

## SURVEY ON KNOWLEDGE OF SEXUALLY TRANSMITTED INFECTIONS AND GONORRHEA: DO WE KNOW ENOUGH?

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### ABSTRACT

**Background:** Sexually Transmitted Infections (STIs) constitute an important group of infections with serious implications for public health. According to WHO, 1 million new contagions are produced daily, with more than 370 million new cases yearly. STIs can be originated from viruses, bacteria, fungi, or parasites. Regardless of their nature, they can be either cured or treated and controlled, but more importantly, they are preventable. **Aims:** The best tool to fight against STIs is prevention, which has a strong dependence on knowledge. This work aimed to assess the level of knowledge of society about STIs and gonorrhoea. **Methods:** We conducted an online survey, covering a wide range of ages and levels of education, inquiring about areas such as origin, ways of contagion, prevention, associated diseases, and treatment of STIs and gonorrhoea. We performed a statistical analysis of the answers. **Results and Discussion:** it was found that the general level of knowledge about STIs was independent of the age and level of education of the respondents. The respondent has shown better familiarity with prevention and contagion than with origin, diseases, and treatment. When the question was focused on gonorrhoea, we found a lack in the cognizance of several points. **Conclusions:** Based on our findings, we conclude it is necessary to improve sexual education programs, starting at early ages but directed to all populations, particularly about gonorrhoea.

**Keywords:** Gonorrhoea, STIs, *Neisseria gonorrhoeae*, knowledge, survey

### 1. INTRODUCTION

Sexually transmitted infections (STIs) are caused by more than 30 types of viruses, bacteria, fungi, and parasites. The STIs with the highest incidence are syphilis, gonorrhoea, Chlamydia, and trichomoniasis, which are all curable infections. The STIs caused by viruses, such as hepatitis B virus, herpes simplex virus (HSV or herpes), human immunodeficiency virus (HIV), and human papillomavirus (HPV), are all incurable but treatable infections (WHO, 2018; Workowski *et al.*, 2021). STIs can be acquired by any person, regardless of their gender, age, or sexual orientation. However, the most critical age is between 14 and 24 years old. According to a World Health Organization (WHO) report from

2018, more than 1 million people contract a curable STI every day. It is estimated that more than 376 million people aged between 15 to 49 years old acquire Chlamydia, gonorrhoea, syphilis, or trichomoniasis (WHO, 2018). In Latin America, 89 million new cases occur annually in the same age range, affecting 1 in 20 adolescents (Di Marco, Ferraris, and Langsam, 2018).

In the short term, the most observed manifestations in cases of STIs are oral lesions, genital sores, warts, itching, burning during urination, abnormal genital or anal discharge, and lower abdominal pain (Díez and Díaz, 2011). However, they can cause Pelvic Inflammatory Disease (PID), predisposition to ectopic pregnancy, neurological problems, and even

generalized infections in the long term. In more severe cases, infertility has been reported due to alteration of the upper genital tract in gonococcal or chlamydial infections, and neoplastic transformations can be induced by untreated HPV (Rodríguez, 2014). Likewise, injuries and inflammation due to some STIs increase the predisposition to infection by other microorganisms and may also increase the probability of acquiring HIV (5,6)

One of the most prevalent STIs is gonorrhea, caused by a Gram-negative bacterial pathogen, *Neisseria gonorrhoeae*. On a global scale, the WHO reported in 2018 a total of 87 million new cases of gonorrhea (WHO, 2018). In 2012, 78 million new cases occurred, and 14% corresponded to America. In Argentina, the general trend in the last five years has been continuous growth (Ministerio de Salud de la Nación Argentina, 2021).

Prevention is the best way to control STIs. In this sense, the key is the right information for society. Therefore, it is essential to have a reliable picture of the knowledge level of society.

Surveys of the state of knowledge about STIs, in general, are carried out mostly on high-risk populations, such as young populations between 16 and 28 years old (Di Marco *et al.*, 2018; Visalli *et al.*, 2019; Zin, Ishak, and Manoharan, 2019). However, although adolescents and young adults are more likely to acquire STIs, the rest of the population is not exempt.

This work aimed to survey and identify the level of knowledge that the general population has about STIs and gonorrhea in Argentina. A proportion of the people who have doubts, gaps in their knowledge, common confusions, and misconceptions were found, independent of their age and level of education. The results will allow improvements in the communication about STIs and propose new strategies that generate a responsible attitude in people, especially young people, and thus reduce the incidence of these diseases.

## 2. MATERIALS AND METHODS

### 2.1 Methods

#### 2.1.1 Survey

A cross-sectional study was conducted through an anonymous online survey using Google Forms software on STIs and gonorrhea. It

was targeted to the general population and presented a simple language without exclusion according to age, socioeconomic level, or educational level. Its dissemination was carried out throughout Argentina via WhatsApp, Facebook, Instagram, and e-Mail. It was enabled on June 17<sup>th</sup> 2020 and closed on July 26<sup>th</sup> 2020. In total, it remained available for 40 days.

This questionnaire was prepared in neutral Spanish and structured in four blocks based on the information collected. Open and closed questions were included. In addition, they drew on existing literature to explore respondents' knowledge, attitude, and practices to STIs.

The first block aimed to acquire information about age, gender identity, place of residence, and level of education. In the second block, the questions were directed to determine the degree of knowledge about STIs: what they are, which are their causal agents, and how they are transmitted. In the third block, questions were focused on personal habits, the frequency and reason for using protection methods, exposure to risky sexual behaviors, testing for STIs and reasons to do so, and sources of information if required. A question about the respondent's opinions on current STI campaigns was also included. Finally, in the fourth block, the emphasis was exclusively on gonorrhea: what is the etiological agent, forms of transmission and prevention, if it is an eradicated disease, what is the incidence in Argentina, if there is a vaccine, how is the diagnosis and treatment, and what possible complications the disease may have.

#### 2.1.2 Data analysis

A descriptive analysis of each block was carried out to determine the current situation of knowledge, practices, and access to information and care related to sexual life.

Subsequently, a one-way analysis of variance (ANOVA) with R was performed to verify whether age and educational level had a measurable effect according to the knowledge of the population and if there was a significant difference between the answers given at the different levels of the same factor.

The only variable or independent factor was "Age," whose levels were under 30, 30 to 39, 40 to 49, 50 to 59, and 60 years and older. We proceeded the same way with the "Education" factor: Primary education only, incomplete secondary, complete secondary, tertiary, incomplete college, complete college, and graduate degree levels. Again, correct and incorrect answers were given a particular score.

