**Original Research Article**

**Evaluating Antibiotic Use, Misuse, and Resistance Awareness Among University Students in Northern Cyprus: A Cross-Sectional Study**

**Abstract**

Antibiotic resistance is a growing threat to global health, largely driven by the misuse of antibiotics. Understanding how young adults, particularly university students, use and perceive antibiotics is essential, as their habits can shape lifelong health behaviors. This study explored the knowledge, attitudes, and practices surrounding antibiotic use and resistance among 161 university students from various academic backgrounds in Northern Cyprus.

A structured questionnaire, based on the World Health Organization’s Knowledge, Attitudes, and Practices framework, collected information on students’ demographics, antibiotic use patterns, reasons for unsupervised use, and awareness of antibiotic resistance. The data were analyzed using descriptive statistics, Chi-Square tests, and Multiple Linear Regression.

Results showed that 68 percent of students had used antibiotics in the past year, yet only 44 percent knew how long a course should last. The Chi-Square analysis revealed important associations: gender significantly influenced understanding of when to stop antibiotics, age was linked to beliefs about which illnesses antibiotics can treat, and nationality affected patterns of use. Academic department and year of study were also connected to whether students received formal education on resistance and their views on reusing antibiotics. The regression analysis highlighted that formal education strongly predicted both awareness of resistance and responsible use of antibiotics.

These findings point to the need for better, targeted educational efforts to close knowledge gaps and correct misconceptions. Educational programs that consider students’ age, gender, nationality, and field of study could play a key role in promoting responsible antibiotic use and addressing the serious challenge of antibiotic resistance.

**Keywords:** Antibiotic Resistance, Antibiotic Misuse, University Students, Northern Cyprus, Cross-Sectional Study, Public Health, KAP, Multiple Linear Regression.

**1. Introduction**

The discovery of antibiotics during the 20th century was nothing short of revolutionary. It transformed our ability to treat infectious diseases, dramatically improving health and saving countless lives worldwide. Yet, the very success of these drugs has led to a new challenge: their extensive, and sometimes thoughtless, use has spurred bacteria to evolve, giving rise to strains resistant to our best treatments (1, 4). This trend, known as antibiotic resistance (AR) or antimicrobial resistance (AMR), has escalated into a pressing global health crisis.

The World Health Organization (WHO) doesn't mince words, identifying AMR as a top-tier threat to global health, food systems, and development today (2, 7). The fallout is already apparent: infections that were once simple to manage are becoming harder, sometimes even impossible, to treat. This translates to longer sicknesses, more time spent in hospitals, spiralling healthcare expenses, and, tragically, more deaths (3, 7). With few new antibiotics on the horizon, we face the unsettling possibility of a "post-antibiotic" world where even minor infections could become deadly (9).

Tackling such a multifaceted problem demands action on many fronts, but one crucial area involves understanding and changing human behaviour. How the public thinks about and uses antibiotics their knowledge, attitudes, and practices (KAP) is a key piece of the puzzle. Research consistently shows that educating the public and raising awareness are essential steps towards encouraging people to use antibiotics more wisely (4, 10, 11).

While research in this area is growing, some groups, like university students, haven't received as much attention, especially in unique settings such as Northern Cyprus. University students are an important group they're often setting health habits for life and represent the next wave of professionals and community leaders whose actions will shape future norms (9).

Northern Cyprus, or the Turkish Republic of Northern Cyprus (TRNC), offers a particular context. Its political situation means it's often left out of broad EU and WHO health data projects, creating blind spots in our understanding of issues like antibiotic use (13). What we do know from local studies suggests cause for concern, with reports of high rates of antibiotic misuse, including people getting antibiotics without seeing a doctor (14, 15). Even though rules are now in place to control this, a history of easy access might mean old habits die hard.

This makes it vital to understand how university students in Northern Cyprus view and use antibiotics. This study aims to bridge this knowledge gap. We specifically want to find out:

What do university students in Northern Cyprus actually know about using antibiotics correctly and about the problem of resistance?

What are their attitudes towards antibiotics, and how do they really use them including common misuses like taking them without a prescription, sharing them, or not finishing the course?

Are there links between who the students are (their gender, age, nationality, field of study, etc.) and what they know and do regarding antibiotics? Can these factors help predict their behaviour?

By digging into these questions, we hope to pinpoint exactly where the knowledge gaps and risky behaviours lie. This information will be invaluable for creating educational programs and health campaigns that are targeted, effective, and capable of promoting smarter antibiotic use. Our ultimate goal is to support both local and global efforts in the ongoing fight against antibiotic resistance.

