GOING BLUE: CONFRONTING THE AMR CHALLENGE

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FOREWORD

AMR is personal to me. These are not just words but a reflection of a heart-wrenching experience that hit close to home. I remember my neighbor, a renal patient, whose life was cut short by vancomycin resistance – a stark reminder of the urgency and devastation wrought by antimicrobial resistance (AMR). His passing was probably 15 to 20 years premature and is a painful testament to the critical need for antibiotic stewardship.

My neighbor's story is not unique, but it represents millions affected by AMR. As a healthcare professional, witnessing his struggle and untimely passing was a turning point for me. It underscored the dire consequences of mismanaged antibiotic treatments and the importance of accurate diagnostics. This report is dedicated to his memory, to all those who have suffered, and to those who have lost a loved one as a result of AMR.

Recognizing the gravity of this crisis, we conducted a national survey of 1,002 Americans to further aid in raising awareness. This report shares critical insights from that research, including perspectives from medical professionals and the general public. It underscores the need for a more cautious approach to prescribing antibiotics, as echoed by nearly three-quarters of Americans in our survey.

Our research reveals that 52% of Americans are 'Very concerned' or 'Extremely concerned' about the effects of infections caused by antimicrobial-resistant bacteria on their current or future health. This report is a testament to their concerns.

Marking WHO's World AMR Awareness Week (WAAW), this report is a call to action for healthcare providers and the public alike. By educating ourselves, adhering to medical guidelines, and advocating for patient safety, we can extend lives and preserve the efficacy of life-saving antibiotics. Let's turn our collective grief into a force for change and ensure that no more lives are cut short by AMR.

Go Blue and Warmest Regards,
Tammy Johnson, RN, BS, CPM, Magnolia Medical Technologies

AMR: A GROWING THREAT

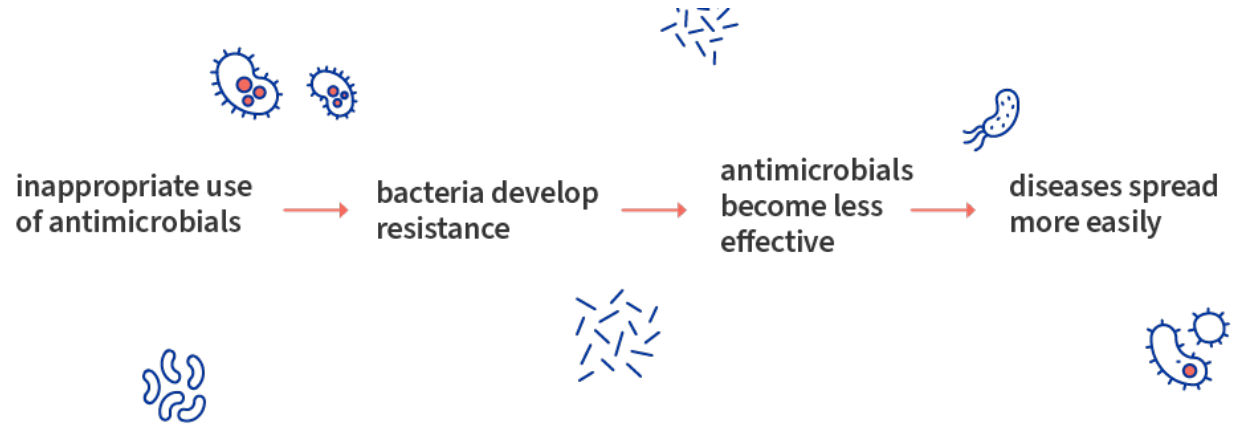
"We're on the cusp of returning to the dark days before antibiotics enabled safer surgery, chemotherapy, and the care of premature infants. We're losing our first-line antimicrobials... Replacement treatments are more costly, more toxic, need much longer durations of treatment, and may require treatment in intensive care units."

– Dr. Margaret Chan, Former Director-General of the World Health Organization

The World Health Organization (WHO) lists antimicrobial resistance (AMR) among the top 10 global public health threats facing humanity.[1] AMR is a condition that occurs naturally when bacteria, viruses, fungi, and parasites evolve over time and no longer respond to medicines making infections harder or impossible to treat for humans, animals, and plants.

In 2019 alone, 1.27 million deaths were attributed to drug-resistant infections globally. This is projected to explode to 10 million deaths by 2050. AMR is projected to create an overall cost of $100 trillion to the global economy by 2050.[2]

How AMR Usually Develops Over Time



Council of the European Union: https://www.consilium.europa.eu/en/infographics/antimicrobial-resistance/

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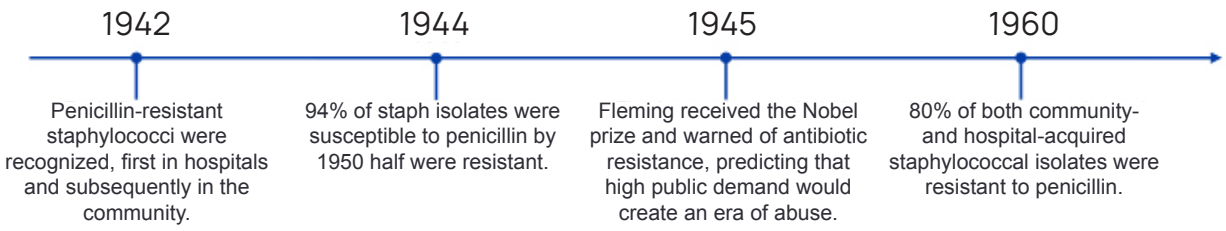
1 https://www.who.int/news-room/fact-sheets/detail/antimicrobial-resistance
2 https://www.uicc.org/what-we-do/areas-focus/antimicrobial-resistance-amr/world-antimicrobial-awareness-week-waaw#:~:text=World%20Antimicrobial%20Awareness%20Week%20(WAAW)%20is%20celebrated%20from%2018%2D,and%20understanding%20of%20antimicrobial%20resistance

