**PORZAK, Mikołaj, DACKA, Michał, SOBCZYK, Mateusz, SODOLSKA, Alicja, ŻURAW, Daria, JASIŃSKI, Kacper, OLEKSA, Paulina, PORZAK, Robert and KUBICKA-DĘBIEC, Magdalena. Risk factors of self-medication with antibiotics for acute pharyngitis. Journal of Education, Health and Sport. 2024;60:58-75. eISSN 2391-8306. https://dx.doi.org/10.12775/JEHS.2024.60.004**
**https://apcz.umk.pl/JEHS/article/view/48175**
**https://zenodo.org/records/10658462**

**The journal has had 40 points in Minister of Science and Higher Education of Poland parametric evaluation. Annex to the announcement of the Minister of Education and Science of 05.01.2024 No. 32318. Has a Journal's Unique Identifier: 201159. Scientific disciplines assigned: Physical culture sciences (Field of medical and health sciences); Health Sciences (Field of medical and health sciences).**
**Punkty Ministerialne 40 punktów. Załącznik do komunikatu Ministra Nauki i Szkolnictwa Wyższego z dnia 05.01.2024 Lp. 32318. Posiada Unikatowy Identyfikator Czasopisma: 201159. Przypisane dyscypliny naukowe: Nauki o kulturze fizycznej (Dziedzina nauk medycznych i nauk o zdrowiu); Nauki o zdrowiu (Dziedzina nauk medycznych i nauk o zdrowiu).© The Authors 2024;**
**This article is published with open access at Licensee Open Journal Systems of Nicolaus Copernicus University in Torun, Poland**

**The authors declare that there is no conflict of interests regarding the publication of this paper.**
**Received: 18.01.2023. Revised: 08.02.2024. Accepted: 15.02.2024. Published: 15.02.2024.**

# Risk factors of self-medication with antibiotics for acute pharyngitis

Mikołaj Porzak[1], Michał Dacka[2], Mateusz Sobczyk[1], Alicja Sodolska[3], Daria Żuraw[4], Kacper Jasiński[1], Paulina Oleksa[5], Robert Porzak [6], Magdalena Kubicka-Dębiec [5]

[1] Stefan Kardynał Wyszyński Regional Specialist Hospital in Lublin, 100 Aleja Kraśnicka, 20-718 Lublin, Poland,

[2] 1'st Military Clinical Hospital in Lublin, al. Racławickie 23,20-049 Lublin, Poland,

[3] Lubimed- Fmily Medical Center in Lublin, Jacka Woronieckiego 11, 20-492, Lublin, Poland,

[4] Central Clinical Hospital, University Clinical Center of Warsaw Medical University, ul. Banacha 1A, 02-097, Warsaw, Poland,

[5] Independent Public Clinical Hospital No. 4 in Lublin, ul. Doktora Kazimierza Jaczewskiego 8, 20-954, Lublin, Poland.

[6] WSEI University in Lublin, Human Faculty

**Corresponding author: Mikołaj Porzak**

Email: mikolaj.porzak@gmail.com

ORCID: 0000-0003-0548-1950

**Michał Dacka:**

Email: michal.dackaa@gmail.com

ORCID: 0009-0005-8783-6517

**Mateusz Sobczyk:**

Email: m.sobczyk1777@gmail.com

ORCID: 0000-0001-8690-2387

**Alicja Sodolska:**

Email: alicja.sodolska@gmail.com

ORCID: 0009-0008-3689-7004

**Daria Żuraw**

Email: dariazuraw19@gmail.com

ORCID: 0000-0003-0815-4322

**Kacper Jasiński:**

Email: kacperjasinski433@gmail.com

ORCID: 0009-0003-3345-2337

**Paulina Oleksa:**

Email: gp.oleksa@gmail.com

ORCID: 0000-0002-3474-6156

**Robert Porzak:**

Email: robert.porzak@wsei.lublin.pl

ORCID: 0000-0002-1263-1315

**Magdalena Kubicka-Dębiec:**

Email: magdalenakubickaa@wp.pl

ORCID: 0000-0002-1645-8943

## Abstract:

**Background:** Self-medicating with antibiotics is prevalent in low- and middle-income nations. This research sought to assess the perspectives on antibiotic usage and self-medication in case of acute pharyngitis, as well as the factors linked to self-medication among patients of a family doctor's clinic in Lublin, Poland.

**Methods:** A original, fully anonymous survey was conducted among patients of a family doctor's clinic in Lublin. The descriptive statistics of answers in questionnaires and Automatic Linear Modeling Regression (LINEAR) was applied to point out the most significant predictors of the antibiotics misuse.