**2. Literature Review**

It’s widely agreed that the core of the antibiotic resistance problem lies in how these essential medicines are used or rather, misused and overused (5, 6). This behaviour chips away at their effectiveness, putting many medical breakthroughs and public health gains at risk (2, 7). It follows, then, that getting a handle on public Knowledge, Attitudes, and Practices (KAP) regarding antibiotics is a cornerstone for building effective stewardship programs (5).

Researchers have explored KAP across many different groups. A study comparing Greece and Turkey, for instance, found that while Greeks knew more, they were also more likely to misuse antibiotics, like dipping into old prescriptions (5). This tells us that knowledge doesn't automatically lead to good practice; context matters, and interventions need to be tailored. In places like Thailand and the UAE, studies found common mistaken beliefs that antibiotics work for colds (viruses) or can treat general pain (6, 7). Similarly, in Colombia, many thought it was fine to stop antibiotics when symptoms ease or use them like painkillers (8). These persistent myths are clear targets for educational efforts.

Who people are and their educational background often shape their antibiotic KAP. In India, science students understood antibiotics better than non-science students (9). An Ethiopian study linked higher education and being in the 26-45 age bracket with greater awareness of AMR (11). Likewise, Colombian research found that higher income and health-related education improved awareness (8). This suggests that education, especially within schools and universities, can make a real difference.

Yet, a persistent "knowledge-practice gap" often surfaces. The Colombian study, for example, noted that even people who knew better still sometimes used leftover antibiotics or pushed pharmacists for them without a prescription (8). This highlights a critical point: just giving people information isn't always enough; we need to understand and address the deeper reasons behind their actions.

Young adults, particularly those in university, are a vital audience for these messages (9). They are at an age where they're cementing their views and behaviours around health. Educating them now can promote responsible antibiotic use for years to come. Studies focusing on university students in places like Lebanon, Bangladesh, and Nepal have found varying KAP levels, but all conclude that more education is needed (3, 10, 26).

Closer to home, research in Northern Cyprus confirms this need. Baddal et al. (14) surveyed students and found knowledge gaps and risky behaviours. Ilktac et al. (15) looked at public awareness more broadly and also found issues with consumption habits. Building on this local and international work, our study aims to provide an up-to-date, in-depth look at the current situation among the diverse student body in Northern Cyprus. By focusing on this specific group, we aim to uncover insights that can help shape effective educational strategies and strengthen the regional response to AR.

**3. Methodology**

3.1. Study Design and Population

To capture a real-time picture of antibiotic knowledge, attitudes, and practices, we used a cross-sectional survey design. Our focus was on university students in Northern Cyprus. This region is home to a large and remarkably diverse student community, with 16 universities hosting over 101,000 students. A striking 87% of these students are international, hailing from more than 135 countries, alongside students from Turkey (55%) and the local Turkish Cypriot community (13%). This diversity was a key consideration in our study.

3.2. Sample Size and Sampling

We calculated our target sample size using the OpenEpi calculator. Based on an estimated 79,801 students, aiming for a 50% outcome frequency (to get the largest possible sample estimate), and setting a 95% confidence level, the ideal sample size came out to 383. While we aimed for this, our final sample size, due to practical collection realities, was 161 students. Although smaller than ideal, this sample still offers a valuable starting point for understanding the situation.

We used a convenience sampling approach to reach students. An online survey link was shared through the researchers' own social media channels Facebook, WhatsApp, Twitter, and Instagram. To reach further, we also used snowball sampling, asking early participants to pass the link along to their friends and classmates.

3.3. Study Tool

Our main tool was a structured, self-administered questionnaire delivered online. We adapted it from the World Health Organization's KAP framework, sharpening its focus on antibiotic use, misuse, and awareness. The questionnaire, presented in English, had five key parts:

**Informed Consent:** Clearly explaining what the study was about, what participation involved, and assuring students that their responses were confidential and their participation was voluntary.

**Demographics:** Questions about age, gender, marital status, living arrangements, income, and nationality.

**Education:** Details on university, department (grouped as health or non-health related), and year of study.

**Antibiotic Use & Misuse:** Exploring how often students use antibiotics, when they last used them, where they get them from, why they might use them without a prescription, and whether they share or reuse them.