Finally, the total scores obtained corresponding to each level of education? Within the same factor were compared.

In addition, the Chi-square test was carried out to determine the association between the information collected in the main questions "What causes gonorrhoea?", "How is it transmitted?", "What complications could it produce if it is not treated in time?", "Is there a vaccine?", "How is the treatment?". "Is it an eradicated disease?" and "What STIs do you know?". A p-value  $\leq 0.05$  was considered statistically significant.

### 3. RESULTS AND DISCUSSION:

#### 3.1 RESULTS

##### 3.1.1 Characterization of the study population

In general, the surveys related to STIs are focused on the young population (Awang, Wong, Jani, and Low, 2014; Di Marco *et al.*, 2018; Drago *et al.*, 2016). It was aimed to perform a survey over a wider age range. A total of 803 responses were collected, mainly with answers from Mendoza and other regions of Argentina. We analyzed the age of the participants, with people younger than 30 years old representing the 55% of the participants, 20% from 30 to 40 years old, 16% from 40 to 50 years old, and 9% corresponding to people older than 50 years old (Figure 1A). On the other hand, we analyzed the level of education, finding that 97% of the subjects had completed at least high school. Among them, 29% had a university degree, and 16% had postgraduate studies (Figure 1B). As we expected, we covered a wide age range. The higher education of the participants is not fully representative of the general population, but it presented a good approach to measuring their knowledge of them.

##### 3.1.2 transmission: ancient myths still prevail

Pathogens causing STIs are found only in fluids of the body, primarily in fluids from the genitourinary tract that are exchanged during sexual activity and in blood. STIs are transmitted from one individual to another during unprotected sexual intercourse, vaginal, anal, or oral. They can be transmitted by pre-seminal fluid, semen, vaginal fluid, and even interaction between skin and/or mucous membranes. Another possibility is through blood, after direct contact with it or by sharing sharp objects, and during pregnancy, childbirth, or lactation (1).

Regarding knowledge about transmission forms, most participants knew the most frequent modes of transmission, like vaginal, anal, and oral sex. However, a low percentage of participants answered that insect bites or displays of affection, such as hugging and kissing an infected person, can constitute transmission routes, as seen in Figure 2.

##### 3.1.3 Knowledge of STIs: HIV and bacteria are the best known

To indagate about causal agents of STIs, we asked an open question. The most often mentioned agents were HIV, *Treponema pallidum*, and *Neisseria gonorrhoeae*, which cause AIDS, syphilis, and gonorrhoea. However, only half of the respondents named HPV, and less than 30% cited *Chlamydia trachomatis*, the most widespread sexually transmitted infection of bacterial origin in the world, as indicated in Figure 3A. Similar results were obtained previously in surveys performed on the young population in Argentina and Malaysia (3,8). Interestingly, we observed confusion with other diseases not considered sexually transmitted, such as Ebola and Zika.

As shown in Figure 3B, we observed that HIV was known independently of education. At the same time, Hepatitis B and C were better known among those who had completed secondary education. *T. pallidum* and genital herpes were less mentioned by the people with postgraduate studies. When answers were analyzed by age range, represented in Figure 3C, hepatitis was less mentioned among participants between 50-60 years old. On the other hand, the immediately previous range, 40-50 years old, were the ones who most mentioned Hepatitis B and C virus (HBV-HCV).

Confusion was observed regarding the transmission of agents and the possible secondary pathologies that they can cause, that is, between STIs and STDs. That was the case for diseases like cervical cancer and cirrhosis: almost 5% of responders (n=40) and less than 1% (n=8) reported cirrhosis as STIs. Since cervical cancer is not transmitted, HPV is the main cause of cervical cancer and genital warts. In the same sense, some participants indicated that "AIDS" is transmitted when this syndrome is caused by untreated HIV infection.

##### 3.1.4 Known and used prevention methods

Prevention is the best way to control STIs. In this sense, the correct information about the

population is fundamental. Condoms, male and female, are the best barrier to avoiding or minimizing the pathogen transmission during sexual intercourse (Holmes, Levine, and Weaver, 2004; Wiyeh, Mome, Mahasha, Kongnyuy, and Wiysonge, 2020; Workowski *et al.*, 2021).

Concerning prevention methods, only 7% (n=56) admitted not using any protective method when having sexual intercourse, and 20% (n=161) responded to not using any effective barrier methods against STIs but only non-barrier contraceptive methods. Furthermore, 24% (n=193) of those surveyed admitted that only sometimes they use prevention methods, as shown in Figure 4. It should be noted that only the condom is a double protection method, preventing pregnancies and transmission of STIs, while the rest only have a contraceptive function.

Most of the respondents reported not having engaged in risky sexual behavior. Although only 2% (n=16) indicated having had intercourse without any type of prevention method, 35% (n=281) have used methods that only work as contraceptives or prophylactics, but not in all types of sexual practices, which indicates that 37% (n=297) of the respondents had or has risky sexual behaviors, as shown in Figure 5. Di Marco *et al.* indicated that an early start in sexual life could be associated with less knowledge about STIs and the use of contraceptive methods (3). They warned that social groups from homes with lower incomes present earlier calendars for the onset of sexual life. Likewise, they highlighted the importance of learning in care/prevention after the start of sexual life and the need to reaffirm prevention policies before starting it.

### 3.1.5 Do we receive enough information about STIs?

We are exposed to a large amount of information coming from several communication forms. All governments have their ways of communicating and teaching about STIs. The next question was addressed to evaluate the amount and quality of data offered through different campaigns regarding sufficient and effective information. When we asked the participants if they considered the information sufficient, just 4% (n=32) answered it was adequate and effective (not shown). When analyzing the answers concerning education level, the participants with higher degrees more often answered that the information was insufficient or effective (Figure 6A). Regarding the age, the extremes think the opposite: while among the people who answered

effective and sufficient, the older population predominated, with 43%; the young people were the majority who answered is not effective nor sufficient, with 26%, as shown in Figure 6B. Even with this level of information, it should be highlighted that 34% (n=273) of the respondents had never had medical check-ups for STIs (not shown).