**Results:** A response number of 262 participants was obtained. About 15,6% (41/262) respondents had self-medicated during the last year due to acute pharyngitis symptoms. We have identified the following important risk factors of anti-health behaviours connected with self-medication: frequent occurrence of symptoms of acute pharyngitis, frequent receiving antibiotics on prescription, frequent diagnosing a bacterial cause of sore throat, higher sensitivity to pain and lower education level. Surprisingly our research shows that women present lower sensitivity to pain than men in case of pain connected with acute pharyngitis.

**Conclusion:** There is a need for greater attention paid to the education of the patients presenting the aforementioned risk factors. Education should focus on the risks to the patients connected with antimicrobial resistance.



**Keywords:** Antibiotics; Antibiotic resistance; Antibiotic self-medication; Self-medication; Risk factors; Risky behaviours; Gender differences; Attitudes; Survey; Lublin; Poland; Family Doctor;


## Introduction

### Problem of pharyngitis

Acute pharyngitis is a commonly occurring ailment. For instance, sore throat accounts for 9% of consultations with a general practitioner in the United Kingdom [1]. Most common symptoms of acute pharyngitis are: sore throat, throat irritation, pain during swallowing. Those signs are easy to be identified and connected by patients with infection of the pharynx.

Despite the correct correlation of symptoms with the ailment, patients often confuse the aetiology of their discomfort. According to many research, most common agents responsible for the acute pharyngitis symptoms are viral infections [2]. The frequency of occurrence of bacterial aetiology is low and estimated at around 5-15% in adults [3]. Most common bacteria causing it is Group A beta-haemolytic streptococcus (GABHS) [3]. Symptoms of viral and bacterial infection may be similar for the patient and their differentiation can be done during the doctor's physical examination or arbitrarily- with the use of rapid antigen detection tests (RADT). Specificity of RADT is estimated at 95% with sensitivity at around 70-90 % [4].

## Self-medication

Self-medication is described as independently treating the symptoms of acute conditions and the occasional use of medications prescribed by a doctor in case of exacerbation of symptoms of chronic diseases [5]. The use of medications accurately matched to symptoms requires patient education. One of the advantages of self-medication is the quick and direct application of potentially effective treatment, which can prevent the development of symptoms [5,6]. On the other hand, there is a variety of risks coming along with the self-medication such as: incorrect choice of therapy, severe adverse effects, not realizing that the same active ingredient is being used under a different name, using an inappropriate dose, occurrence of interactions between drugs or medication and food or use of expired medications [5,6]. The behaviours exhibited by individuals with symptoms of acute pharyngitis vary depending on the place of residence, level of education, and the level of development of the inhabited country. Research shows that factors favouring self-medication include: lower lever of education, non-science qualification [7], female gender [8–10].

## Self-medication with antibiotics as a threat to public health

Self-medication with antibiotics is a global health-concern. Such behaviour contributes to rise of antimicrobial resistance among bacteria [11]. According to the Annual Epidemiological Report on Antimicrobial Resistance in the EU/EEA (EARS-Net) for 2022, antimicrobial resistance (AMR) remains high and increases annually. For instance at the turn of 2021 and 2022, there was a 7% rise of the reported number of resistant strains. Therefore one of the key targets adopted by the European Council in the year 2023 is to combat AMR [12].

## Situation in Poland

The appearing signs of a sore throat are a common reason for self-medication [13,14]. Most often, the OTC drugs are used to relief the symptoms. Substances available in polish pharmacies without prescription include nonsteroidal anti-inflammatory drugs (NSAIDs), topical anaesthetics or antiseptic agents. Those products are available in both pharmacies and grocery shops. When it comes to the turnover of antibiotics in Poland, they are only available in pharmacies and require a prescription [15]. Despite the supervision over the sale of antibiotics and restricted access to these substances, self-medication with antibiotics for symptoms of throat inflammation is present in Poland, which has been shown in one of the studies run on a population of adult patients from Lublin city [16].

### The aim of the study

Diminishing the prevalence of self-medication with antibiotics in the public necessitates a thorough understanding of the involved risk factors. However, the determinants of antibiotic self-medication remain inadequately characterized. Despite the unquestionable threat arising from self-medication with antibiotics, there is still a lack of research identifying risk factors for such behaviours in local communities. Some studies in Poland have investigated antibiotic use, nevertheless, there is still little amount of such studies. That is why we have conducted a survey identifying the risk factors of self-treatment with antibiotics in sore throat symptoms.

The aim of this paper is to investigate prevalence and risk factors for self-medication with antibiotics among population of patients of one of a family doctor's clinic in the area of Lublin.

## Material and method

### Study instrument

This was a cross-sectional study conducted among primary care patients of one of the Family Doctor's clinic in Lublin who completed an original questionnaire. The study was fully anonymous, so there was no need to collect consents from the questionees or local bioethical committee.