**AR Awareness:** Gauging if they'd heard of AR, if they'd had any formal education about it, and testing their knowledge on key points like when to stop taking antibiotics and what they can treat.

3.4. Pretest and Ethical Considerations

Before launching the full survey, we ran a pretest with a small student group. This helped us check that the questions were clear, relevant, and likely to gather the information we needed. We adhered strictly to ethical guidelines. We secured ethical approval before starting. Every participant saw a detailed consent form and had to agree before they could start the survey, ensuring they knew what they were signing up for. We kept all responses anonymous and confidential.

3.5. Data Analysis

Once we had the data, we cleaned, coded, and analyzed it using IBM SPSS Statistics. Our analysis followed these steps:

**Descriptive Statistics:** We calculated basics like frequencies and percentages to paint a picture of our sample group and give an overview of their antibiotic KAP.

**Chi-Square Tests:** We used these tests to look for statistical links between who the students were (their demographics) and what they knew or did about antibiotics. We considered a p-value below 0.05 as a sign of a significant association.

**Multiple Linear Regression (MLR):** We took the analysis a step further with MLR. This helped us see how well various factors (like demographics and education) could predict students' awareness and behaviour regarding antibiotics. We used R-squared (R2) to see how much of the variation our model could explain and RMSE to check how accurate its predictions were. We split our data into training and testing sets to make sure our models weren't just fitting the initial data but could actually predict outcomes.

**4. Results**

Our survey captured responses from 161 university students. Here, we present the key findings, starting with who participated, moving to their antibiotic use and knowledge, and finishing with statistical analyses that explore the underlying relationships.

4.1. Who Participated? (Demographic Profile)

Our student sample was slightly weighted towards males (56.5%). The largest cohort was young adults aged 18-24 (62.7%). Most were single (93.2%) and tended to live in apartments. A significant majority (78.3%) described their income level as 'medium'. Reflecting the local university makeup, an overwhelming 97.5% were international students. When it came to health information, doctors remained the top source (43.5%), though the internet was also popular (20.5%). Very few (5.3%) reported any chronic health conditions. Students primarily came from Near East University (61.1%) and Cyprus International University (30.1%). They were spread across different study years, but with a concentration in the fourth (21.1%) and sixth (19.9%) years. Crucially, a large proportion (70.8%) were studying in health-related fields. (See Table 1 for a summary).

**Table 1. Summary of Participant Demographics (N=161)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Characteristic** | **Category** | **Frequency** | **Percent (%)** |
| **Gender** | Male | 91 | 56.5 |
|  | Female | 70 | 43.5 |
| **Age Group** | 18-24 | 101 | 62.7 |
|  | 25-34 | 52 | 32.3 |
|  | 35-44 | 8 | 5.0 |
| **Marital Status** | Single | 150 | 93.2 |
|  | Married/Other | 11 | 6.8 |
| **Income Level** | Low | 24 | 14.9 |
|  | Medium | 126 | 78.3 |
|  | High | 11 | 6.8 |
| **Nationality** | International | 157 | 97.5 |
|  | Turkish/Cypriot | 4 | 2.5 |
| **Health Info Source** | Doctor/Provider | 70 | 43.5 |
|  | University Service | 32 | 19.9 |
|  | Family/Friends | 26 | 16.1 |
|  | Internet | 33 | 20.5 |
| **Department** | Health-Related | 114 | 70.8 |
|  | Non-Health-Related | 47 | 29.2 |
| **Year of Study** | 1st - 3rd | 57 | 35.4 |
|  | 4th - 6th | 79 | 49.1 |
|  | Graduates | 25 | 15.5 |

4.2. Antibiotic Use, Knowledge, and Attitudes

It's clear that antibiotics are a familiar medication for these students; nearly 69% had taken them at least occasionally in the last year. When asked how recently, 23.0% said within the last six months, and 15.9% within the last month.

