

# Let's Talk About Sex: Tyrolean Online Study on Reproductive Health Issues

## Lasst uns über Sex sprechen: eine Tiroler Online-Studie zu Problemen der reproduktiven Gesundheit



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### ABSTRACT

#### Introduction

The way pupils and university students talk about sex does not reflect their real understanding of reproductive health issues. Therefore, we developed a survey for pupils and students in Tyrol, Austria, to evaluate the current state of knowledge.

#### Methods

Two questionnaires with 39 items for pupils (n = 369) and 53 items for university students (n = 537) were developed, and an online survey was carried out in Tyrol, Austria, between April and July 2022. A sum score for each correct answer to ten identical items in both questionnaires was used to compare groups (range: 0–11 points), with analysis performed using independent sample t-test, analyses of variance (ANOVAs) and chi-square test.

#### Results

With regards to reproductive health issues and fertility awareness, female vs. male participants (p < 0.001), university students vs. pupils (p < 0.001) and medical students vs. other students (p < 0.001) had greater knowledge. Participants who had already had sexual intercourse showed a broader knowledge of contraception and fertility (p < 0.001).

The age at which the decline of female fertility becomes relevant was misstated by the adolescents, who gave a mean age of 42.6 years compared to university students who asserted a mean age of 35.9 years ( $p < 0.001$ ). Overall, the lowest rate of correct answers was found with respect to emergency contraception (30.7%), while knowledge of contraceptive methods was comparatively high (99.2%).

### Conclusion

Substantial lack of knowledge of reproductive health issues exists, with differences found between pupils and university students, between genders, and according to field of study. Future health and fertility awareness programs at school and university should focus on gender-specific aspects to prevent unplanned pregnancies, sexually transmitted diseases, and childlessness.

## ZUSAMMENFASSUNG

### Einleitung

Die Art, wie Schüler und Schülerinnen sowie Studenten und Studentinnen über Sex sprechen, gibt kein wirkliches Bild von ihrem Verständnis von Problemen der reproduktiven Gesundheit wieder. Wir haben deshalb eine Online-Umfrage bei Schüler und Schülerinnen sowie Studierenden in Tirol, Österreich durchgeführt, um den aktuellen Wissensstand in diesen Gruppen zu beurteilen.

### Methoden

Es wurden 2 Fragebogen mit jeweils 39 Items für Schüler\*innen ( $n = 369$ ) und 53 Items für Studierende ( $n = 537$ ) entwickelt. Die Online-Befragung von Schüler\*innen und Student\*innen in Tirol, Österreich wurde zwischen April und Juli 2022 durchgeführt. Ein Summenscore für jede richtige Antwort zu zehn ausgewählten Items, die in beiden Fragebogen identisch waren, wurde verwendet, um die beiden Gruppen

zu vergleichen (Spannbreite: 0–11 Punkte). Zur Auswertung wurden t-Tests für unabhängige Stichproben, Varianzanalysen (ANOVAs) sowie Chi-Quadrat-Test eingesetzt.

### Ergebnisse

Hinsichtlich ihrer Kenntnisse von Problemen der Reproduktionsgesundheit sowie ihr Fertilitätsbewusstsein wiesen die weiblichen Teilnehmerinnen mehr Kenntnisse auf als die männlichen Teilnehmer ( $p < 0,001$ ), Studierende hatten ein größeres Wissen als Schüler und Schülerinnen ( $p < 0,001$ ) und Medizinstudent\*innen wussten mehr verglichen mit Studierenden anderer Fachrichtungen ( $p < 0,001$ ). Teilnehmer\*innen, die bereits sexuellen Verkehr gehabt hatten, wussten mehr über verschiedene Formen der Verhütung und zur Fertilität ( $p < 0,001$ ).

Das Alter, ab dem sich die weibliche Fertilität zu verringern beginnt, wurde von den Jugendlichen inkorrekt angegeben. Die Jugendlichen gaben ein mittleres Alter von 42,6 Jahren an, verglichen mit Student\*innen, die ein mittleres Alter von 35,9 Jahren angaben ( $p < 0,001$ ). Am niedrigsten fiel die Prozentzahl richtiger Antworten bei den Fragen zur Notfallverhütung aus (30,7%), wohingegen das Wissen um Verhütungsmethoden relativ hoch war (99,2%).