The survey was available both in paper and on the internet, with an easy access QR code. Participants filled the survey on their own and returned it in directly to the first author. Results were gathered between December 2023 and January 2024.

The survey was divided into 3 parts. First one was a one concerning demographic data. In second part the questions revolved around the occurrence and diagnosis of pharyngitis as well

as the ways the questionee  deal with it's symptoms. The Numeric Rating Scale from 0 to 10 was with authors' modification was applied to assess sensitivity to the pain. The aim of the third one was to determine the anti-health attitudes among the surveyed patients. DOI of the questionnaire: https://osf.io/x4up8/.

**Sample type and size**

Total number of respondents was 319. The final sample of the examined individuals subjected to further statistical calculations included only adults (18-85 years old) who were not related professionally with health-care (e.g. doctors, pharmacists, nurses). After implementing the inclusion criteria, overall count of participants amounted to 262.

**Method**

The descriptive statistics of answers in questionnaires and Automatic Linear Modeling regression (LINEAR) was applied to point out the most significant predictors of the antibiotics misuse. The LINEAR procedure has been part of the SPSS statistical package since version 19. It is an improvement over the traditional regression analysis technique. In particular, the two main advantages of the LINEAR procedure, are the automatic selection of variables and the automatic preparation of data. The procedure use adaptive LASSO estimator what speeds up the data analysis process thanks to several automatic mechanisms [17,18].

# Results

## Group

The group of participants is described in the Table 1. The participants of the study are a diverse group, consisting of both males and females with varied educational backgrounds, places of residence, and financial situations. A total of 262 individuals participated in the study, with 167 females and 95 males. The majority of the participants have attained Bachelor's/Master's or equivalent education level (69.1%), followed by those with upper secondary education (20.6%). The participants predominantly reside in large cities with populations ranging from 100,000 to 500,000 inhabitants (65.3%), while a smaller percentage live in rural areas (13.7%) or very large cities with over 500,000 inhabitants (9.2%). In terms of financial situation, most participants rated their financial status as good (60.7%), followed by those who considered it average (23.7%). A small percentage rated their financial situation as very good (14.5%) and an even smaller group considered it bad (1.1%).

*Table 1: Group*

| | | Sex category | | | | | |
|---|---|---|---|---|---|---|---|
| | | Female | | Male | | Total | |
| | | N | % | N | % | N | % |
| Education level | Primary | 1 | 0.6 | 2 | 2.1 | 3 | 1.1 |
| | Lower secondary | 0 | 0.0 | 1 | 1.1 | 1 | 0.4 |
| | Vocational | 6 | 3.6 | 5 | 5.3 | 11 | 4.2 |
| | Upper secondary | 35 | 21.0 | 19 | 20.0 | 54 | 20.6 |
| | Bachelor's/Master's or equivalent | 120 | 71.9 | 61 | 64.2 | 181 | 69.1 |
| | Doctorate or equivalent | 5 | 3.0 | 7 | 7.4 | 12 | 4.6 |
| Place of residence | Rural area | 23 | 13.8 | 13 | 13.7 | 36 | 13.7 |
| | Small city (up to 50,000) | 3 | 1.8 | 3 | 3.2 | 6 | 2.3 |
| | Medium city (50 - 100 thousand) | 20 | 12.0 | 5 | 5.3 | 25 | 9.5 |
| | Large city (100,000 - 500,000) | 107 | 64.1 | 64 | 67.4 | 171 | 65.3 |
| | Very large city ( 500,000+ inhabitants) | 14 | 8.4 | 10 | 10.5 | 24 | 9.2 |
| Financial situation | Very good | 23 | 13.8 | 15 | 15.8 | 38 | 14.5 |
| | Good | 105 | 62.9 | 54 | 56.8 | 159 | 60.7 |
| | Average | 38 | 22.8 | 24 | 25.3 | 62 | 23.7 |
| | Bad | 1 | 0.6 | 2 | 2.1 | 3 | 1.1 |
| | Total | 167 | 100.0 | 95 | 100.0 | 262 | 100.0 |

## Use of antibiotics

Participants' answers to the questionnaire evaluating the use of antibiotics presented in Table 2 provides an insight into the frequency of acute pharyngitis symptoms and the corresponding use of antibiotics across different sex categories. It's evident that both genders experience acute throat inflammation symptoms at varying frequencies. Interestingly, while females reported symptoms less frequently than males, they were more prone to not seeking medical attention despite experiencing these symptoms.

