiliation. In addition, the MSF addresses the antibiotic gap by always treating drug-resistant infections and by developing tools such as the Mini Lab, that uses a mobile app(Antibiogo) so it can improve antibiotic prescribing."

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[22] "Global Antibiotic Research and Development Partnership." *GARDP*, gardp.org.

[23] Nicole. "About GARDP." *GARDP*, 27 Sept. 2022, gardp.org/about-gardp/.

[24] "Médecins sans Frontières (MSF) International." *Médecins sans Frontières (MSF) International*, www.msf.org.

Relevant UN resolutions, treaties, and events (Previous attempts)

The 2030 Agenda on the 17 Sustainable Development Goals (DSGs)

The 17 Sustainable Development Goals (SDGs) where adopted by all UN Member-States on September 25th, 2015, and they are known as Global Goals since they are a universal call to action by the international community and their goals are to end poverty, protect the planet and ensure prosperity and peace by 2030 to everyone, hence the 2030 Action Agenda. Specifically, the 3rd and 4th goals are linked directly to antibiotic access gap and specifically to the Less Economically Developed Countries (LEDCs). SDG 3 or Goal 3 of the SDGs is to "Ensure healthy lives and promote well-being for all at all ages" and it shows how the need for healthcare is everywhere and for everyone while stressing the fact that it is a need. Additionally, SDG 4 or Goal 4 calls for "Quality Education" and it is to ensure a more inclusive and quality way of education around the globe, including raising awareness for many different issues and one of these is the antibiotic gap globally and in LEDCs

2015 WHO Global Action Plan on AMR[25]

In May 2015, the World Health Assembly adopted a Global Action Plan on Antimicrobial Resistance, that has a few main objectives. First of all, it was designed to improve awareness and understanding of antimicrobial resistance though basic raising awareness such as education, training and communication. Strengthening the knowledge and evidence through research and reduce the infection through effective sanitation hygiene and infection prevention measures. Additionally, optimizing the use of antimicrobial medicine in human healthcare and developing the economic case for sustainable investment that takes into account the needs of all countries.

WHO Model Lists of Essential Medicines[26]

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[25] WHO. "Global Action Plan on Antimicrobial Resistance." *Www.who.int*, 1 Jan. 2016, www.who.int/publications/i/item/9789241509763.

[26] World Health Organization. "WHO Model List of Essential Medicines - 23rd List, 2023." *Www.who.int*, World Health Organization, 26 July 2023, www.who.int/publications/i/item/WHO-MHP-HPS-EML-2023.02.

"The WHO Model List of Essential Medicines and Model List of Essential Medicines for Children are updated and published every two years, and they are intended as a guide for countries or regional authorities to adopt or adapt in accordance with local priorities and treatment guidelines for the development and updating of national essential medicines lists. Selection of a limited number of essential medicines as essential, taking into consideration national disease burden and clinical need can lead to improved access through streamlined procurement and distribution of quality-assured medicines, support more rational or appropriate prescribing and use and lower costs for both health care systems and for patients."

Possible solutions

Enhance and create new policies and frameworks in order to enhance affordability and equitable access

Antibiotic use is of paramount importance all through the globe, and though it is only accessible to the More Economically Developed Countries (MEDCs), and so having frameworks that allow access to rural areas will ensure at least the partial equality in the healthcare sector. Also, this would allow for a more stronger global and national mechanism to develop gradually in order to lower the cost of antibiotics, while also ensuring a fair distribution across those urban and rural areas. Specifically, frameworks and policies as such would solely focus on creating a more sustainable financing system that as a result encourages local production through technology transfer, and fostering partnerships between governments, international organizations and private companies all together.

Encouraging responsible antibiotic use and management

Those limited areas that have access to the antibiotics, need to be very aware of what they have in order to manage their resources correctly and reach the most they can with the limited access. By promoting such responsible use and effective management, all of the Less Economically Developed Countries (LEDCs) will have a chance to improve their pharmaceutical sector. Particularly, those restrictions include strict regulations to be implemented in order to prevent antibiotics being used as non prescribed medicine and over the counter, that is designed to train healthcare workers in prescribing practices and also raising public awareness on the dangers of misuse and overuse. All of the education campaigns can be based in the communities while also being able to help patients understand when the antibiotics are necessary and when they are not, that has a goal of reducing unnecessary demand. At the same time, monitoring mechanisms should be

strengthened in order to track antibiotic consumption patterns, allowing for policymaking that is based on evidence.

Create finding platforms and/or mechanisms in order to enhance international cooperation

In order to reduce the antibiotic access gap in the Less economically Developed Countries (LEDCs) we could create funding platforms and mechanisms that where established in order enhance international cooperation within the international community as well as private sectors. By combining many resources at a global level, these platforms can lower the costs through purchasing in bulk, provide financial aid, and ensure a more fair thus equal distribution of essential antibiotics. Beyond improving the antibiotics's affordability, they can also strengthen the supply chains, support diagnostic services, and promote responsible antibiotic use within local health systems. This international cooperation could further enable all of the countries to share knowledge, coordinate research, and take joint responsibility, and generally be more transparent with each other as to ensure that both urban and rural, LEDCs and MEDCs are able to contribute to making antibiotics more accessible, equitable, and sustainable worldwide.