### Schlussfolgerung

Es gibt wesentliche Lücken im Wissen um die Reproduktionsgesundheit, mit erheblichen Unterschieden zwischen dem Wissen von Schüler\*innen und Universitätsstudent\*innen sowie zwischen den Geschlechtern und zwischen Studierenden verschiedener Fachrichtungen. Künftige Gesundheits- und Fertilitätsaufklärungsprogramme an Schulen und Universitäten sollten ihre Aufmerksamkeit auch auf geschlechtsspezifische Aspekte richten, um ungewollten Schwangerschaften, der Übertragung von Geschlechtskrankheiten und Kinderlosigkeit vorzubeugen.

## Introduction

The school system in Austria consists of elementary schools ( $> 30\,000$  pupils in Tyrol) followed by different kinds of secondary schools, including middle schools ( $> 20\,000$  pupils in Tyrol), high schools ( $> 30\,000$  pupils in Tyrol), polytechnic schools ( $> 1\,400$  pupils in Tyrol) and special need schools ( $> 700$  pupils in Tyrol) [1]. Every year, 1800 students in Austria begin their medical studies, 400 of them in Tyrol [2].

Sexual education is offered at different times during school life. Sexual education starts in the fourth grade of elementary school and is continued in secondary schools. The subject is mainly addressed by biology teachers but may also be taught by external providers such as social workers or medical students [3].

In the last ten years, improvements in sexual education programs have helped to lower the number of teenage pregnancies

in Austria by more than 50% [4]. However, there are no statistical records on abortions in Austria. In Germany, around 100000 abortions are performed every year, with 6000–7000 abortions carried out in women under the age of 20 years and 2000–3000 in women under 18 years of age [5].

According to a German survey, 52% of male and 49% of female adolescents first have sexual intercourse when they are aged between 16–18 years. Contraception methods cited by adolescents include condoms (56%), hormonal contraceptives (52%), intrauterine devices (copper and hormonal) (5%) and coitus interruptus (3%) [6]. In Austria, emergency contraception has been available without prescription since 2009, and more than 120000 pills are sold every year. These sales figures indicate that the number of emergency contraception pills sold has more than quadrupled since they first became available without a prescription [7]. This

might also reflect an increasing skepticism about hormonal contraception. Knowledge about alternatives to hormonal contraceptives is quite limited and there are similarly large gaps in young people's understanding of how contraceptives work in general, especially among users between the age of 14–19 years [6].

Surveys indicate that knowledge about the physiology of reproduction, contraception, and fertility awareness is limited in adolescents [8, 9, 10, 11]. Both the time to pregnancy when having regular sexual intercourse and the impact of female age on fertility are strongly underestimated [8].

The awareness of endometriosis has become more widespread in the last ten years. However, the time between initial symptoms and the final diagnosis of endometriosis is still long (around 5 years) [12]. As endometriosis affects up to 300000 women in Austria [13], there is an urgent need to increase the awareness of endometriosis, especially in adolescents.

Studies on gender differences in the knowledge of fertility and contraception are controversial. While some studies report a greater awareness in women compared to men [14, 15], others report no significant difference [16] or diverging results [17]. In university students, female sex and the study of medicine were correlated with a better knowledge of fertility [15].

Our aim is to work closely with the local government to revise the current sexual education program provided to pupils in Tyrol, Austria. Therefore, we developed an online survey for pupils and university students to allow us to assess their knowledge of reproductive health issues including contraception, fertility and gynecological diseases. We also evaluated the impact of demographic characteristics to identify subgroups who are not reached with the currently available educational programs.