*Table 2: Frequency of acute pharyngitis symptoms, not seeking medical aid, receiving a prescription for an antibiotic and risky behaviours connected with antibiotic use*

| | | Sex category | | | | | |
|---|---|---|---|---|---|---|---|
| | | Female | | Male | | Total | |
| | | N | % | N | % | N | % |
| Symptoms of acute throat inflammation | 0 - less than 1/year, never | 29 | 17.4 | 28 | 29.5 | 57 | 21.8 |
| | 1 | 45 | 26.9 | 23 | 24.2 | 68 | 26.0 |
| | 2 | 40 | 24.0 | 18 | 18.9 | 58 | 22.1 |
| | 3 | 28 | 16.8 | 14 | 14.7 | 42 | 16.0 |
| | 4 | 9 | 5.4 | 8 | 8.4 | 17 | 6.5 |
| | 5 and more | 16 | 9.6 | 4 | 4.2 | 20 | 7.6 |
| Not seeking medical attention despite the symptoms of acute throat inflammation | 0 - less than 1/year, never | 72 | 43.1 | 40 | 42.1 | 112 | 42.7 |
| | 1 | 42 | 25.1 | 28 | 29.5 | 70 | 26.7 |
| | 2 | 16 | 9.6 | 9 | 9.5 | 25 | 9.5 |
| | 3 | 23 | 13.8 | 12 | 12.6 | 35 | 13.4 |
| | 4 | 9 | 5.4 | 3 | 3.2 | 12 | 4.6 |
| | 5 and more | 5 | 3.0 | 3 | 3.2 | 8 | 3.1 |
| Taking an antibiotic without consulting a doctor | 0 - less than 1/year, never | 144 | 86.2 | 77 | 81.1 | 221 | 84.4 |
| | 1 | 15 | 9.0 | 10 | 10.5 | 25 | 9.5 |
| | 2 | 2 | 1.2 | 5 | 5.3 | 7 | 2.7 |
| | 3 | 3 | 1.8 | 1 | 1.1 | 4 | 1.5 |
| | 4 | 2 | 1.2 | 0 | 0.0 | 2 | 0.8 |
| | 5 and more | 1 | 0.6 | 2 | 2.1 | 3 | 1.1 |
| Diagnosing a bacterial cause of the symptoms | 0 - less than 1/year, never | 121 | 72.5 | 81 | 85.3 | 202 | 77.1 |
| | 1 | 37 | 22.2 | 9 | 9.5 | 46 | 17.6 |
| | 2 | 4 | 2.4 | 2 | 2.1 | 6 | 2.3 |
| | 3 | 2 | 1.2 | 2 | 2.1 | 4 | 1.5 |
| | 4 | 2 | 1.2 | 1 | 1.1 | 3 | 1.1 |
| | 5 and more | 1 | 0.6 | 0 | 0.0 | 1 | 0.4 |
| Frequency of receiving antibiotics on a prescription | 0 - less than 1/year, never | 74 | 44.3 | 58 | 61.1 | 132 | 50.4 |
| | 1 | 52 | 31.1 | 15 | 15.8 | 67 | 25.6 |
| | 2 | 16 | 9.6 | 10 | 10.5 | 26 | 9.9 |
| | 3 | 11 | 6.6 | 7 | 7.4 | 18 | 6.9 |
| | 4 | 8 | 4.8 | 3 | 3.2 | 11 | 4.2 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | 5 and more | 6 | 3.6 | 2 | 2.1 | 8 | 3.1 |
| Shortening antibiotic treatment without consulting a doctor | 0 - less than 1/year, never | 152 | 91.0 | 83 | 87.4 | 235 | 89.7 |
| | 1 | 6 | 3.6 | 4 | 4.2 | 10 | 3.8 |
| | 2 | 0 | 0.0 | 3 | 3.2 | 3 | 1.1 |
| | 3 | 3 | 1.8 | 3 | 3.2 | 6 | 2.3 |
| | 4 | 5 | 3.0 | 2 | 2.1 | 7 | 2.7 |
| | 5 and more | 1 | 0.6 | 0 | 0.0 | 1 | 0.4 |

## Self-medication

Another critical aspect highlighted by the data is the tendency to self-medicate with antibiotics without consulting a doctor. A significant percentage across both genders admitted to taking antibiotics without a prescription, with a higher proportion among females. This behaviour poses a concern for antibiotic resistance and inappropriate use of medications, emphasizing the need for better education and awareness regarding responsible antibiotic use.

The assessment of diagnosing a bacterial cause for the symptoms shows a general trend of not extensively exploring this aspect, with a larger percentage reporting minimal efforts in determining the bacterial origin of the condition. Additionally, while there's a high frequency in receiving antibiotics on a prescription, a considerable portion of respondents, especially females, indicated a lower rate of receiving prescribed antibiotics, which might indicate either underdiagnosis of acute pharyngitis or a reluctance among healthcare providers to prescribe antibiotics.

The Chi-square tests indicate a lack of significant association between sex categories and the different aspects evaluated—symptoms, seeking medical attention, self-medication, diagnosing bacterial causes, frequency of receiving antibiotics, and shortening antibiotic treatment. However, the trends observed in the data warrant further investigation into the factors influencing antibiotic use behaviours, potentially beyond gender-related aspects.