Further reading

After finishing reading your study guide, you can also read more about the use and general history of antibiotics below:

- McKenna, Maryn. "What Do We Do When Antibiotics Don't Work Any More?" *Www.ted.com*, 2015, www.ted.com/talks/maryn_mckenna_what_do_we_do_when_antibiotics_don_t_work_any_more.

- "Antibiotics - Latest Research and News | Nature." *Www.nature.com*, www.nature.com/subjects/antibiotics.
- Salam, Md Abdus, et al. "Antimicrobial Resistance: A Growing Serious Threat for Global Public Health." *Healthcare*, vol. 11, no. 13, 5 July 2023, pmc.ncbi.nlm.nih.gov/articles/PMC10340576/, https://doi.org/10.3390/healthcare11131946.
- Ahmed, Sirwan Khalid , et al. "Antimicrobial Resistance: Impacts, Challenges, and Future Prospects." *Journal of Medicine Surgery and Public Health*, vol. 2, no. 100081, 1 Mar. 2024, pp. 100081–100081, www.sciencedirect.com/science/article/pii/S2949916X24000343, https://doi.org/10.1016/j.glmedi.2024.100081.

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Global action plan on antimicrobial resistance. (2016, January 1). World Health Organization (WHO). https://www.who.int/publications/i/item/9789241509763

Just a moment... (n.d.). Just a moment... https://www.oecd.org/en/publications/global-outlook-on-financing-for-sustainable-development-2025_753d5368-en.html

Poorly regulated antibiotic use in Nigeria: A critical public health concern and its impact on medical practice. (n.d.). PMC Home. https://pmc.ncbi.nlm.nih.gov/articles/PMC12214438/

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WHO model list of essential medicines - 23rd list, 2023. (2023, July 26). World Health Organization (WHO). https://www.who.int/publications/i/item/WHO-MHP-HPS-EML-2023.02

Why India is a stronghold for superbugs. (2024, October 14). Nature. https://www.nature.com/articles/d44151-024-00167-8

Canden. (2024, February 12). *Antibiotics and their role in modern medicine*. Premier Family Medical. https://premierfamily.net/antibiotics-and-their-role-in-modern-medicine/

Document viewer. (n.d.). UNDOCS. https://docs.un.org/en/A/HRC/RES/36/13

Goal 3 | Department of Economic and Social Affairs. (n.d.). | Sustainable Development. https://sdgs.un.org/goals/goal3

(n.d.). Google. https://www.google.com/url?sa=t&source=web&rct=j&opi=89978449&url=https://www.agenziacoesione.gov.it/comunicazione/agenda-2030-per-lo-sviluppo-sostenibile/%3Flang%3Den%23:~:text%3DSigned%2520on%252025%2520September%25202015%2520by%2520the,which%2520are%2520part%2520of%2520a%2520b

roader%2520programme&ved=2ahUKEwiU6drkrNSPAxVV0wIHHRuJIpkQ-tANegQICRAK&usg=AOvVaw0zJFkagRyo_EG2A64iVQPU

Health. (2025, September 10). United Nations Sustainable Development. https://www.un.org/sustainabledevelopment/health/

Infographic: Total antibiotic consumption in humans. (2022, March 7). European Centre for Disease Prevention and Control. https://www.ecdc.europa.eu/en/publications-data/infographic-total-antibiotic-consumption-humans

Infographic: Tracking antibiotic use in Europe. (2023, November 16). Statista Daily Data. https://www.statista.com/chart/31270/antibiotic-consumption-levels-in-selected-countries/

Just a moment... (n.d.). Just a moment... https://data.unicef.org/sdgs/goal-3-good-health-wellbeing/

Just a moment... (n.d.). Just a moment... https://www.lshtm.ac.uk/research/centres/amr/news/451646/antibiotic-access-dilemma-balancing-availability-and-stewardship-lmics

Legionnaires' disease-legionnaires' disease - Symptoms & causes - Mayo Clinic. (2025, April 19). Mayo Clinic. https://www.mayoclinic.org/diseases-conditions/legionnaires-disease/symptoms-causes/syc-20351747

Page restricted. (n.d.). Page restricted | ScienceDirect. https://www.sciencedirect.com/science/article/pii/S266652472500059X

Pneumonia | Pneumonia symptoms | Signs of pneumonia | MedlinePlus. (n.d.). MedlinePlus - Health Information from the National Library of Medicine. https://medlineplus.gov/pneumonia.html

What to know about infectious diseases. (2023, September 1). Cleveland Clinic.