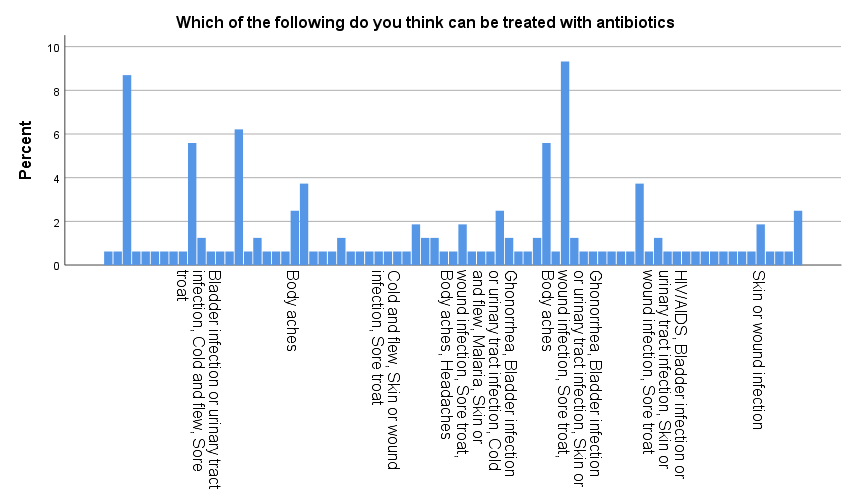
A key area of concern is *how* students get antibiotics. While 57.8% followed the proper route (prescription), a worrying 21.1% admitted to buying them without one, and 6.2% got them from friends or family. Why did they bypass prescriptions? The main reasons were that symptoms felt mild (40.7%), they had leftovers (18.6%), or it was simply faster and easier (12.4%).

Awareness of AR isn't entirely absent 72.7% had heard of it, and 60.9% had even received some formal education on it. But this awareness didn't always translate to solid knowledge. While a good number (76.4%) knew they should finish the whole course, 13.0% still thought stopping when feeling better was okay. Misguided practices were also common: a striking 70.2% believed it was acceptable to use someone else's antibiotics for the same illness, and 39.8% saw no issue in reusing an old prescription if symptoms seemed similar. (See Table 2).

**Table 2. Key Findings on Antibiotic Use, Knowledge, and Attitudes (N=161)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Variable** | **Response** | **Frequency** | **Percent (%)** |
| **Used in Past Year** | Yes (Occasionally to Always) | 111 | 68.9 |
|  | No (Never) | 50 | 31.1 |
| **Source of Antibiotics** | Prescribed by Provider | 93 | 57.8 |
|  | Bought (No Prescription) | 34 | 21.1 |
|  | Given by Friend/Family | 10 | 6.2 |
|  | Other | 24 | 14.9 |
| **Heard of AR?** | Yes | 117 | 72.7 |
|  | No | 44 | 27.3 |
| **Formal Education on AR?** | Yes | 98 | 60.9 |
|  | No | 63 | 39.1 |
| **When to Stop?** | Finish Dosage | 123 | 76.4 |
|  | Feel Better | 21 | 13.0 |
|  | Don't Know | 17 | 10.6 |
| **Use Friend's ABX?** | Yes | 113 | 70.2 |
|  | No | 30 | 18.6 |
|  | Don't Know | 18 | 11.2 |
| **Reuse Same ABX?** | Yes | 64 | 39.8 |
|  | No | 65 | 40.4 |
|  | Don't Know / Ask Doctor | 32 | 19.8 |

When asked what antibiotics treat, there was significant confusion (Figure 1). While many knew they work for bacterial issues like UTIs (59.8%) and skin infections (55.4%), many also thought they'd work for colds and flu (37.5%) which are viral – or even for body aches (24.1%) and headaches (15.2%).

Figure 1. Perceived Conditions Treatable with Antibiotics (% of N=161)

4.3. Exploring Connections (Chi-Square Tests)

To dig deeper, we looked for connections between student characteristics and their antibiotic KAP. We found several significant links (Table 3):

**Gender:** It mattered when it came to knowing *when to stop* (p<0.001), with females showing significantly better understanding. Gender also linked to AR awareness (p=0.011), having had formal education (p=0.016), and views on using others' antibiotics (p=0.008).

**Age:** Seemed to affect beliefs about *what antibiotics treat* (p=0.03), with younger students holding more misconceptions.

**Nationality:** Was connected to *why students took antibiotics* (p=0.02) and their beliefs about *treatable conditions* (p=0.01), suggesting cultural or background influences.

**Year of Study:** Directly impacted whether students had *received formal AR education* (p=0.01), with those further along in their studies more likely to have done so.

**Department:** Showed strong links to *when to stop* (p=0.01), *reusing antibiotics* (p=0.03), and *treatable conditions* (p<0.001), clearly indicating that students in health fields had a better grasp.