Antimicrobial resistance began with the administration of a “miracle” drug to Anne Miller in 1942. Anne was the first patient ever treated and saved with penicillin, the world’s first antibiotic. By 1944, almost all staph isolates were susceptible to penicillin. Astonishingly by 1950, only six years later, half of all staph isolates were already resistant to penicillin.

The Start of Resistance



This pattern of resistance, first emerging in hospitals and then spreading to the community, is now a well-established pattern that recurs with each new wave of antimicrobial resistance.

Lobanovska, Yale J Biol Med. 2017 Mar; 90(1): 135-145. Published online 2017 Mar 29
J Antimicrob Agents 2000 Nov16 Suppl 1:53-10; doi: 10.1016/s0924-8579(00)00299-5. Antibiotic resistance staphylococci WHO A summary of events in the antibiotic-resistance timelinez

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As antibiotics became more popular, widely available, and widely administered, an increasing number of bacterial strains began to show signs of resistance. Today, AMR is outpacing the scientific community’s ability to develop new antibiotics. Daptomycin, which was discovered over 40 years ago, was the last new class of antibiotics developed.

This is alarming given the reliance of so many critically ill patients on antibiotic therapy.

AMR Impact to Patients

Organ transplant

>33,000 organ transplants were completed in 2016/US

Chemotherapy

>650,000 people receive outpatient chemotherapy each year/US

Chronically ill

~30,000,000 with diabetes

Renal patients

>500,000 received dialysis in 2016/US

Richard Baltz, Pewtrusus.org lead developer of Daptomycin Llor, Carl Ther Adv Drug Saf 2013 Dec; 5(6):229-241
Milken Institute School of Public Health Antibiotic Resistance Action Betwork 2019 AR Threat Report CDC

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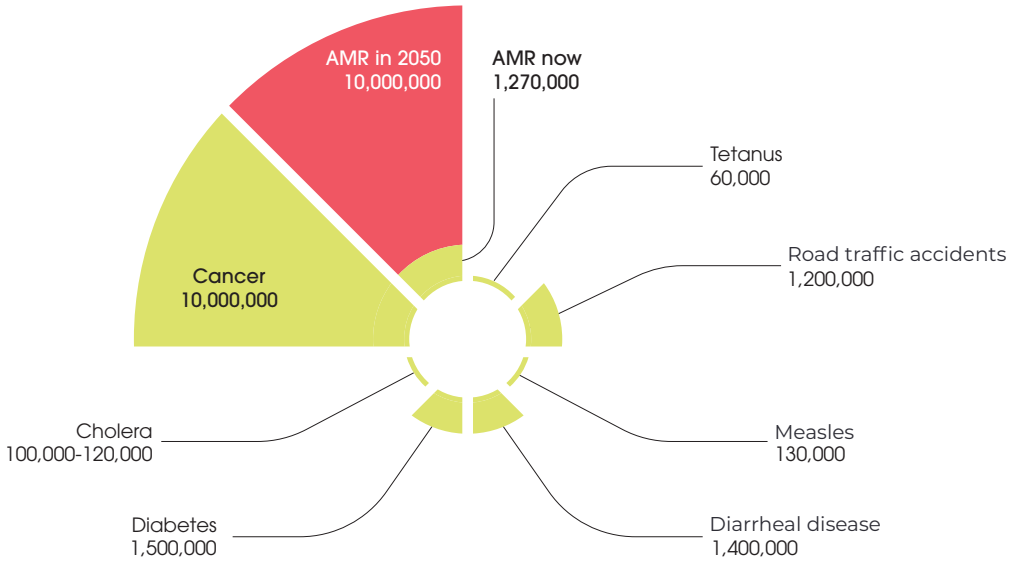
These patients will be at extreme risk for increased morbidity. It not only impacts these critically-ill patients but also patients with traditional infections that could be treated with antibiotics. It is predicted that by 2050, AMR infections will tie with cancer as a leading cause of death, far outpacing other causes, such as diabetes and road traffic accidents.[3]

Wealthy countries, like the United States will not be immune to the global reach of AMR. The CDC reports that at least 2.8 million Americans are infected with antibiotic-resistant germs annually with at least 35,000 dying because of these infections.[4]

AMR is a global threat that is indiscriminate in who it impacts. In response to the growing global threat of AMR, we support more education and initiatives like the WHO's World AMR Awareness Week (WAAW), which encourages everyone to take action to stem the tide of AMR.[5]

2050 Predicted Mortality from AMR Compared to Other Leading Causes of Death



UN Environment Programme. 'Antimicrobial resistance: a global threat': https://www.unep.org/explore-topics/chemicals-waste/what-we-do/emerging-issues/antimicrobial-resistance-global-threat#:~:text=The%20World%20Health%20Organization%20(WHO,development%2C%20and%20equity%20within%20societies

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WORLD ANTIMICROBIAL AWARENESS WEEK
18-24 NOVEMBER

"Antimicrobial resistance is a complex problem that requires a multifaceted, global response."