## Materials and Methods

### Questionnaires

The development of the survey was based on questionnaires used in former studies, with some items modified and others newly designed. First, a literature search was carried out between December 2021 and March 2022 to identify questionnaires with a comparable focus [9, 16, 18]. We identified three main questionnaires: a Danish study of university students [16], a Canadian study of undergraduate students [18], and a German online survey of adolescents [9]. After screening, we included items focusing on reproductive health and fertility from the Danish [16] and the Canadian study [18] and items focusing on contraception from the German study [9]. Twenty-five items for pupils and 38 items for university students (excluding demographic aspects) were newly developed.

Multiple choice questions were chosen to provide the participants with a wide range of possible answers. Questions using a Likert scale ranging from 1 to 10 (1 = very strongly disagree, 10 = very strongly agree) were also included.

The questionnaire for pupils consisted of 39 questions, the one for university students had 53 questions. Topics covered included demographic aspects (8), reproductive health (8 male /9 female pupils vs. 13 male/14 female students), contraception (5 pupils vs. 12 students), satisfaction with current contraception (both 9), fertility (both 4) and gynecological diseases (4 pupils vs. 6 students).

► **Table 1** Questions evaluating knowledge of female health issues including fertility.

1.	How long is the menstrual cycle?
2.	At what time during the menstrual cycle is it likely that a pregnancy will occur with unprotected sexual intercourse (click on the timeline)?
3.	What is the period of time during which an oocyte can be fertilized?
4.	How long after sexual intercourse are sperm capable of fertilizing an oocyte?
5.	What is the period of time during which the "morning-after pill" can be taken to prevent pregnancy?
6.	Which contraceptive methods protect against sexually transmitted diseases?
7.	What is the most important risk factor for infertility?
8.	What is the most important risk factor for miscarriage?
9.	From what age does a woman's fertility decrease?
10.	What symptoms can occur when suffering from endometriosis?

To compare the knowledge of female health issues between pupils and university students, ten identical questions were identified in both questionnaires (► **Table 1**).

The survey was conducted with SurveyMonkey (License acquired in March 2022).

### Data

The ethical committee of the Medical University of Innsbruck, Austria, approved the study (AN 1012/2022). It was conducted in accordance with the Declaration of Helsinki. The prospective cross-sectional survey was carried out in Tyrol, Austria, between April and July 2022. Participation in the study was voluntary, and data was collected anonymously. The invitation to participate in the study including web links and QR codes to the questionnaires, was distributed online via emails to various study program directors and study representatives or school principals. Consent to participate in the study was given online at the beginning of each questionnaire.

Data processing was done in accordance with the EU General Data Protection Regulation (GDPR). The requirements for participating in the study were sufficient German language skills and current registration as a pupil or university student in Tyrol.

### Data analysis and statistics

Each correct answer was given one point, except for question six, which had the option of giving multiple answers (two points). This resulted in a range of 0–11 points. Statistical analysis was conducted using IBM SPSS Statistics for Windows, version 26.0 (IBM Corp., Armonk, NY, USA). T-tests, ANOVA and chi-square test were used for group comparisons and Cohen's d for effect size. The confidence interval (CI) was 95% and a two-sided p value of <0.05 was considered statistically significant. Effect sizes were estimated using Hedges' g in t-tests, with g = 0.3, g = 0.5 and g = 0.8 and phi

in chi-square tests, with  $\phi = 0.1$ ,  $\phi = 0.3$  and  $\phi = 0.5$  indicating small, medium, and large effect sizes, respectively [19].

## Results

### Study Population

A total of 906 participants responded to the survey, of whom 369 were pupils (median age  $15.63 \pm 1.3$  years) and 537 were university students (median age  $23.82 \pm 4.3$  years). The adolescents participating in this online study attended the following type of

schools: lower secondary school (“Mittelschule”):  $n = 75$  (20.3%); pre-vocational school (“polytechnische Schule”):  $n = 42$  (11.4%); apprenticeship training (“Berufsschule/Lehre”):  $n = 2$  (0.5%); intermediate or higher vocational school (“berufsbildende mittlere und höhere Schule”):  $n = 68$  (18.4%); higher general secondary school (“allgemeinbildende höhere Schule”):  $n = 182$  (49.3%).