**Table 3. Summary of Significant Chi-Square Test Results (p<0.05)**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Independent Variable** | **Dependent Variable** | **Chi-Square Value** | **df** | **p-value** | **Key Observation** |
| Gender | When to Stop Taking ABX | 18.860 | 2 | <0.001 | Females demonstrated better knowledge. |
| Gender | AR Awareness | 6.470 | 1 | 0.011 | Females showed higher awareness. |
| Gender | Formal Education | 5.797 | 1 | 0.016 | Females more likely to have received education. |
| Gender | Use Friend's ABX | 9.593 | 2 | 0.008 | Attitudes differed significantly by gender. |
| Age Group | Treatable Conditions | 153.328 | 148 | 0.03\* | Younger students held more misconceptions. |
| Nationality | Occasion for Taking ABX | 139.14 | 108 | 0.020 | Reasons for use varied with nationality. |
| Nationality | Treatable Conditions | 1800.77 | 1647 | 0.010 | Beliefs about effectiveness varied with nationality. |
| Year of Study | Formal Education | 27.47 | 12 | 0.010 | Senior students had higher rates of education. |
| Department | When to Stop Taking ABX | 101.13 | 69 | 0.010 | Health students understood duration better. |
| Department | Reuse Same ABX | 119.12 | 92 | 0.030 | Health students less likely to approve reuse. |
| Department | Treatable Conditions | 1575.93 | 1403 | <0.001 | Health students had clearer understanding. |

4.4. Predicting Behaviour (Multiple Linear Regression - MLR)

Our MLR models aimed to see what best predicts antibiotic awareness and behaviour (Table 4).

**AR Awareness:** The model did a great job (R2=0.914), showing that factors like education and gender strongly predict whether a student is aware of resistance.

**Formal Education on AR:** This model was incredibly strong (R2=0.954), confirming that having formal education is almost perfectly predicted by the factors we looked at – meaning education itself is a key measurable input.

**When to Stop:** This model explained a lot (R2=0.811), but the higher error rate (RMSE 0.605) suggests that even with education, there's still confusion about this crucial point.

**Using Others' ABX:** The model predicted this well (R2=0.873), but the fact that it happens often suggests something beyond knowledge drives this risky behaviour.

**Reusing Same ABX:** This model (R2=0.813) had the highest error (RMSE 0.952), showing that while we can predict some of it, reusing old antibiotics is a complex behaviour influenced by many, perhaps unpredictable, factors.

**Table 4. Summary of Multiple Linear Regression (MLR) Testing Results**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Dependent Variable** | **R²** | **R** | **MSE** | **RMSE** | **Interpretation** |
| Antibiotic Resistance Awareness | 0.914 | 0.956 | 0.148 | 0.385 | Highly predictable; Education & gender are key. |
| Formal Education on AR | 0.954 | 0.977 | 0.074 | 0.272 | Education is a very predictable factor. |
| When to Stop taking Antibiotics | 0.811 | 0.901 | 0.366 | 0.605 | Predictable, but significant knowledge gaps remain. |
| Usage of Antibiotic Obtain from Someone | 0.873 | 0.934 | 0.281 | 0.530 | Predictable, but behaviour persists. |
| Usage of same antibiotics | 0.813 | 0.902 | 0.907 | 0.952 | Predictable, but highly variable in practice. |

In essence, the MLR confirms that formal education is hugely influential, especially for awareness. However, when it comes to *actual behaviour*, things get fuzzier, suggesting that knowledge alone isn't the whole story.

**5. Discussion**

Our exploration into the antibiotic habits of university students in Northern Cyprus paints a complex, and at times, worrying picture. While students aren't entirely unaware of antibiotic resistance, there's a clear disconnect between general awareness and specific knowledge, and an even wider gap when it comes to actual practice. These findings resonate with global concerns but are also shaped by the unique demographic and educational setting of Northern Cyprus. Here, we discuss what our results mean, how they fit with other research, and what makes them particularly important, especially the insights from our regression analysis.

5.1. The Pervasiveness of Antibiotic Use and Misuse

Finding that over two-thirds of students used antibiotics in a year isn't necessarily surprising, but it does show how deeply these drugs are embedded in their healthcare experience. The real concern lies in how they're used. The fact that more than one in four students got antibiotics without seeing a doctor is a significant red flag. This mirrors trends seen locally (4, 14) and internationally (8, 16), hinting that efforts to control non-prescription access aren't fully succeeding, or at least aren't changing ingrained behaviours. When students say they self-medicate for 'mild symptoms' or because it's 'faster', it points to a need for education not just about what antibiotics do, but when professional medical advice is truly needed. Using leftovers adds another layer to this misuse, often driven by a mix of convenience and perhaps a misunderstanding of how specific infections need specific treatments.