Overall, this dataset underscores the need for targeted interventions to enhance proper antibiotic use, encourage seeking medical advice when experiencing symptoms, and emphasize the importance of professional medical consultations before initiating antibiotic treatments.

## Pain sensitivity

Table 4 presents data on pain sensitivity in scale 0 – no pain to 10 – the highest possible pain categorized by sex, specifically looking at pain intensity that prompts a visit to the doctor and

pain intensity that prompts antibiotic use without consulting a doctor. The results are organized by sex category (Female, Male), and for each category, the Mean (M) and Standard Deviation (SD) are provided for both pain intensity scenarios.

*Table 3 Pain level prompting a visit to a doctor and self-medication*

| | Sex category | | | | | |
|---|---|---|---|---|---|---|
| | Female | | Male | | Total | |
| | M | SD | M | SD | M | SD |
| Pain intensity prompting a visit to the doctor | 6.67 | 2.36 | 5.47 | 2.99 | 6.26 | 2.65 |
| Pain intensity prompting antibiotic use without consulting a doctor | 3.72 | 3.94 | 2.46 | 3.26 | 3.12 | 3.67 |

The Mann-Whitney U test was applied to assess differences between male and female groups in both pain intensity scenarios.

- For pain intensity prompting a visit to the doctor, there is a statistically significant difference between male and female groups ($Z = -2.529$, $p = 0.011$). Such difference suggests higher sensitivity to pain among male part of participants.
- For pain intensity prompting antibiotic use without consulting a doctor, although there is a numerical difference, it is not statistically significant ($Z = -1.649$, $p = 0.099$).

These results suggest that there are gender-related differences in pain sensitivity, particularly when it comes to seeking medical attention for pain intensity in acute pharyngitis. The significance of these differences should be considered in the broader context of the study and its implications.

## Correlates of incorrect use of antibiotics

The mean of answers to three, below mentioned questions was calculated to describe patients' tendency to incorrect use of antibiotics:

1. Not seeking medical attention despite the symptoms of acute throat inflammation.
2. Taking an antibiotic without consulting a doctor.
3. Shortening antibiotic treatment without consulting a doctor.

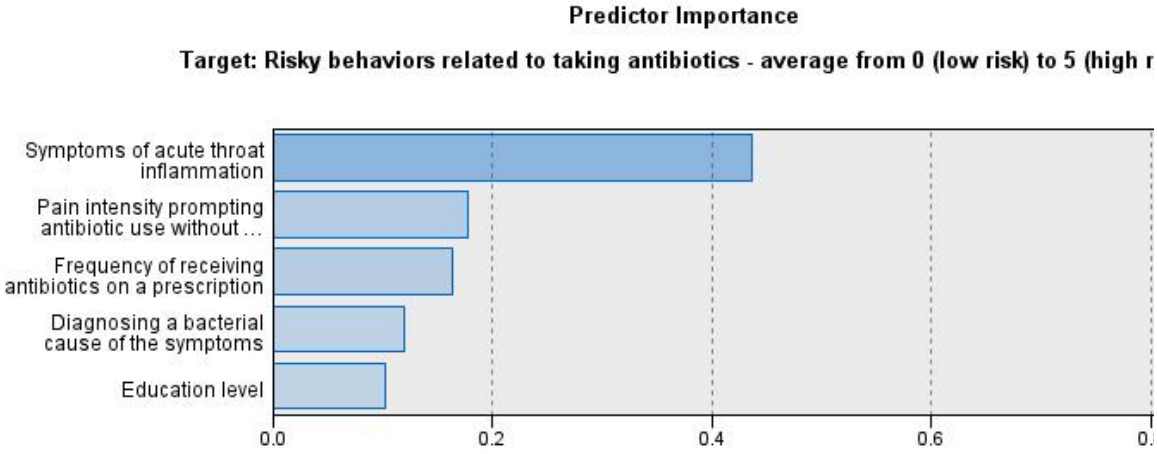
The mean of incorrect antibiotics use was included as dependent variable to the analysis of regression in the Automated Linear Modeling procedure (ALMS). Independent variables applied to the regression analysis were:

1. Frequency of occurrence of symptoms of acute throat inflammation (sore throat, throat irritation, pain during swallowing),
2. Sensitivity to pain,
3. Frequency of receiving antibiotics on a prescription,
4. Frequency of diagnosing a bacterial cause of sore throat,
5. Education level,
6. Demographic data.