### 3.1.6 Half of the interviewed do not know the nature of the causal agent of gonorrhea

When inquiring in the survey about the nature of the transmitting agent of gonorrhea, the Gram-negative bacteria *N. gonorrhoeae*, we found that half of the respondents answered correctly. On the other hand, 7% (n=56) chose viruses, fungi, or parasites among the wrong answers. The remaining 43% (n=345) indicated that they did not know, as shown in Figure 7A. Furthermore, it was observed that most of those who knew the nature of the causative agent of gonorrhea had completed university education or postgraduate studies. In the same direction, the answer "I don't know" decreased with increasing educational level, as shown in Figure 7B. In addition, those who knew the bacterial origin of the disease did so almost regardless of age, as can be seen in Figure 7C.

When we asked about the current state of gonorrhea and its eradication, 41% of the people answered they do not know (Figure 8A). Interestingly, a significant proportion of the people who answered affirmatively have tertiary education, and a significant proportion of those who answered negatively have the highest level of education (Figure 8B). There were no differences in the answers when stratified by age (not shown).

### 3.1.7 Gonorrhea: transmission, prevention, and treatment

Gonorrhea is transmitted in the same way as the other STIs. When the interviewees enquired about the transmission of this disease, most of them answered that sexual intercourse is one of the ways of transmission. 96% correlated it with vaginal contacts, whereas only 64% (n=514) and 68% (n=546) correlated it with anal and oral contacts, respectively. The least mentioned routes caught our attention: just 26 % (n=209) knew that it could be transmitted from mother to child, 20% (n=161) mentioned transfusions, and 10% (n=80) via transplacental transmission. Infected surfaces were the most common among the wrong answers, probably due to confusion with the

COVID-19 pandemic. The results are summarized in Figure 9.

There are no preventive vaccines for this disease (Jerse, Bash, and Russell, 2014). However, 65% (n=522) of the respondents did not know if there was a vaccine, as shown in Figure 10A.

Furthermore, even when gonorrhea has been treated with antibiotics, the bacteria constantly develop resistance (M Unemo and Nicholas, 2012; Magnus Unemo and Shafer, 2014). Nevertheless, 50% (n=402) did not know about the treatment, as represented in Figure 10B.

When asked about the possible complications that gonorrhea can cause, 72% (n=578) of those surveyed did not have this information. The remaining percentage that answered affirmatively mentioned infertility, Pelvic Inflammatory Disease, arthritis, sepsis, neonatal blindness, abortions, and abscesses, among others. This can be seen in Figure 10C.

### 3.1.8 General knowledge

To know the potential differences in the knowledge of the participants concerning their educational level or age, it was performed an analysis of the "correct" answers of the participants. First, the relative data were used in the one-way ANOVA using the software R. Analyzing the five age ranges as the "Age" factor, no significant differences were found. From this, it follows that the level of knowledge (independent variable) was not conditioned by the age of the respondents, as indicated in Figure 11 A. The same tendency was followed with the "Education" factor, where the level of education was not associated with knowledge about STIs and gonorrhea, as visible in Figure 11 B.

## 3.2 DISCUSSION

The information recovered from the survey showed a significant knowledge level about STIs, without statistically significant differences regarding the age or educational level of the participants. Although, there is a minor familiarity related to gonorrhea, particularly in details such as the nature of the disease, treatments, and complications generated during or after the disease.

In the present work, inaccurate information was found, misconceptions about which infections are mainly sexually transmitted, and the

prevalence of old myths regarding contagions.

In agreement with previous works performed in Argentina and other countries, we found that young people have low levels of knowledge (3,7,9,16). Even more, we found that the older population also lacks in their cognizance, and they have differences regarding specific points like the pathogenic agents, methods of prevention, and ways of contagion.

It concerns the small percentage recognizing Hepatitis B or C and HPV Chlamidya as STIs. A better knowledge of HIV was expected, thanks to the prevention and information campaigns about AIDS in the last years.

Regarding the prevention methods used, the most popular and used is the condom, being also a "barrier method" able to function as a contraceptive and preventive of STIs, in concordance with other studies (7,17).

Prevention and information campaigns resulted in being qualified as insufficient, non-effective, or both for most respondents. Therefore, it would be necessary to indague deeply understand the reasons for this opinion, to improve future campaigns.

Even when gonorrhea is in the top 3 of the most named STIs agents, there is low knowledge about the nature of the agent, the treatment, and the existence of vaccines. However, the prevention and transmission of *N. gonorrhoeae* are better understood due to their similarities with the rest of the STIs.

## 4. CONCLUSIONS:

The prevalence of gonorrhea in Argentina has increased since 2000. In the period 1992-1999, there was a statistically significant decrease in the number of cases of gonorrhea ( $p < 0.05$ ) compared to the previous period, which was attributed to improved diagnosis, the efficacy of fluoroquinolones used for treatment, and to the increased use of protection methods by AIDS prevention campaigns (Ministerio de Salud de la Nación Argentina, 2021). Subsequently, it continued with an upward trend. Something similar happened with Chlamydia, for which there was a decrease in incidence since 1980. Still, higher frequencies of sexually transmitted viral infections appeared simultaneously. From this, it follows that the decrease in cases is due to improved diagnosis, contact tracing, and treatment rather than to the use of barrier methods of protection like condoms (Andersson-Ellström and Milsom, 2002).



Based on the data obtained, we found some ignored issues, misconceptions, mistakes, and gaps in the information regarding STIs and gonorrhea. In general, it is observed that people know that they should use STI prevention methods, although they do not know why and what to take care of. Prevention is focused on sexual intercourse without considering transfusions and transmission from mother to child. However, even when most respondents admit to using some protection method during sexual intercourse, a significant percentage do it only sometimes, or even not at all.

Knowledge is a general level about STIs. When gonorrhea was inquired to a greater extent, the greatest shortcomings in knowledge were visualized. From the nature of the disease-causing agent to effective vaccines and treatments, the information that people have is scarce. Age and educational level are not associated with knowledge about STIs and gonorrhea.

In conclusion, the results of this study indicate that institutional work should be done at different levels to increase awareness about STIs in Argentinian society, particularly about gonorrhea.

## 5. DECLARATIONS

### 5.1. Study Limitations

The present work was based on surveys of 803 participants, and they may not be fully representative of all population in Argentina. Also, the participants were residents of different cities of Argentina, with a high percentage living in Mendoza. Despite these limitations, our findings are consistent with those in the literature.

### 5.2. Acknowledgements

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### 5.3. Funding source

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### 5.4. Competing Interests

The authors declare that they have no competing interests.