5.2. The Reality of Knowledge Gaps

It's one thing to have heard of antibiotic resistance; it's another to understand its implications and the actions needed to prevent it. Our study shows this gap clearly. Less than half knew the correct stopping rule a fundamental aspect of responsible use. The widespread acceptance of sharing antibiotics (70.2%) is particularly alarming, suggesting a lack of understanding about individual prescriptions and the risks involved. And the persistent confusion over whether antibiotics work for viruses (like colds) shows a basic educational failure that needs immediate attention (6, 8). Even among a group where many study health, these misconceptions thrive, telling us that current educational approaches, if they exist, aren't hitting the mark for everyone.

5.3. Understanding the Influences: Demographics and Education

Our analysis confirms that you can't treat all students as a single group.

**Gender:** Why do females seem to know more? Perhaps they engage more with health information or services (20). Whatever the reason, it suggests that a one-size-fits-all approach to education might miss some male students.

**Age & Experience:** It makes sense that older students might know more (22), but it also means we need to reach younger students *before* poor habits set in.

**Nationality:** The impact of nationality is a crucial reminder that students arrive with diverse backgrounds, beliefs, and healthcare experiences. Educational materials need to be culturally aware and sensitive.

**Education's Power:** The stark difference between health and non-health students, and between junior and senior students, is perhaps the clearest message: *formal education works* (25, 26). When AR is part of the curriculum, students learn. This strongly supports making AR education a standard part of *all* university programs, not just health-related ones.

5.4. What the MLR Adds: Predicting the Future (and the Gaps)

Our MLR analysis takes us beyond simple links. It shows us how strongly these factors predict outcomes. The standout finding is how powerfully formal education predicts awareness (R2=0.954). It’s a clear signal: if we want students to know about AR, we need to teach them.

But the MLR also sounds a note of caution. When we look at actual behaviours like stopping early or reusing drugs the models, while still strong, show more 'noise' (higher RMSE). This is strong evidence for the "knowledge-practice gap" (8). It tells us that while education is essential, it's not a magic bullet. To change behaviour, we likely need to address other drivers: convenience, perceived cost/difficulty of seeing a doctor, peer influences, and perhaps even deeply ingrained cultural habits. Interventions need to be multifaceted, combining education with policy and practical support.

5.5. A Call to Action for Northern Cyprus

These findings carry special weight for Northern Cyprus. Its large international student body is both a challenge and an opportunity. Universities here can become powerful centres for AR education, influencing not just local practice but potentially spreading awareness worldwide as students graduate and move on. We need targeted programs that hit the specific weak spots we've identified. And we need partnerships universities, health authorities, and pharmacies must work together to create a consistent message and enforce sensible rules around antibiotic access.

**6. Conclusion**

In short, our study among university students in Northern Cyprus reveals a concerning reality: while awareness of antibiotic resistance exists, it often doesn't translate into sound knowledge or safe practices. We found widespread antibiotic misuse, driven by significant gaps in understanding and influenced by factors like gender, age, nationality, and, very clearly, a student's educational path. Our regression analysis powerfully confirms that *formal education is a key weapon* in raising awareness. Yet, it also wisely reminds us that *knowledge alone doesn't guarantee responsible behaviour*.

This points to a clear path forward. We urgently need well-designed educational initiatives that:

Go back to basics, clarifying the difference between viruses and bacteria.

Hammer home the importance of finishing every antibiotic course as prescribed.

Emphasize that antibiotics are personal medications, not to be shared or self-prescribed.

Are smart and sensitive, recognizing the diverse backgrounds of the students.

Reach *every* student, regardless of their field of study.

The fight against antibiotic resistance is a marathon, not a sprint. By equipping our university students our future decision-makers with the right knowledge and fostering a culture of responsibility, we can make significant strides. It’s an investment in their health, and in the health of communities in Northern Cyprus and across the globe.

**7. Limitations**

It's important to consider some limitations when interpreting these findings:

**The Sample:** With 161 students reached through convenience and snowball methods, our sample isn't as large or as random as we'd ideally want. This means we should be cautious about saying these results apply to *all* university students in Northern Cyprus. Future work should aim for a larger, more representative group.

**A Snapshot in Time:** Because we surveyed students only once (cross-sectional design), we can't say for sure what causes what, or how things might change over time. We need studies that follow students longer-term to see what really works.