The analysis resulted in information pointing variables most correlated with the tendency to incorrect antibiotics use, presented in Table 4 and Chart 1. According to the results, the tendency to incorrect use of antibiotics is correlated significantly with the frequency of occurrence of the following variables: symptoms of acute pharyngitis, sensitivity to pain, receiving antibiotics on prescription, diagnosing a bacterial cause of sore throat and education level.

*Table 4: Correlates of risky antibiotic use*

| Model term | Coefficient | Significance | Importance |
|---|---|---|---|
| Intercept | 1,681 | 0.000*** | |
| Frequency of occurrence of symptoms of acute throat inflammation (sore throat, throat irritation, pain during swallowing) | -0,845 | 0.000*** | 0.436 |
| Sensitivity to pain | 0.063 | 0.001** | 0.177 |
| Frequency of receiving antibiotics on a prescription | -0,345 | 0.002** | 0.164 |
| Frequency of diagnosing a bacterial cause of sore throat | -0,489 | 0.008** | 0.120 |
| Education level | 0,645 | 0,047* | 0,103 |




## Discussion

This is the first local survey in the area of Lublin, providing insights about attitudes and behaviour regarding self-medication with antibiotics for sore throat and risk factors of inappropriate use of antibiotics.

We found that women more frequently happen to experience symptoms of throat inflammation which is comparable with other studies. According to the study run in the UK in 2006 by Gulliford et al. 64 per 1000 consultations with doctor's among female and 46,5 per 1000 consultations among male were due to the sore throat and pharyngitis symptoms [1].

Another important finding was that despite more frequent occurrence of symptoms of pharyngitis among women, they tend to seek for medical advice less often. This result stands in the opposite to many previous researches. According to many studies, women tend to visit general practitioner more often than male, both with acute and chronic ailments [19–21]. Moreover, women tend to present more pro-health attitudes than men [22]. Nevertheless our study presents a unique look on the way women act in case of pharyngitis. It may suggest higher level of self-sufficiency in case of less severe ailments such as pharyngitis. Aforementioned studies showed reactions to more severe diseases. Moreover, less frequent seeking of medical advice by women may be connected with lower sensitivity to pain in comparison to men.

A difference in sensitivity to pain is visible in our study. Women seek medical help at a higher level of pain than men. Our result is not reflected in previous works. Other researches showed

that women are more sensitive to pain [23] deriving from chronic [23,24] and acute disorders [23,25], experimental pain [23,26] and post-procedural pain [23,27]. What is unique about our fining is that previous researches did not analyse pain sensitivity in case of acute pharyngitis.

According to other authors, antibiotics together with analgesics are two of the most frequent self-medicated drugs [28,29]. Risk of self-medication with antibiotics occur more frequent among female respondents to our survey, which aligns with other studies [30,31]. Engaging in self-medication illustrates individuals' desire to take care of their well-being and deal with minor health issues. Proper self-medication brings advantages like reduced healthcare expenses, fewer doctor consultations, and consequently, enhanced accessibility of healthcare professionals for those with urgent needs [32]. More significantly, such behaviour could contribute to the development of antibiotic resistance [33].

One of our key findings points out the strong predictors for presenting anti-health behaviour connected with antibiotic use. The more frequent symptoms of acute pharyngitis, receiving antibiotics on prescription, diagnosing a bacterial cause of sore throat, higher sensitivity to pain and lower education level the higher the risk of presenting anti-health attitudes by an individual. Other risk factors worth noting include: long waiting time to visit the physician [34,35] ,low income rate [35,36] ,lack of time [34] , and low level of knowledge on antibiotics [13]. Promoting awareness of those factors among general practicioners could draw their attention towards educating in the topic of self-medication those patients who present mentioned risk factors.

## Conclusions

Family doctors and physicians in general should pay greater attention to educating patients with acute pharyngitis symptoms who often have diagnosed a bacterial aetiology of their symptoms, especially the female part of the group. Special consideration should also be given to patients reporting severe pain connected with sore throat. Frequent episodes of bacterial angina and intense pain prompting a doctor's visit are strong indicators of an increased risk of self-medication with antibiotic and premature self-termination of antibiotic therapy without consulting a physician. Education should focus on the negative consequences of self-medicating with antibiotics, the growing problem of antibiotic-resistant strains, and the arising risks for the patient.

Our results emphasize the necessity for comprehensive intervention initiatives aimed at the public healthcare practitioners and policymakers, aiming to decrease the prevalence of self-medication among the Polish population.

Moreover, due to the little amount of similar studies in Poland, there is a need for further investigation of similar kind in other cities and local communities in order to identify, confirm and eliminate the risk factors of anti-health behaviours connected with antibiotic self-medication.