– Dr. Tedros Adhanom Ghebreyesus, Director-General of WHO, during a WAAW campaign.

3 https://amr-review.org/sites/default/files/AMR%20Review%20Paper%20-%20Tackling%20a%20crisis%20for%20the%20health%20and%20wealth%20of%20nations_1.pdf
4 https://www.cdc.gov/drugresistance/pdf/5-Things-To-Know-H.pdf
5 https://www.who.int/campaigns/world-antimicrobial-awareness-week

INACCURATE DIAGNOSTIC TEST RESULTS CONTRIBUTE TO AMR

"The greatest medicine of all is to teach people how not to need it."

- Hippocrates

Many of the initiatives recommended to mitigate the rise of AMR during WAAW are focused on the proper use of antibiotics after prescription. However, there's a more fundamental opportunity - should antibiotics have been prescribed in the first place?

The CDC projects that at least 28% of antibiotics prescribed in the outpatient situation are unnecessary.[6] This is a gross misuse of antibiotics which contributes to AMR.

In the in-patient setting, infections are commonplace. One of the most serious types are bloodstream infections, leading to sepsis, which carry an increased risk for in-patient mortality or morbidity. Blood cultures are the gold-standard test for determining if a patient has a bloodstream infection caused by bacteria or fungi.[7]

However, up to **40% of positive blood culture results can be false positives due to potential contaminants that reside on the patients' skin**.[8] Given the severity of bloodstream infections and the uncertainty of the test results, these patients may be subjected to extended, unnecessary treatment with powerful antibiotics that:

- Disrupts their healthy gut microbiome, which subsequently causes a dysregulation of their immune system
- Results in acute kidney injury
- Extends length of hospitalization and increases risk of exposure to other infections
- Increases the costs of hospitalization

The Human Cost of AMR

SECONDARY INFECTION

3 Million +

antibiotic-resistant and C. difficile infections each year and 48,000 people die based on the CDS's 2019 report.

ADVERSE DRUG EFFECTS

1 in 5 Patients

experience adverse drug event (ADE) associated with antibiotic administration in acute care hospital setting.

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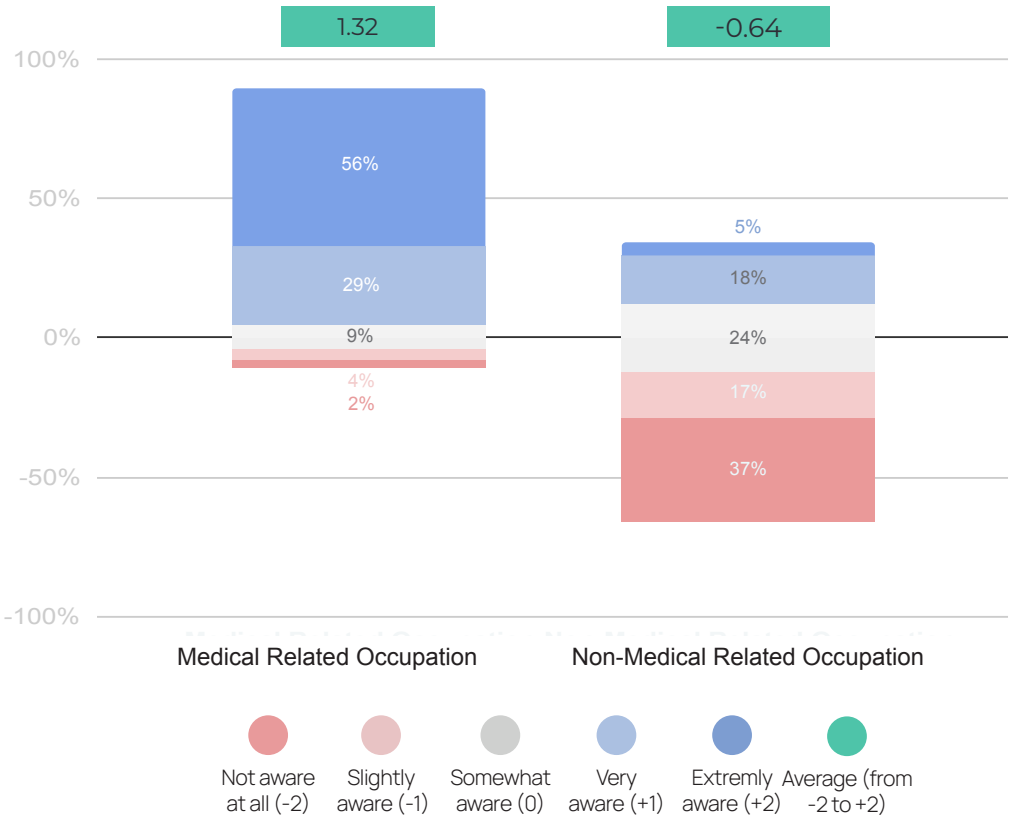
6 https://www.cdc.gov/antibiotic-use/data/outpatient-prescribing/index.html
7 https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7143506/#:~:text=The%20current%20gold%20standard%20in,as%20BACTEC%20(Becton%20Dickinson)
8 https://www.atsjournals.org/doi/full/10.1513/AnnalsATS.201910-757RL

Not only is this experience extremely detrimental to the patient, but it is also costly to the healthcare system and contributes to AMR.