**Honest Answers?** We relied on students telling us what they know and do. It's possible some might have forgotten details or perhaps didn't want to admit to misusing antibiotics (recall or social desirability bias).

**Just Students:** Our findings are about university students. They might not reflect what the general public or healthcare workers in Northern Cyprus know and do.

**Language:** We used English, which is common in these universities but isn't everyone's first language. This might have caused minor issues for some international students.

Despite these points, we believe this research provides a solid starting point and a clear signal that action is needed. It lays the groundwork for future studies that can build on these insights and help us better tackle antibiotic resistance through education.

**8. References**

1. Aggarwal R, Mahajan P, Pandiya S, Bajaj A, Verma SK, Yadav P, et al. Antibiotic resistance: a global crisis, problems and solutions. Crit Rev Microbiol. 2024:1-12.
2. Salam MA, Al-Amin MY, Salam MT, Pawar JS, Akhter N, Rabaan AA, et al. Antimicrobial Resistance: A Growing Serious Threat for Global Public Health. Healthcare. 2023;11(13):1946.
3. Adebisi YA. Balancing the risks and benefits of antibiotic use in a globalized world: the ethics of antimicrobial resistance. Global Health. 2023;19(1):1–7.
4. Sullman MJM, Lajunen TJ, Baddal B, Apostolou M. Antibiotics Knowledge, Attitudes and Behaviours among the Population Living in Cyprus. Antibiotics. 2023;12(5):879.
5. Lajunen TJ, Sullman MJM, Baddal B, Tekeş B, Apostolou M. Antibiotics Knowledge, Attitudes and Behaviours among the Population Living in Greece and Turkey. Antibiotics. 2023;12(8):1279.
6. Niyomyart A, Chow SKY, Bualoy W, Butsing N, Tao X, Zhu X. Antibiotic Knowledge, Antibiotic Resistance Knowledge, and Antibiotic Use: A Cross-Sectional Study among Community Members of Bangkok in Thailand. Antibiotics. 2023;12(8):1312.
7. World Health Organization. Antimicrobial resistance. [Online]. Available from: <https://www.who.int/news-room/fact-sheets/detail/antimicrobial-resistance> [Accessed: October 5, 2024].
8. Restrepo MS, Gaviria MG, Bolaños SA, Higuita-Gutiérrez LF. Knowledge, Attitude and Practice Regarding Antibacterial and Their Resistance in Medellín-Colombia: A Cross-Sectional Study. Antibiotics. 2023;12(7):1101.
9. Mohan L, Anand S, Mittal M, Goyal K, Akanksha, Dixit A, et al. Cross-sectional study: knowledge assessment of youth regarding the global public health threat of antibiotic resistance. J Public Health (Berl.). 2023:1-10.
10. Azim MR, Ifteakhar KMN, Rahman MM, Sakib QN. Public knowledge, attitudes, and practices (KAP) regarding antibiotics use and antimicrobial resistance (AMR) in Bangladesh. Heliyon. 2023;9(10):e21166.
11. Muhummed AM, Alemu A, Maidane YO, Tschopp R, Hattendorf J, Vonaesch P, et al. Knowledge, Attitudes, and Practices of Rural Communities Regarding Antimicrobial Resistance and Climate Change in Adadle District, Somali Region, Ethiopia: A Mixed-Methods Study. Antibiotics. 2024;13(4):292.
12. Marzan M, Islam DZ, Lugova H, Krishnapillai A, Haque M, Islam S. Knowledge, attitudes, and practices of antimicrobial uses and resistance among public university students in Bangladesh. Infect Drug Resist. 2021;14:519-33.
13. European Commission. Turkish Cypriot Community. [Online]. Available from: <https://cyprus.representation.ec.europa.eu/about-us/turkish-cypriot-community_en> [Accessed: October 5, 2024].
14. Baddal B, Lajunen TJ, Sullman MJM. Knowledge, attitudes and behaviours regarding antibiotics use among Cypriot university students: a multi-disciplinary survey. BMC Med Educ. 2022;22(1):823.
15. Ilktac M, Tarabishi MT, Ozbirtan P, Gulcan C, Celik G. A public awareness study about antibiotic consumption habits and antibacterial resistance in north-eastern region of Cyprus. J Infect Dev Ctries. 2020;14(05):463–70.