## Disclosure

Conceptualization: Mikołaj Porzak, Michał Dacka, Mateusz Sobczyk, Robert Porzak; Methodology: Mikołaj Porzak, Alicja Sodolska , Daria Żuraw, Robert Porzak; Formal analysis: Alicja Sodolska , Daria Żuraw; Investigation: Kacper Jasiński, Paulina Oleksa; Data curation: Paulina Oleksa, Mikołaj Porzak; Writing - rough preparation: Mikołaj Porzak, Michał Dacka; Writing - review and editing: Mateusz Sobczyk, Alicja Sodolska , Daria Żuraw, Magdalena Kubicka-Dębiec, Kacper Jasiński, Paulina Oleksa; Project administration: Mikołaj Porzak, Magdalena Kubicka-Dębiec.

All authors have read and agreed with the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: DOI of the original survey: https://osf.io/x4up8/

Acknowledgments: We would like to thank Dr Izabela Michalak, the Medical Director of Willowa Family Medical Center in Lublin, for allowing us to run a survey in the ‘’Willowa’’ facility.

Conflicts of Interest: The authors declare no conflict of interest.

## References:


1. Gulliford M, Latinovic R, Charlton J, Little P, Van Staa T, Ashworth M. Selective decrease in consultations and antibiotic prescribing for acute respiratory tract infections in UK primary care up to 2006. *J Public Health*. 2009;31(4):512-520. doi:10.1093/pubmed/fdp081

2. Anderson J, Paterek E. Tonsillitis. In: *StatPearls*. StatPearls Publishing; 2023. Accessed January 10, 2024. http://www.ncbi.nlm.nih.gov/books/NBK544342/

3. Ebell MH, Smith MA, Barry HC, Ives K, Carey M. Does This Patient Have Strep Throat? *JAMA*. 2000;284(22):2912-2918. doi:10.1001/jama.284.22.2912

4. Clinical Practice Guideline for the Diagnosis and Management of Group A Streptococcal Pharyngitis: 2012 Update by the Infectious Diseases Society of America | Clinical Infectious Diseases | Oxford Academic. Accessed January 10, 2024. https://academic.oup.com/cid/article/55/10/e86/321183

5. Organization WH. Guidelines for the regulatory assessment of medicinal products for use in self-medication. Published online 2000. Accessed January 9, 2024. https://iris.who.int/handle/10665/66154

6. Hughes CM, McElnay JC, Fleming GF. Benefits and Risks of Self Medication: *Drug Saf*. 2001;24(14):1027-1037. doi:10.2165/00002018-200124140-00002

7. Sapkota AR, Coker ME, Rosenberg Goldstein RE, et al. Self-medication with antibiotics for the treatment of menstrual symptoms in Southwest Nigeria: a cross-sectional study. *BMC Public Health*. 2010;10:610. doi:10.1186/1471-2458-10-610

8. Awad A, Eltayeb I, Matowe L, Thalib L. Self-medication with antibiotics and antimalarials in the community of Khartoum State, Sudan. *J Pharm Pharm Sci Publ Can Soc Pharm Sci Soc Can Sci Pharm*. 2005;8(2):326-331.

9. Zhu X, Pan H, Yang Z, Cui B, Zhang D, Ba-Thein W. Self-medication practices with antibiotics among Chinese university students. *Public Health*. 2016;130:78-83. doi:10.1016/j.puhe.2015.04.005

10. Osemene K, Lamikanra A. A Study of the Prevalence of Self-Medication Practice among University Students in Southwestern Nigeria. *Trop J Pharm Res*. 2012;11(4):683-689. doi:10.4314/tjpr.v11i4.21

11. Karakonstantis S, Kalemaki D. Antimicrobial overuse and misuse in the community in Greece and link to antimicrobial resistance using methicillin-resistant S. aureus as an example. *J Infect Public Health*. 2019;12(4):460-464. doi:10.1016/j.jiph.2019.03.017

12. Antimicrobial resistance in the EU/EEA (EARS-Net) - Annual epidemiological report for 2022. Published online 2022.

13. Zawahir S, Lekamwasam S, Halvorsen KH, Rose G, Aslani P. Self-medication Behavior with antibiotics: a national cross-sectional survey in Sri Lanka. *Expert Rev Anti Infect Ther*. 2021;19(10):1341-1352. doi:10.1080/14787210.2021.1911647

14. Zeb S, Mushtaq M, Ahmad M, et al. Self-Medication as an Important Risk Factor for Antibiotic Resistance: A Multi-Institutional Survey among Students. *Antibiotics*. 2022;11(7):842. doi:10.3390/antibiotics11070842

15. Regulation of the Minister of Health dated April 19, 1950, regarding the production and trade of antibiotics. Accessed January 10, 2024. https://isap.sejm.gov.pl/isap.nsf/DocDetails.xsp?id=WDU19500200177

16. Drozd M, Drozd K, BYå A. KNOWLEDGE, ATTITUDE AND PERCEPTION REGARDING ANTIBIOTICS AMONG POLISH PATIENTS.

17. Ciuperca G. Automatic variable selection in a linear model on massive data. *Commun Stat - Simul Comput*. 2022;51(9):4937-4956. doi:10.1080/03610918.2020.1752377

18. Yang H. The Case for Being Automatic: Introducing the Automatic Linear Modeling (LINEAR) Procedure in SPSS Statistics. 2013;39.