Individuals who work in medical related occupations are very aware that inaccurate results from a blood culture test can lead to the unnecessary administration of antibiotics. Their level of awareness is elevated as compared to those who work in non-medical related fields. There is a significant educational gap that needs to be bridged.

How aware are you that inaccurate results from a blood culture test can lead to unnecessary administration of antibiotics?



Note: Magnolia Medical Research, June 2023, N=1002, all respondents. Averages were calculated by coding responses from a -2 to +2 to scale

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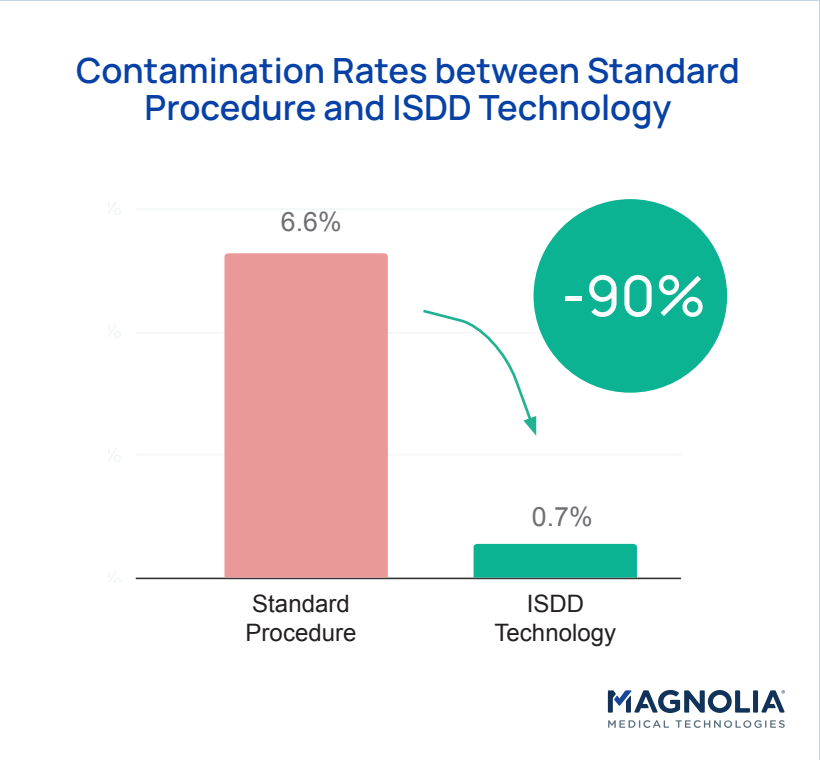
In addition to awareness and education, technology solutions exist that can improve the accuracy of critical tests like blood cultures and ultimately contribute to antimicrobial stewardship.

One example is the initial specimen diversion device (ISDD), which has been clinically proven to increase the accuracy of blood cultures. A 2021 study published in the *Journal of Hospital Infection*, reported an incredible 90% reduction in blood culture contamination rate using the ISDD, Steripath.

More importantly, this directly contributed to a 31.4% decrease in vancomycin days of therapy hospital-wide by, stopping the risk for misdiagnosis at the source.[9]



"Using solutions that prevent the administration of unnecessary antibiotics may be one of the best approaches. Not only do they prevent additional burden to the healthcare system, they also align with one of the philosophical pillars of medicine - first do no harm.

– Tammy Johnson, RN, BS, CPM, Magnolia Medical Technologies

9 Journal of Hospital Infection, 2021. Initial Specimen Diversion Device® reduces blood culture contamination and vancomycin use in academic medical centre: https://www.sciencedirect.com/science/article/pii/S0195670121003819

THE KNOWLEDGE GAP: AMR AWARENESS

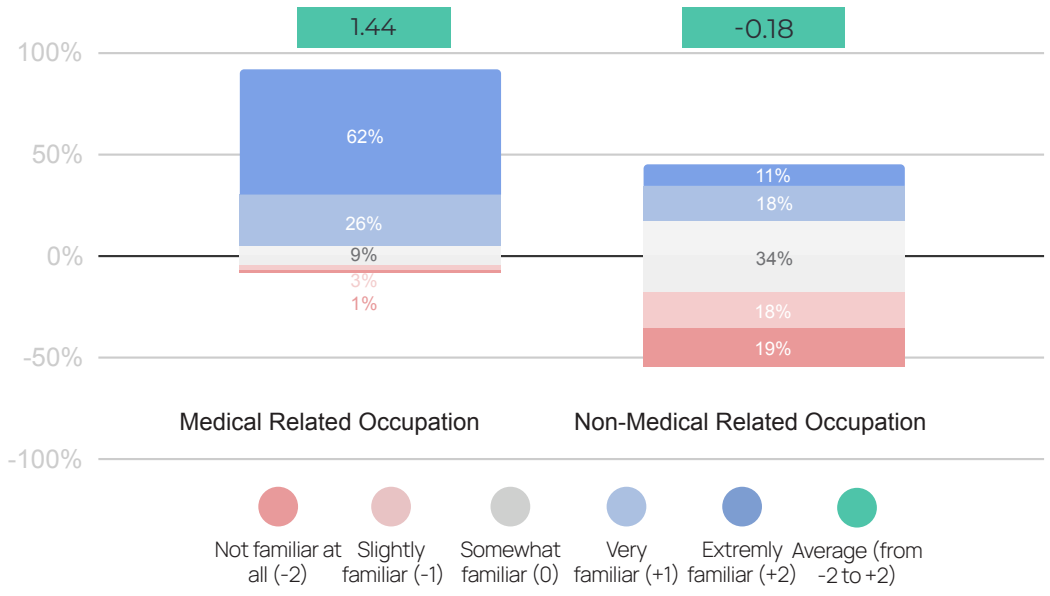
"Problems cannot be solved at the same level of awareness that created them."