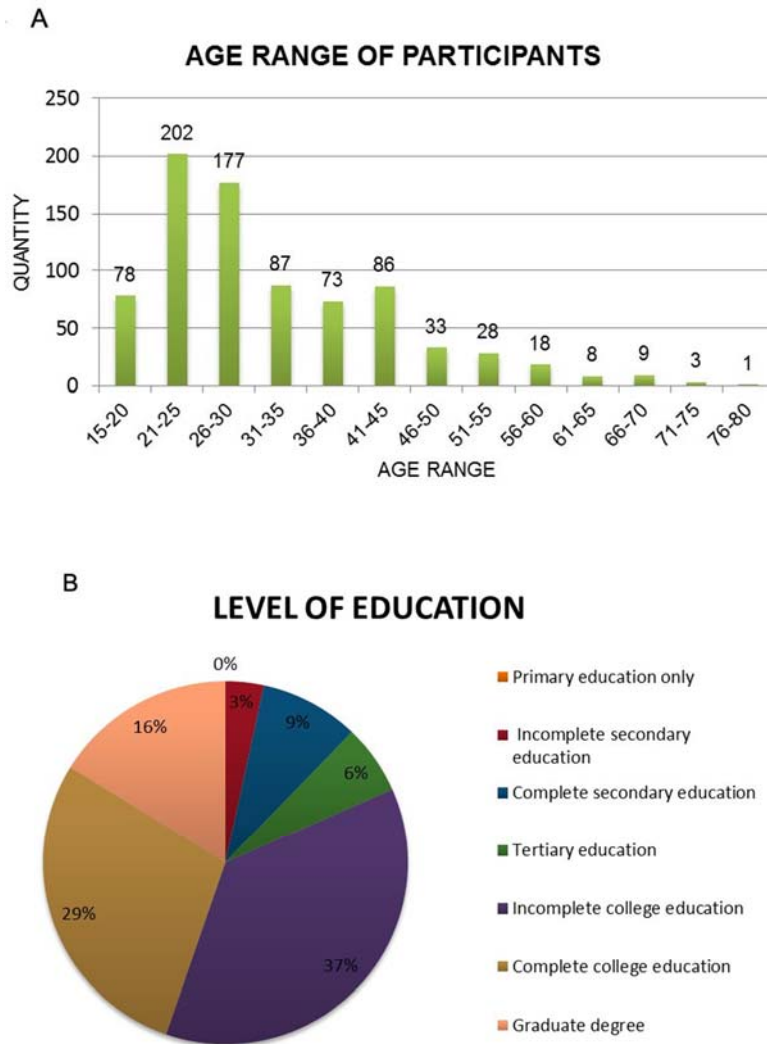
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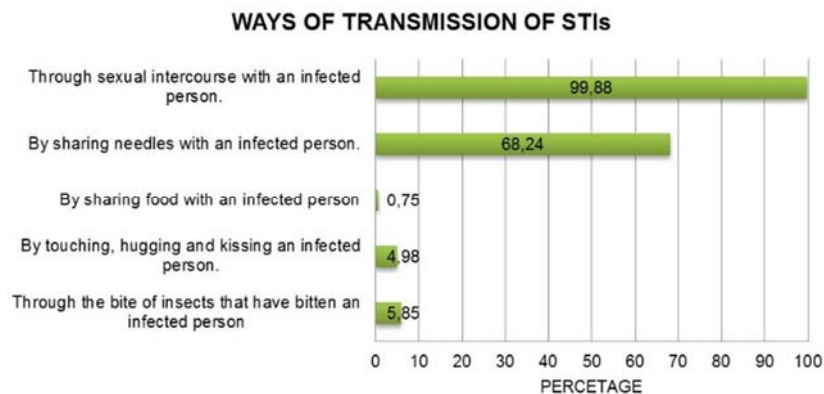
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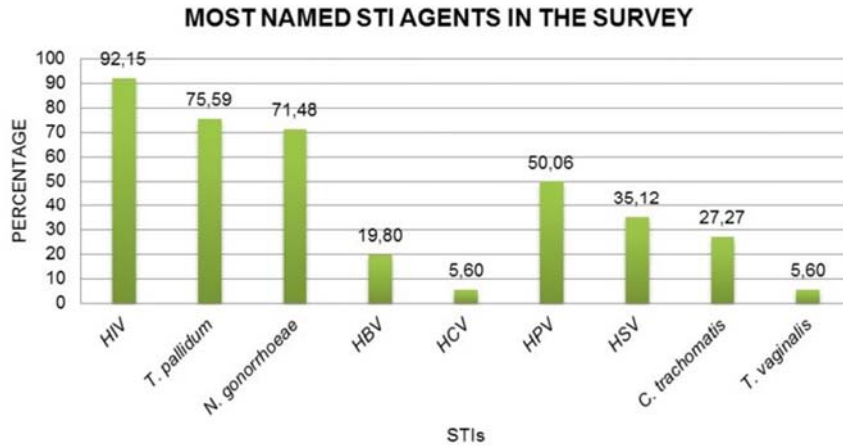
**Figure 1: Characterization of the respondents according to age and education level.** A- Classification of the survey participants according to age ranges. The results are shown in the number of participants. B- Classification according to the highest level of education reached. The results are shown in percentages.



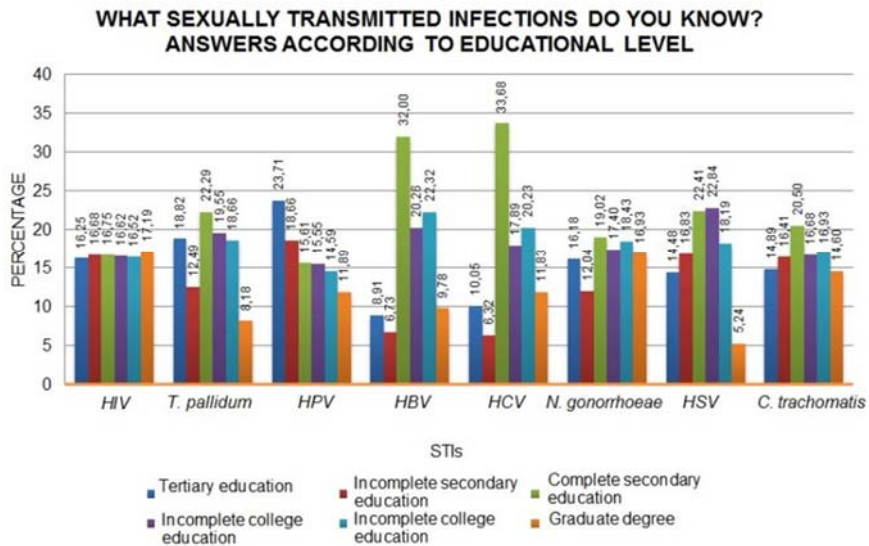
**Figure 2. Ways of transmission of STIs.** Closed question with the possibility to mark more than one answer. Results are presented in percentages.