More female than male persons participated (232 female pupils [62.87%], 438 female students [81.56%]). Demographic characteristics of the study population (age, gender, nationality, religious beliefs, family, and sexual history) are presented in ► **Table 2**.

► **Table 2** Study population’s demographics, family, and sexual history.

	Pupils			Students		
	Female	Male	Total	Female	Male	Total
Total n (%)	232 (62.9%)	137 (37.1%)	369 (100%)	438 (81.6%)	99 (18.4%)	537 (100%)
Median age	$15.84 \pm 1.3$	$15.28 \pm 1.1$	$15.63 \pm 1.3$	$23.74 \pm 4.4$	$24.13 \pm 3.6$	$23.82 \pm 4.3$
<b>Nationality<sup>1</sup> n (%)</b>						
Austrian	205 (88.4%)	117 (85.4%)	322 (87.3%)	283 (64.6%)	67 (67.7%)	350 (65.2%)
German	5 (2.2%)	4 (2.9%)	9 (2.4%)	73 (16.7%)	11 (11.1%)	84 (15.6%)
Other	22 (9.5%)	16 (11.7%)	38 (10.3%)	82 (18.7%)	21 (21.2%)	103 (19.2%)
<b>Religious beliefs<sup>1</sup> n (%)</b>						
Christianity	188 (81%)	117 (85.4%)	305 (82.7%)	332 (75.8%)	67 (67.7%)	399 (74.3%)
Atheism/agnosticism	34 (14.7%)	10 (7.3%)	44 (11.9%)	101 (23.1%)	30 (30.3%)	131 (24.4%)
Islam	8 (3.5%)	7 (5.1%)	15 (4.1%)	4 (0.9%)	1 (1.01%)	5 (0.9%)
Judaism	0 (0%)	1 (0.7%)	1 (0.3%)	0 (0%)	0 (0%)	0 (0%)
Other	2 (0.9%)	2 (1.5%)	4 (1.1%)	1 (0.2%)	1 (1%)	2 (0.4%)
<b>Study subject<sup>1</sup> n (%)</b>						
Medicine	–	–	–	230 (52.5%)	72 (72.7%)	302 (56.2%)
Other	–	–	–	208 (47.5%)	27 (27.3%)	235 (43.8%)
<b>Sexual orientation<sup>1</sup> n (%)</b>						
Heterosexual	185 (79%)	121 (88.3%)	306 (82.9%)	380 (86.8%)	84 (84.9%)	464 (86.4%)
Homosexual	7 (3%)	7 (5.1%)	14 (3.8%)	10 (2.3%)	7 (7.1%)	17 (3.2%)
Bisexual	19 (8.2%)	4 (2.9%)	23 (6.2%)	35 (8%)	5 (5%)	40 (7.5%)
Asexual	1 (0.4%)	0 (0%)	1 (0.3%)	1 (0.2%)	1 (1%)	2 (0.4%)
Other	20 (8.6%)	5 (3.7%)	25 (6.8%)	12 (2.7%)	2 (2%)	14 (2.6%)
<b>Sexual History<sup>1</sup> n (%)</b>						
Sexual experience	64 (27.7%)	27 (19.7%)	91 (24.7%)	406 (92.7%)	88 (88.9%)	494 (92%)
<b>Family planning<sup>1</sup> n (%)</b>						
Has children	0 (0%)	2 (1.5%)	2 (0.5%)	16 (3.7%)	4 (4%)	20 (3.7%)
Number of children	$0 \pm 0$	$4 \pm 0$	$4 \pm 0$	$1.44 \pm 0.81$	$1.25 \pm 0.5$	$1.40 \pm 0$
Wants to have children	156 (67.2%)	91 (68.4%)	247 (67.7%)	318 (75.4%)	68 (71.6%)	386 (74.8%)
Average age for first child*	$26.3 \pm 3.6$	$26.8 \pm 5.7$	$26.5 \pm 4.5$	$28.3 \pm 3.4$	$29.1 \pm 2.5$	$28.4 \pm 3.3$

<sup>1</sup> Percentage of respective gender group.