-Albert Einstein

One of the primary objectives of the "Go Blue" campaign is to raise awareness of AMR. In the United States, a clear divide exists between individuals who work in medical related occupations and those who do not regarding their familiarity with the term "antimicrobial-resistant bacteria."

Individuals who work in medical related occupations are nine times more familiar with the term compared to those who work in non-medical related occupations.

How would you rate your familiarity with the term "antimicrobial-resistant bacteria"?



Note: Magnolia Medical Research, June 2023, N=1002, all respondents. Averages were calculated by coding responses from a -2 to +2 to scale

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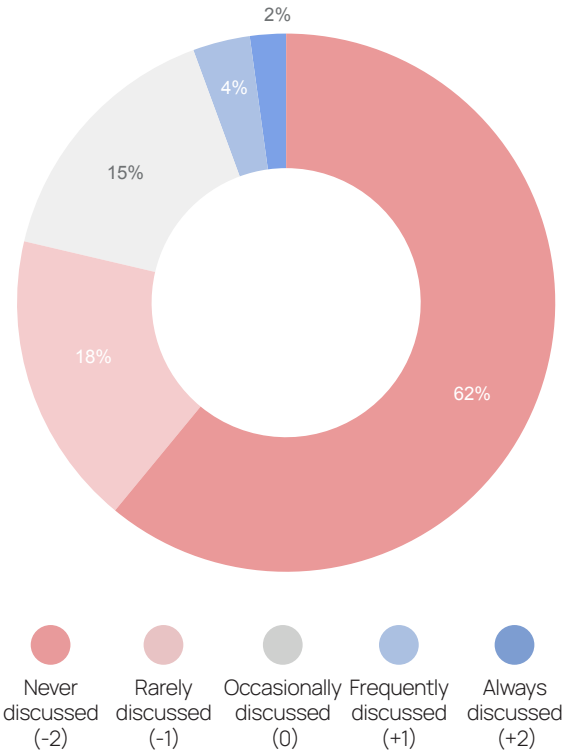
AMR cannot be fully addressed until there is more education to raise the overall level of understanding of this issue among the U.S. populace. For example, individuals who have non-medical related professions rarely raise the topic of antimicrobial resistance with their healthcare providers. In fact, almost 2 out of 3 have never discussed it.

This appears to be driven by the knowledge gap of AMR because when this same question was posed to individuals who work in healthcare, the percentage who never discussed AMR dropped by nearly 50%.

Have you discussed antimicrobial-resistant bacteria with your healthcare provider? [Non-Medical Related Occupation Only]



Note: Magnolia Medical Research, June 2023, N=1002, all respondents

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On average, non-medical related individuals are only slightly aware that inaccurate blood culture results can lead to the unnecessary administration of antibiotics. For respondents with medical related experience, they were on average very aware that inaccurate blood culture results can lead to unnecessary administration of antibiotics.

AMR EDUCATION IMPERATIVE

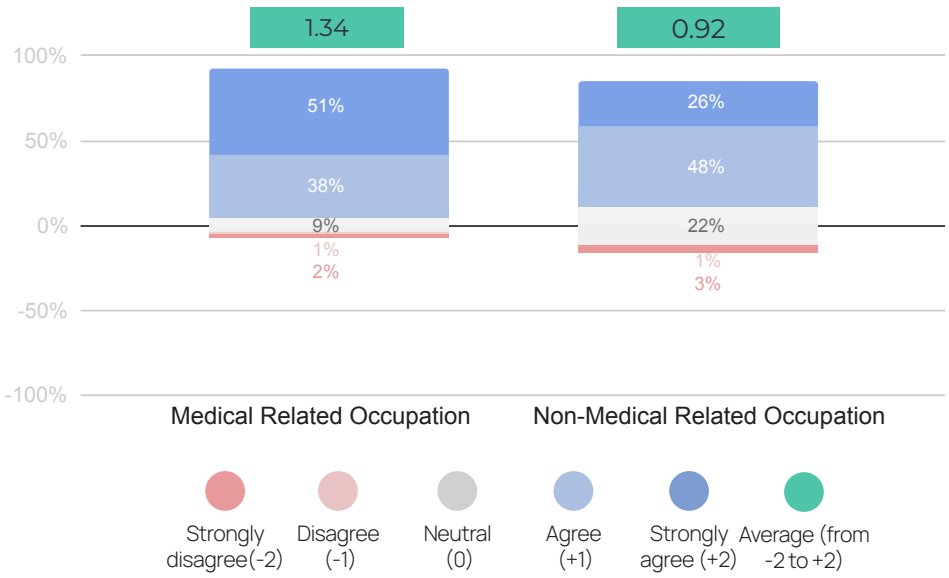
"Education is the kindling of a flame, not the filling of a vessel."