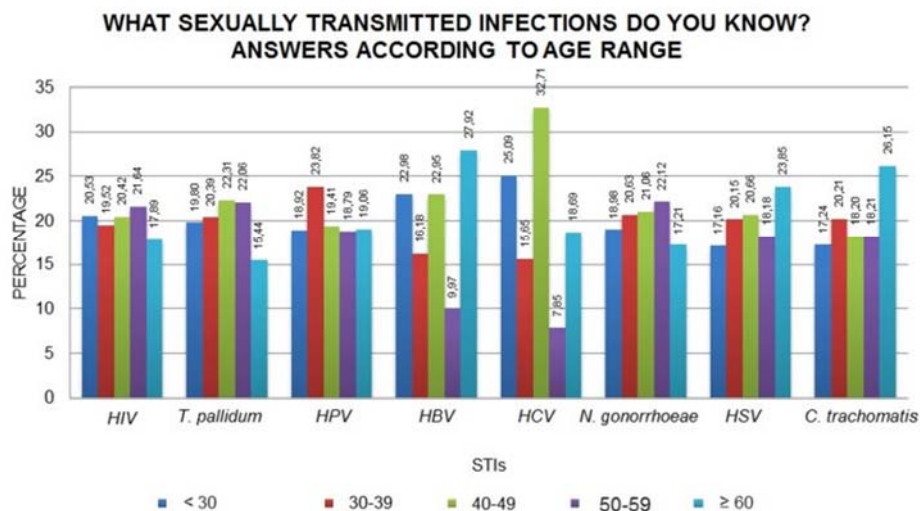
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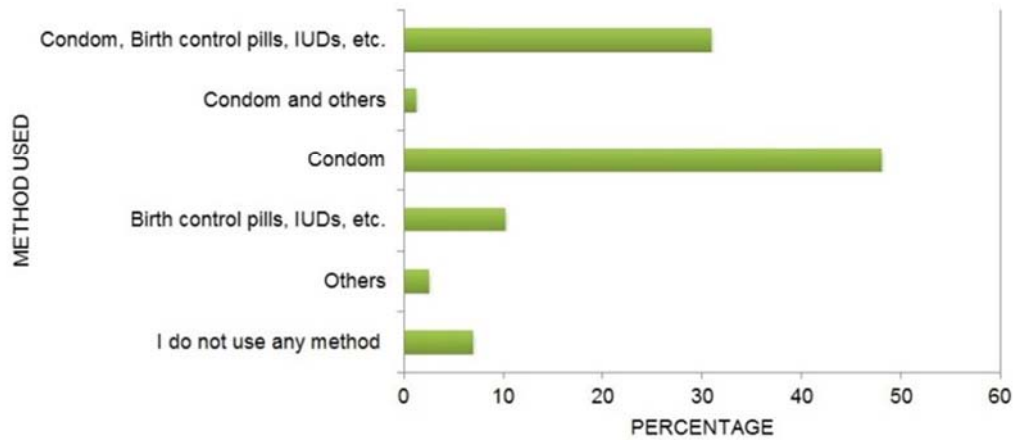


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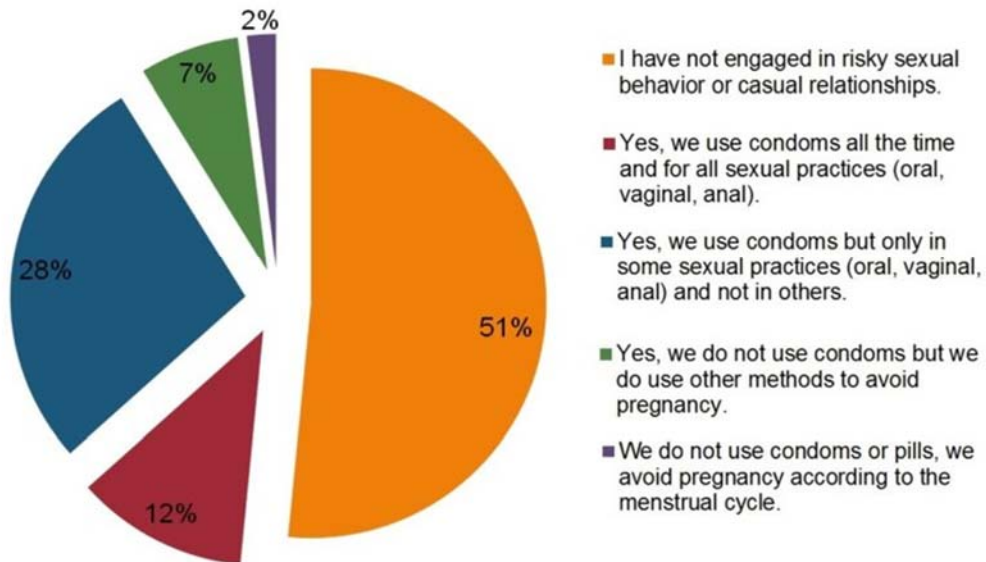
**Figure 3. The most known Sexually Transmitted Infections.** Open question. The graphs show the percentage of answers for each infection: A- general answers. B. Answers according to education level. C- Answers according to age.