+ Number of subjects who have children and mean number of their children.

\* Number of subjects who wish to have children and mean age they wish to have their first child.

Chi-square test was performed to compare the study populations' nationalities, religious beliefs, sexual orientation, and sexual experience. Significant differences in the number of male and female participants with a small effect size relating to gender and educational status were present in the Austrian [ $\chi^2(1) = 24.93, p < 0.001, \phi = 0.19$ ] and German cohorts [ $\chi^2(1) = 5.91, p = 0.015, \phi = 0.25$ ] and in the subgroup that had already had sexual intercourse [ $\chi^2(1) = 6.84, p = 0.009, \phi = 0.108$ ], resulting in a higher participation of male pupils and female students than expected. These differences were also present with a small effect size in the subgroup analysis of Christians [ $\chi^2(1) = 41.66, p < 0.001, \phi = 0.24$ ] and heterosexual orientation [ $\chi^2(1) = 43.39, p < 0.001, \phi = 0.24$ ]. There was no significant difference in the distribution of male and female participants with regards to atheistic/agnostic belief, homosexual and bisexual orientation.

## Questionnaires

### Pupils

369 of the 532 questionnaires were analyzed further. The following reasons led to exclusion from the study: not being a pupil ( $n = 4$ ), missing or declined consent ( $n = 23$ ), incomplete questionnaire ( $n = 35$ ), not answering any items evaluating knowledge ( $n = 91$ ), age above 18 years ( $n = 8$ ), and identifying as non-binary ( $n = 2$ ) due to the small number (► Fig. 1).

### Students

In total, 652 university students participated. Exclusion criteria were: not being a student ( $n = 3$ ), missing or declined consent ( $n = 6$ ), incomplete questionnaire ( $n = 20$ ), not answering any items evaluating knowledge ( $n = 85$ ), and identifying as non-binary ( $n = 1$ ) due to the small number. 537 questionnaires were analyzed in the student group (► Fig. 1).

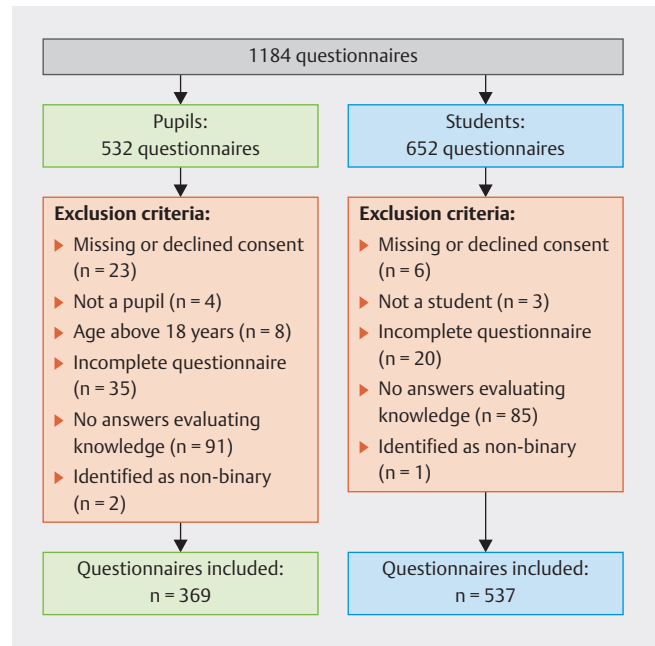
## Reproductive health issues

Pupils had significantly less knowledge about reproductive health issues than students (4.3 vs. 7.6,  $t = 26.55, p < 0.001; g = 1.79$ ). There was a significant gender difference with a medium effect size showing higher scores for females than males (6.6 vs. 5.2,  $t = 8.11, p < 0.001; g = 0.61$ ). Higher education led to significantly higher scores, with the highest scores for female students (female pupils vs. male pupils: 4.8 vs. 3.6) and female students vs. male students (7.6 vs. 7.4), [ $F(3, 902) = 256.89, p < 0.001$ ].