19. Jatrana S, Crampton P. Gender differences in general practice utilisation in New Zealand. *J Prim Health Care*. 2009;1(4):261-269. doi:10.1071/hc09261

20. Hunt K, Ford G, Harkins L, Wyke S. Are Women More Ready to Consult than Men? Gender Differences in Family Practitioner Consultation for Common Chronic Conditions. *J Health Serv Res Policy*. 1999;4(2):96-100. doi:10.1177/135581969900400207

21. Green CA, Pope CR. Gender, psychosocial factors and the use of medical services: a longitudinal analysis. *Soc Sci Med 1982*. 1999;48(10):1363-1372. doi:10.1016/s0277-9536(98)00440-7

22. Courtenay WH. Constructions of masculinity and their influence on men's well-being: a theory of gender and health. *Soc Sci Med*. 2000;50(10):1385-1401. doi:10.1016/S0277-9536(99)00390-1

23. Fillingim RB, King CD, Ribeiro-Dasilva MC, Rahim-Williams B, Riley JL. Sex, Gender, and Pain: A Review of Recent Clinical and Experimental Findings. *J Pain*. 2009;10(5):447-485. doi:10.1016/j.jpain.2008.12.001

24. Schmidt CE, Bestmann B, Küchler T, Longo WE, Rohde V, Kremer B. Gender differences in quality of life of patients with rectal cancer. A five-year prospective study. *World J Surg*. 2005;29(12):1630-1641. doi:10.1007/s00268-005-0067-0

25. Prevalence and burden of migraine in the United States: data from the American Migraine Study II - PubMed. Accessed January 17, 2024. https://pubmed.ncbi.nlm.nih.gov/11554952/

26. Riley JL, Robinson ME, Wise EA, Myers CD, Fillingim RB. Sex differences in the perception of noxious experimental stimuli: a meta-analysis. *Pain*. 1998;74(2-3):181-187. doi:10.1016/s0304-3959(97)00199-1

27. De Cosmo G, Congedo E, Lai C, Primieri P, Dottarelli A, Aceto P. Preoperative psychologic and demographic predictors of pain perception and tramadol consumption using intravenous patient-controlled analgesia. *Clin J Pain*. 2008;24(5):399-405. doi:10.1097/AJP.0b013e3181671a08

28. Shehnaz SI, Agarwal AK, Khan N. A Systematic Review of Self-Medication Practices Among Adolescents. *J Adolesc Health*. 2014;55(4):467-483. doi:10.1016/j.jadohealth.2014.07.001

29. Young AM, Glover N, Havens JR. Nonmedical Use of Prescription Medications Among Adolescents in the United States: A Systematic Review. *J Adolesc Health*. 2012;51(1):6-17. doi:10.1016/j.jadohealth.2012.01.011

30. Schepis TS, Krishnan-Sarin S. Sources of Prescriptions for Misuse by Adolescents: Differences in Sex, Ethnicity, and Severity of Misuse in a Population-Based Study. *J Am Acad Child Adolesc Psychiatry*. 2009;48(8):828-836. doi:10.1097/CHI.0b013e3181a8130d

31. Goldsworthy RC, Mayhorn CB. Prescription Medication Sharing Among Adolescents: Prevalence, Risks, and Outcomes. *J Adolesc Health*. 2009;45(6):634-637. doi:10.1016/j.jadohealth.2009.06.002

32. Bennadi D. Self-medication: A current challenge. *J Basic Clin Pharm*. 2013;5(1):19-23. doi:10.4103/0976-0105.128253

33. Okeke IN, Klugman KP, Bhutta ZA, et al. Antimicrobial resistance in developing countries. Part II: strategies for containment. *Lancet Infect Dis*. 2005;5(9):568-580. doi:10.1016/S1473-3099(05)70217-6

34. Figueiras A, Caamano F, Gestal-Otero JJ. Sociodemographic factors related to self-medication in Spain. *Eur J Epidemiol*. 2000;16(1):19-26. doi:10.1023/A:1007608702063

35. Abosede OA. Self-medication: An important aspect of primary health care. *Soc Sci Med*. 1984;19(7):699-703. doi:10.1016/0277-9536(84)90242-9

36. Tirgar Tabari S, Hajian K, Naderi AR. Self-management in skin disease among Babolian teachers, educational year of 2000-01. *J Babol Univ Med Sci*. 2004;6(2):56-60.