### HOW DO YOU TAKE CARE OF YOURSELF DURING SEXUAL INTERCOURSE?

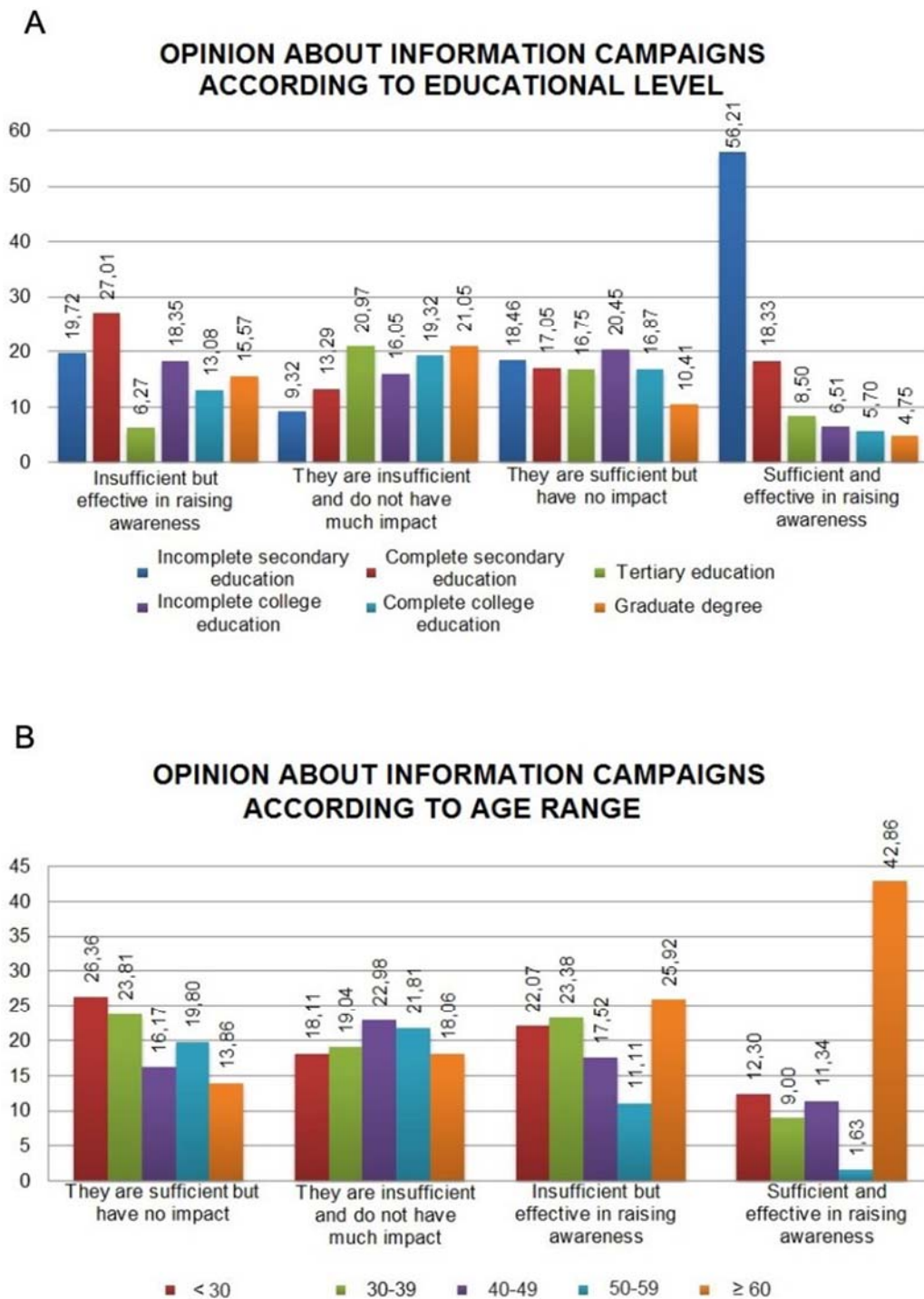


**Figure 4. Methods of prevention used.** Answers of participants to the question about the prevention method used during their sexual intercourse. Closed question. The results are presented in percentages.

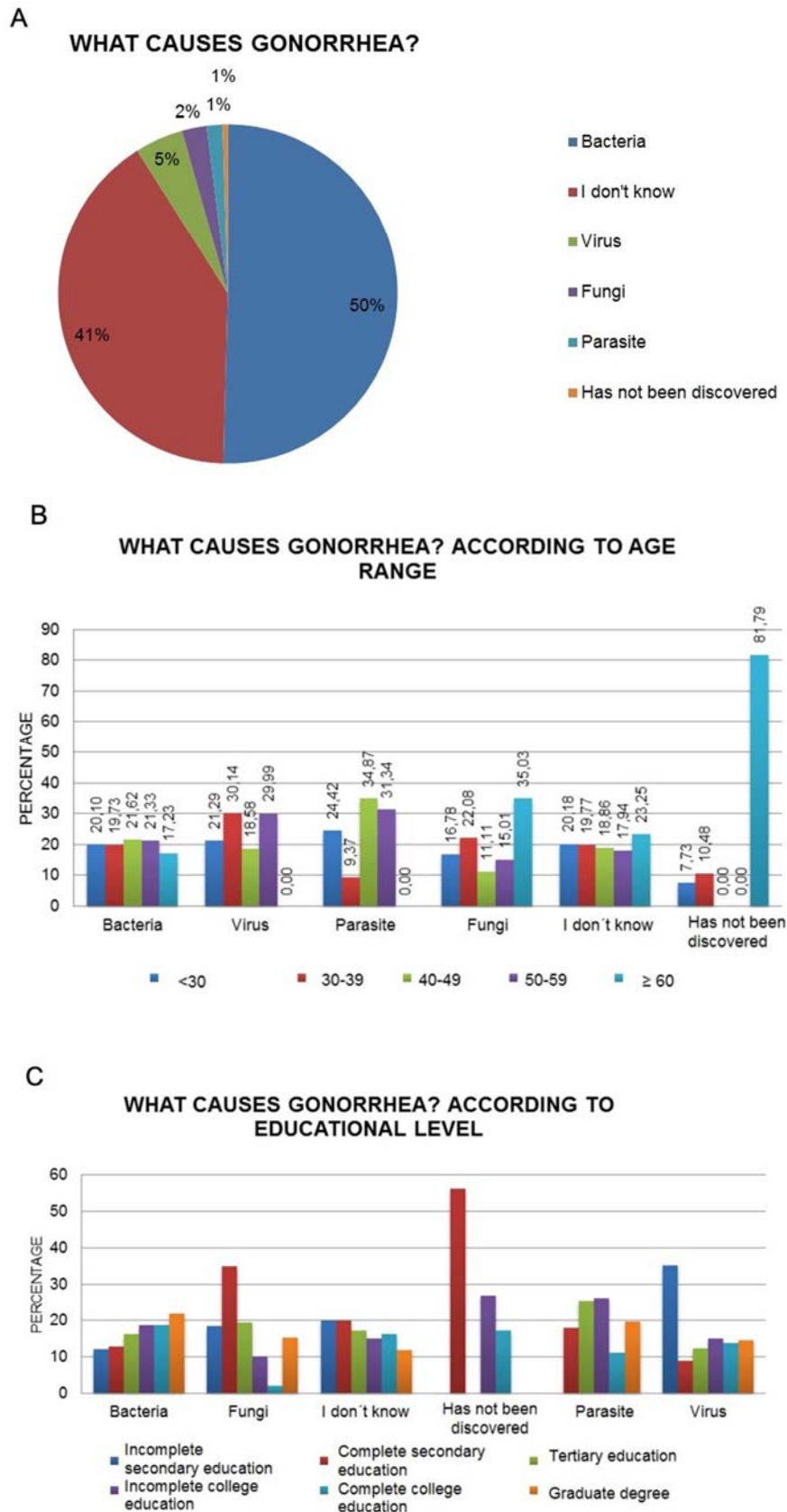
### HAVE YOU ENGAGED IN RISKY SEXUAL BEHAVIORS ?