In the student group, medical students had a significantly higher score compared to non-medical students, with a medium effect size (7.1 vs. 6.0,  $t = 7.01, p < 0.001; g = 0.61$ ).

Pupils and students who had already had sexual intercourse had significantly more knowledge resulting in a large effect size and achieved 2.5 more points on average than participants without sexual experience (7.1 vs. 4.6,  $t = 17.22, p < 0.001; g = 1.2$ ).

The overall percentage of questions answered correctly is shown in ► Fig. 2.



► Fig. 1 Flow chart depicting identification, screening, and inclusion process. Out of 1184 questionnaires, 532 were answered by pupils and 652 by students. After applying the exclusion criteria, 369 remained in the pupil cohort and 537 in the student cohort. Participants who identified as non-binary were excluded due to the small number in each subgroup.

## Detailed analysis

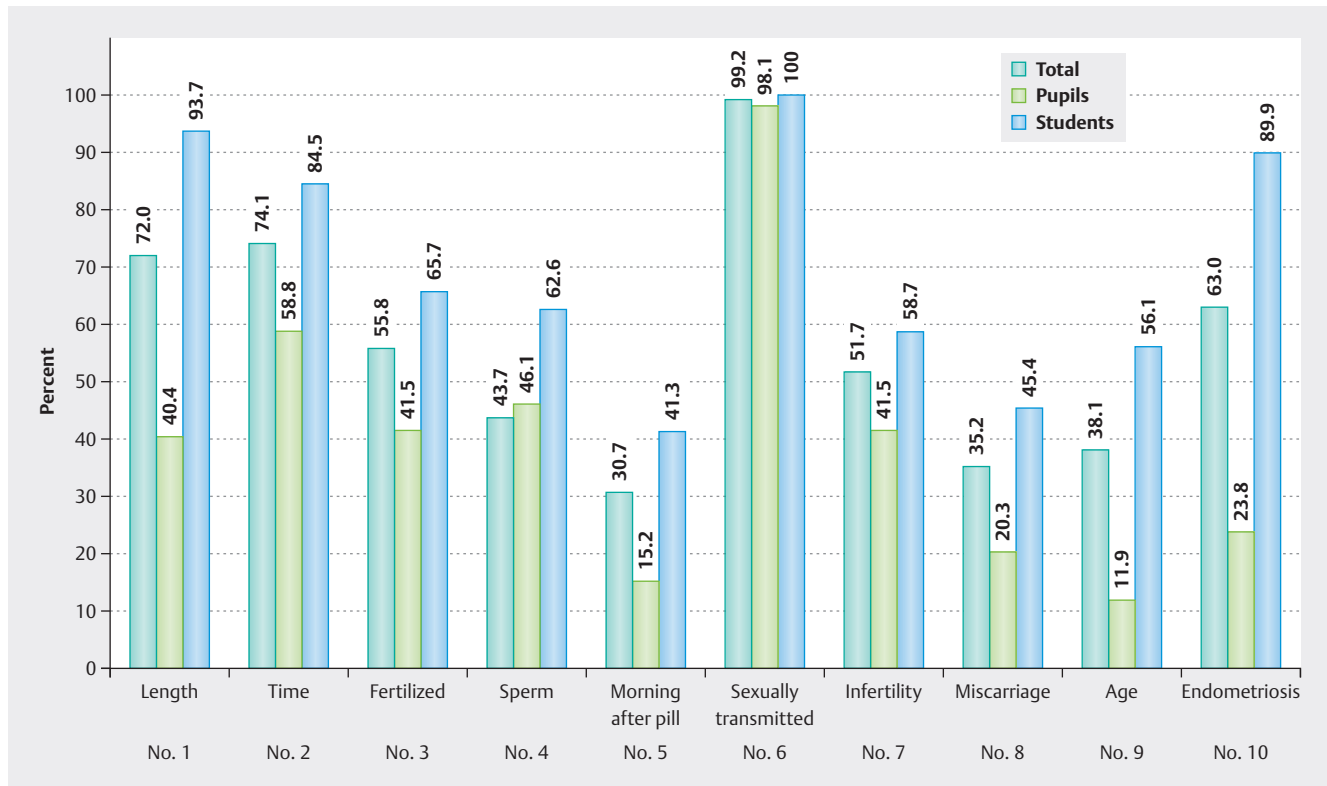
### 1. How long is the menstrual cycle?