-Socrates

There is broad support for additional education on the consequence of AMR on the effectiveness of patient treatments.

Given that healthcare providers see the devastating impact of AMR first hand, it's no surprise that those respondents with medical related professions had a higher level of agreement with the statement that "more education is needed for patients about antimicrobial-resistant bacteria," with 51% strongly agreeing as compared to 26% for those respondents without medical related occupations.

To what extent do you agree with the statement: "More education is needed for patients about antimicrobial-resistant bacteria."



Note: Magnolia Medical Research, June 2023, N=1002, all respondents. Averages were calculated by coding responses from a -2 to +2 to scale

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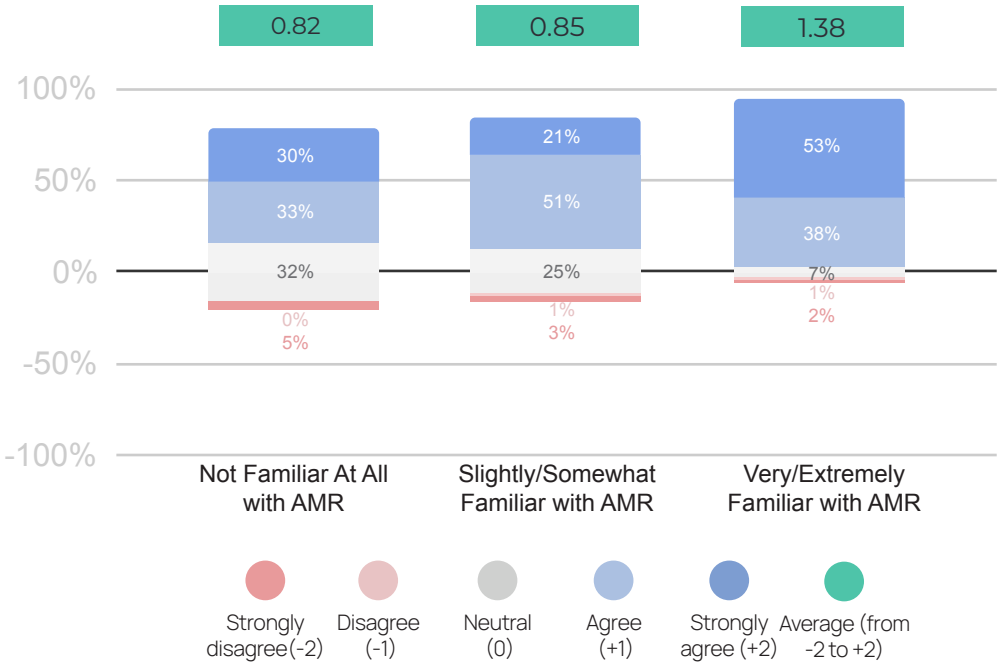
It is also clear that a higher level of familiarity with the term AMR translates to a stronger level of agreement with that statement.

To what extent do you agree with the statement: "More education is needed for patients about antimicrobial-resistant bacteria."



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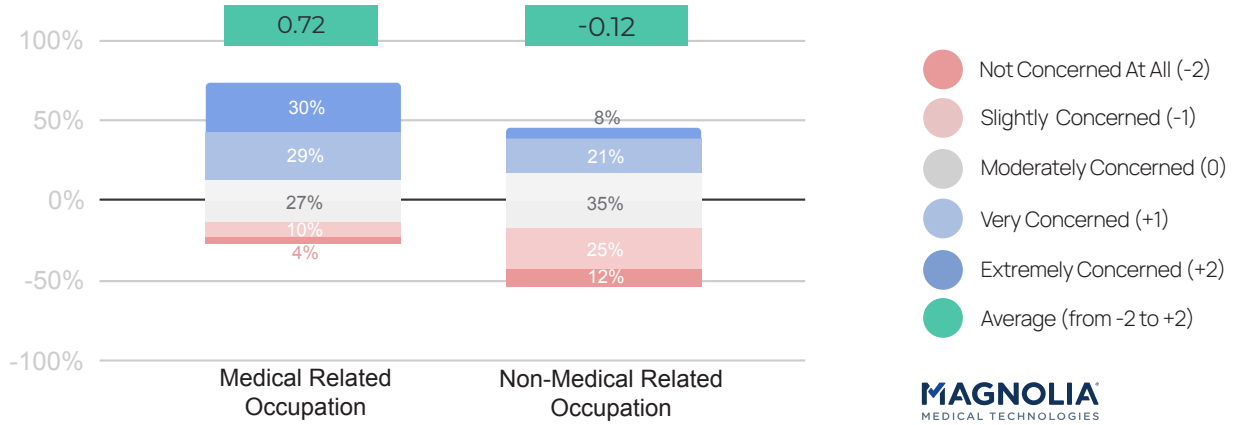
> The fight against antibiotic-resistant bacteria requires not just medical solutions, but educational ones – informing healthcare providers and the public about when and how to use antibiotics."
>
> – Centers for Disease Control and Prevention (CDC)

Beyond the need for more AMR education, medical professionals are five times more concerned about the effects of infections caused by antimicrobial-resistant bacteria on their current and future health than non-medical professionals.