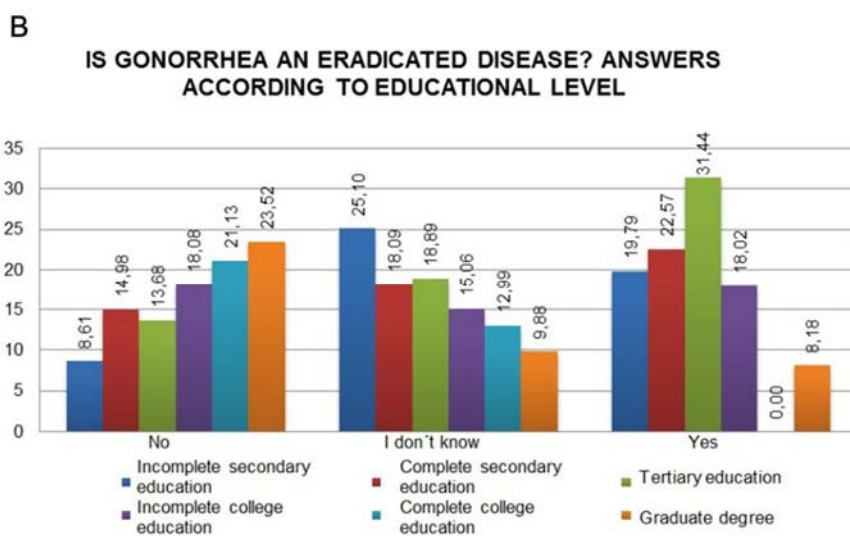
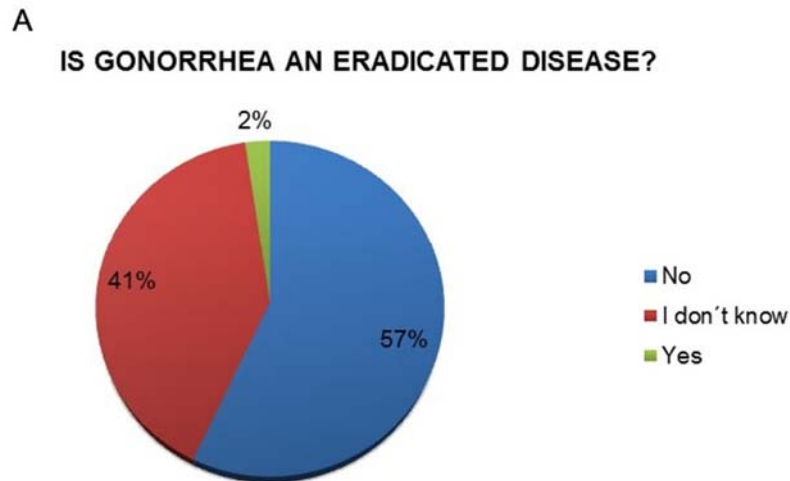
**Figure 5. Risky sexual behaviors.** The participants were asked about their participation in risky sexual intercourse and their behavior in those cases. Closed question. Results are presented in percentages.



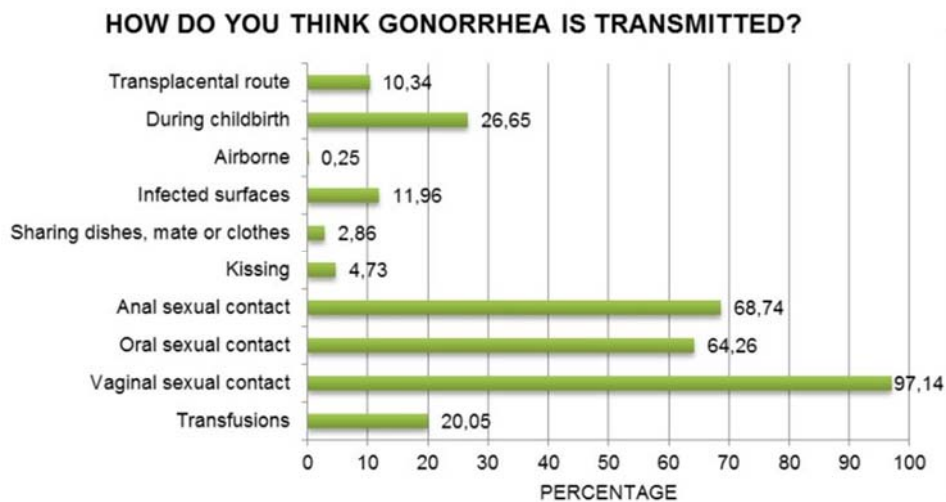
**Figure 6. Level of conformity with the current information campaigns about STIs.** A- Answers of participants according to educational level. B-Answers of participants according to age range. The results are shown in percentage.



**Figure 7. The nature of the agent causing gonorrhoea.** The participants were asked about the nature of the agent causing gonorrhoea with a closed question. A- general answers. B. Answers according to education level. C- Answers according to age. All the results are presented in percentages.



**Figure 8 Current state of gonorrhoea.** A- Answers about the eradication of the disease. B- Answers about the eradication of gonorrhoea according to their academic level.