16. Akande-Sholabi W, Oyesiji E. Antimicrobial stewardship: knowledge, perceptions, and factors associated with antibiotics misuse among consumer’s visiting the community pharmacies in a Nigeria Southwestern State. J Pharm Policy Pract. 2023;16(1):119.
17. Mohammad LM, Kamran RM, Gillani SW. A study assessing public knowledge and behaviour of antibiotic use in Abu Dhabi and Dubai. J Pharm Health Serv Res. 2023;14(3):317–26.
18. Shaibani R, Shaibani RA, Alaswad RS, Alarbe NS, Rihee ME. Libyan community pharmacists’ knowledge, attitude, and practice concerning non-prescription dispensing of antibiotics. Libyan J Med Res. 2024;18(1):138–50.
19. Mete B, Salcan T, Demirhindi H. Behaviour and perception of parents on irrational use of antibiotics in children at primary care level: A cross-sectional study from Turkey. Asian Pac J Trop Med. 2023;16(6):253–60.
20. Huang Y, Gu J, Zhang M, Ren Z, Yang W, Chen Y, et al. Knowledge, attitude and practice of antibiotics: A questionnaire study among 2500 Chinese students. BMC Med Educ. 2013;13:163.
21. Minen MT, Duquaine D, Marx MA, Weiss D. A survey of knowledge, attitudes, and beliefs of medical students concerning antimicrobial use and resistance. Microb Drug Resist. 2010;16(4):285–9.
22. Rusic D, Bozic J, Vilovic M, Bukic J, Zivkovic PM, Leskur D, et al. Attitudes and knowledge regarding antimicrobial use and resistance among pharmacy and medical students at the University of Split, Croatia. Microb Drug Resist. 2018;24(10):1521–8.
23. Shah P, Shrestha R, Mao Z, Chen Y, Chen Y, Koju P, et al. Knowledge, Attitude, and Practice Associated with Antibiotic Use among University Students: A Survey in Nepal. Int J Environ Res Public Health. 2019;16(20):3996.1
24. Okeke IN, Laxminarayan R, Bhutta ZA, Duse AG, Jenkins P, O’Brien TF, et al. Antimicrobial resistance in developing countries. Part I: Recent trends and current status. Lancet Infect Dis. 2005;5(8):481–93.
25. Sawair FA, Baqain ZH, Abu Karaky A, Abu Eid R. Assessment of self-medication of antibiotics in a Jordanian population. Med Princ Pract. 2008;18(1):21–5.
26. Sawalha AF. A descriptive study of self-medication practices among Palestinian medical and nonmedical university students. Res Social Adm Pharm. 2008;4(2):164–72.
27. Levy SB. The challenge of antibiotic resistance. Sci Am. 1998;278(3):46–53.
28. Murray CJ, Ikuta KS, Sharara F, Swetschinski L, Robles Aguilar G, Gray A, et al. Global burden of bacterial antimicrobial resistance in 2019: a systematic analysis. The Lancet. 2022;399(10325):629-55.
29. Ashiru-Oredope D, Hopkins S, Vasandani S, Umoh E, Oloyede O, Nilsson A, et al. Healthcare workers' knowledge, attitudes and behaviours with respect to antibiotics, antibiotic use and antibiotic resistance across 30 EU/EEA countries in 2019. Eurosurveillance. 2021;26(12):1900633.
30. Effah CY, Amoah AN, Liu H, Agboyibor C, Miao L, Wang J, et al. A population-base survey on knowledge, attitude and awareness of the general public on antibiotic use and resistance. Antimicrob Resist Infect Control. 2020;9(1):101.
31. Sakr S, Ghaddar A, Hamam B, Sheet I. Antibiotic use and resistance: An unprecedented assessment of university students' knowledge, attitude and practices (KAP) in Lebanon. BMC Public Health. 2020;20(1):521.
32. Kumar Jha K, Saini S, Raj A, Bishnoi H. The Antibiotic Resistance Crisis. Asian J Pharm Res Dev. 2023;11(5):44-52.
33. Muteeb G, Rehman MT, Shahwan M, Aatif M. Origin of Antibiotics and Antibiotic Resistance, and Their Impacts on Drug Development: A Narrative Review. Pharmaceuticals. 2023;16(11):1595.
34. Lambert M, Smit CCH, De Vos S, Benko R, Llor C, Paget WJ, et al. A systematic literature review and meta-analysis of community pharmacist-led interventions to optimise the use of antibiotics. Br J Clin Pharmacol. 2022;88(6):2617-41.