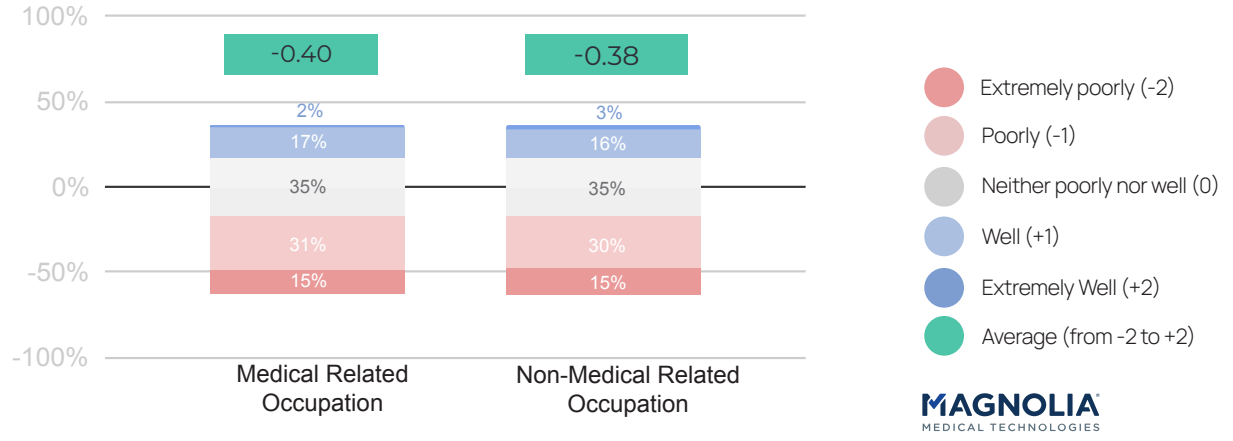
Given the timeline for penicillin discovery to penicillin resistance, this concern could become an unfortunate reality as we witness the evolution of infections that once responded positively to antibiotics become immune to the same antibiotics today.

How concerned are you about the effects of infections caused by antimicrobial-resistant bacteria on your current or future health?



Addressing the AMR crisis requires governmental agencies to support education programs and patient safety initiatives that incentivize the healthcare system to prioritize the accuracy of critical diagnostic tests, like blood cultures. As demonstrated in the 2021 *Journal of Hospital Infection* study, the accuracy of blood culture results has been directly tied to a reduction in the unnecessary administration of antibiotics. However, the perception among respondents is that the U.S. government is not doing enough to safeguard the health of hospitalized Americans.

In your opinion, how well is the government performing in terms of protecting the health of Americans in hospitals?



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UNITING FOR CHANGE

"One person can make a difference, and everyone should try."

-Socrates

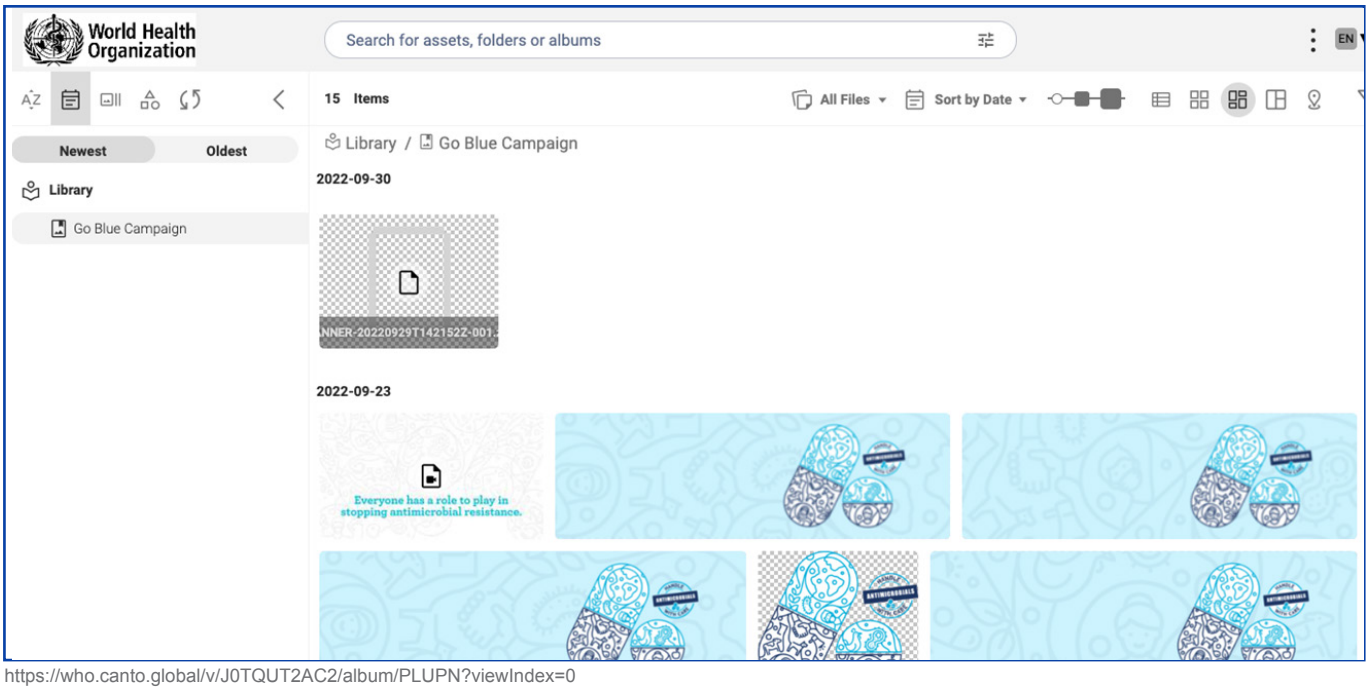
In the face of such a daunting challenge and the perceived lack of action by governmental agencies, it is easy to become complacent or paralyzed into non-action. You may be asking yourself - "what can I really do to affect change?"