**Figure 9. Transmission of gonorrhoea.** The answers correspond to an open question about how gonorrhoea is transmitted. The results are presented in percentages



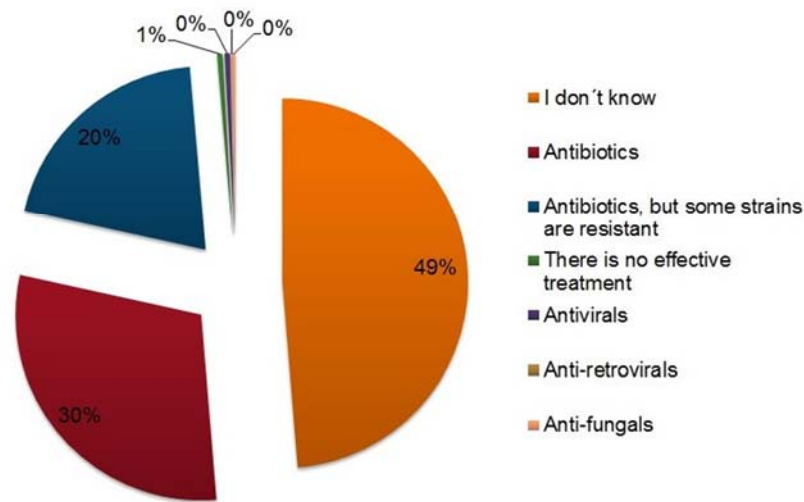
A

**IS THERE A VACCINE FOR GONORRHEA?**



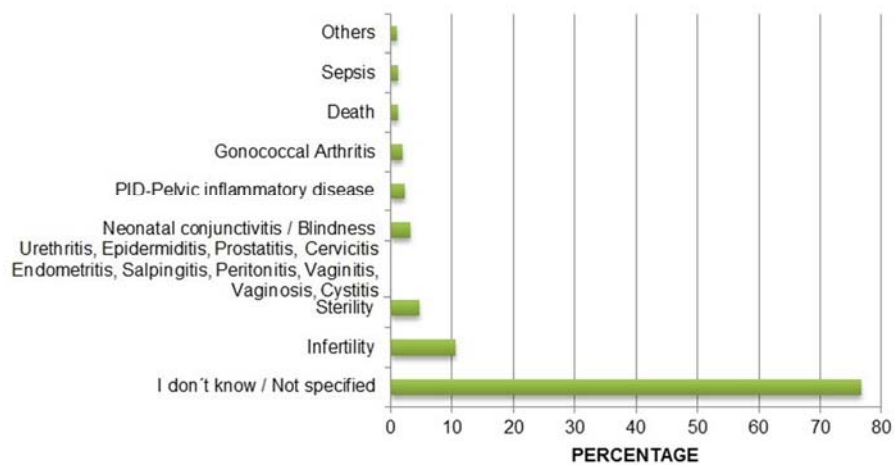
B

**HOW IS GONORRHEA TREATED?**



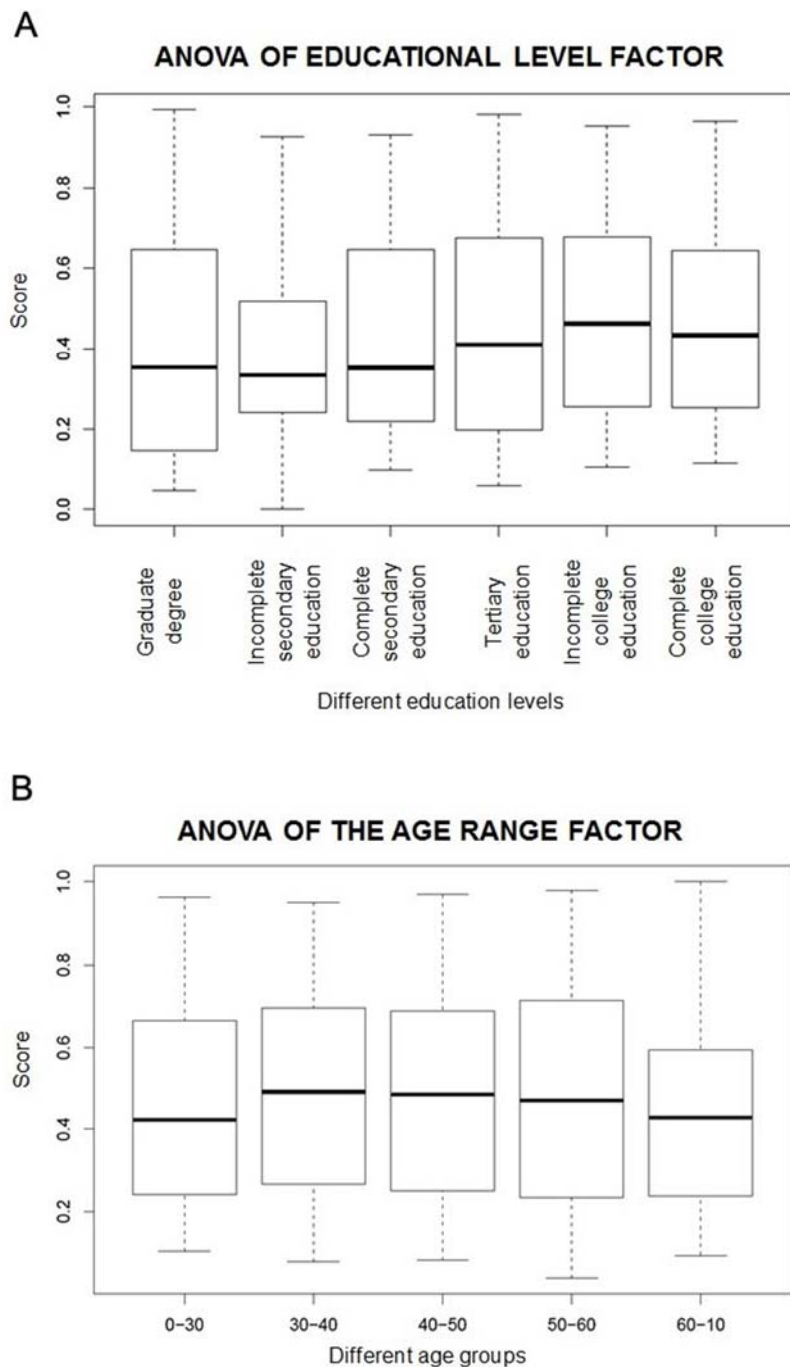
C

**WHAT COMPLICATIONS CAN GONORRHEA PRODUCE?**



**Figure 10. Prevention, treatment, and complications of gonorrhoea.** The answers of the participants over the questions. A- Is there a vaccine against gonorrhoea? Three options to choose from. B- How is the treatment against gonorrhoea? Closed question C- What are the complications that gonorrhoea can cause? (open question).





**Figure 11. General knowledge of the participants, according to educational level and age.** ANOVA analysis of the correct answers for selected questions. A- Analysis according to educational level. B-Analysis according to age range.