We strongly believe that the collective actions of each individual can play a major role in slowing the pace of resistance. You can contribute to the fight against AMR in several ways.

1 Raise AMR Awareness by "Going Blue for AMR."

The WHO provides many free backgrounds that can be used to update personal social media profiles. These backgrounds can be applied to LinkedIn, Facebook, Twitter / X, TikTok, Instagram, etc.

Moreover, consider reaching out to your corporate social media account manager, to see if they would be willing to do the same for WHO WAAW from November 18 to November 24, 2023.



https://who.canto.global/v/J0TQUT2AC2/album/PLUPN?viewIndex=0

2 Approach to antibiotics.

Always see a medical professional to determine if you need antibiotics in the first place.

If one needs antibiotics, here's a set of guidelines to follow from the NHS:

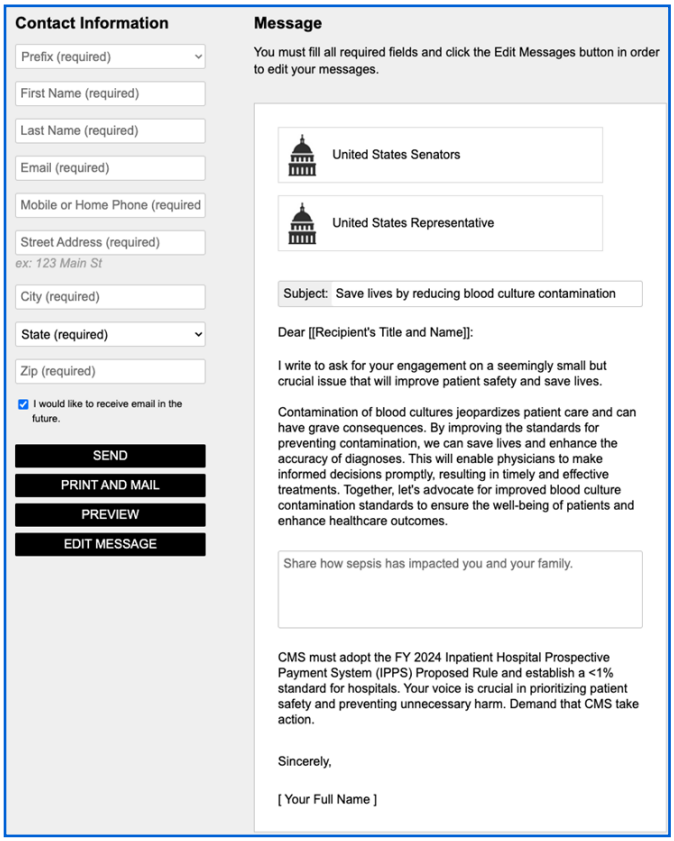
- only use antibiotics when recommended by a healthcare professional
- follow the expert advice of your healthcare professional
- complete your full course of medication when these are advised for you as not taking the full course of antibiotics can mean that bacteria get a chance to develop resistance
- never save antibiotics for the future or to share with friends and family
- dispose of any unused medicines safely at your local pharmacy to protect the environment, never bin or flush

3 Advocate for more accurate blood culture diagnostic standards.

False-positive blood culture results, obtained for life-threatening conditions, can average up to 40% false positives. This often results in patients receiving unnecessary, powerful antibiotics for an extended period of time.

This can be likened to a world where 40% of those who test positive for cancer are misdiagnosed and mistakenly receive chemotherapy for cancer.

You can advocate for important patient safety measures that protect patients when they are most vulnerable, Visit VoicesOfSepsis.org to learn more and share your support for these initiatives with your congressional representatives.



As I recall the untimely passing of my neighbor, a victim of AMR, his story fuels our mission. His loss, far too early and entirely preventable, serves as a poignant reminder of the stakes we face. This report is more than data and recommendations; it's a tribute to his memory and a call to action. We must act decisively to preserve the power of antibiotics.

Our collective response can make a difference. By raising awareness, especially during 'Go Blue' week, and adhering to medical guidance, we each play a crucial role. This battle is not just medical; it's a commitment to our shared future. United, we can turn our grief into a powerful force for change, ensuring that the tragedy of AMR does not repeat. Let's pledge to protect our health legacy, inspired by the lives touched by AMR.

– Tammy Johnson, RN, BS, CPM, Magnolia Medical Technologies

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