The definition of eumenorrhea is a menstrual cycle length of 25–35 days. In the pupil cohort ( $n = 369$ ), 40.4% ( $n = 149$ ) gave the correct answer. The reported mean was 17.3 days ( $SD = 17.2$  days). In the student cohort ( $n = 537$ ), 93.7% ( $n = 503$ ) gave the right answer, with a mean of 27.2 days ( $SD = 4.6$  days) for the whole student subgroup. A statistically significant difference with a large effect size was observed for the reported mean ( $t = 10.28, p < 0.001; g = 0.89$ ) as well as the number of correct answers [ $\chi^2(1) = 307.84, p < 0.001, \phi = 0.58$ ] (► Fig. 3a+b).

### 2. At what time during the menstrual cycle is it likely that pregnancy will occur with unprotected sexual intercourse (click on the timeline)?

The highest chance for a pregnancy is between day 9 and 14 of a menstrual cycle [20].

In the pupil cohort, 58.8% ( $n = 217/369$ ) gave the correct answer (mean: day 13.6,  $SD = 5.7$  days). In the student cohort, 84.5% ( $n = 454/537$ ) gave the correct answer (mean: day 14.3,  $SD = 2.8$  days). The mean of the days reported by respondents was statistically significant with a neglectable effect size ( $t = 2.22, p = 0.027; g = 0.17$ ) as was the number of correct given answers with a small effect size [ $\chi^2(1) = 75.41, p < 0.001, \phi = 0.29$ ]. As question 1 and 2 are correlated, a joint evaluation was performed: 25.7% ( $n = 95$ ) of pupils answered both questions, 47.7% ( $n = 176$ ) answered one and 26.6% ( $n = 98$ ) answered no question correctly compared to 62.2% ( $n = 334$ ) in the student group who answered



► **Fig. 2** Percentage of correctly answered questions. The percentage of all correct answers for the pupil and student cohorts are shown for each individual question listed in ► **Table 1**.

both questions, 35.0% (n = 188) who answered one and 2.8% (n = 15) who answered no question correctly (► **Fig. 4**).

### 3. What is the period of time during which an oocyte can be fertilized?

An oocyte can be fertilized during a period of between 24 [21] and 48 hours.

In the pupil cohort, 41.5% (153/369) gave the correct answer (mean: 21.9 hours, SD = 20.8 hours) and 65.7% of the student cohort gave the correct answer (353/537, mean: 30 hours, SD = 19.4 hours). The mean time reported by respondents was statistically significant with a small effect size ( $t = 6.01$ ,  $p < 0.001$ ;  $g = 0.41$ ) as was the number of correct answers [ $\chi^2(1) = 52.26$ ,  $p < 0.001$ ,  $\phi = 0.24$ ].

### 4. How long after sexual intercourse are sperm capable of fertilizing an oocyte?

Sperm can fertilize an oocyte between 3–5 days after ejaculation [21].

The correct answer was given by 46.1% (170/369) of the pupil cohort and 62.6% (336/537) of the student cohort. The mean reported by participants was 8.7 days (SD = 14.3 days) in the pupil cohort and 8.2 days (SD = 13.8 days) in the student cohort. The number of correct answers was statistically significant with a small effect size [ $\chi^2(1) = 24.15$ ,  $p < 0.001$ ,  $\phi = 0.16$ ]. No significant difference was detected in the responses to the mean number of days ( $t = 0.55$ ,  $p = 0.58$ ;  $g = 0.04$ ).

### 5. What is the period of time during which the “morning-after pill” can be taken to prevent pregnancy?

Emergency contraception can be taken up to 72 (levonorgestrel) or 120 hours (ulipristal acetate) after intercourse.

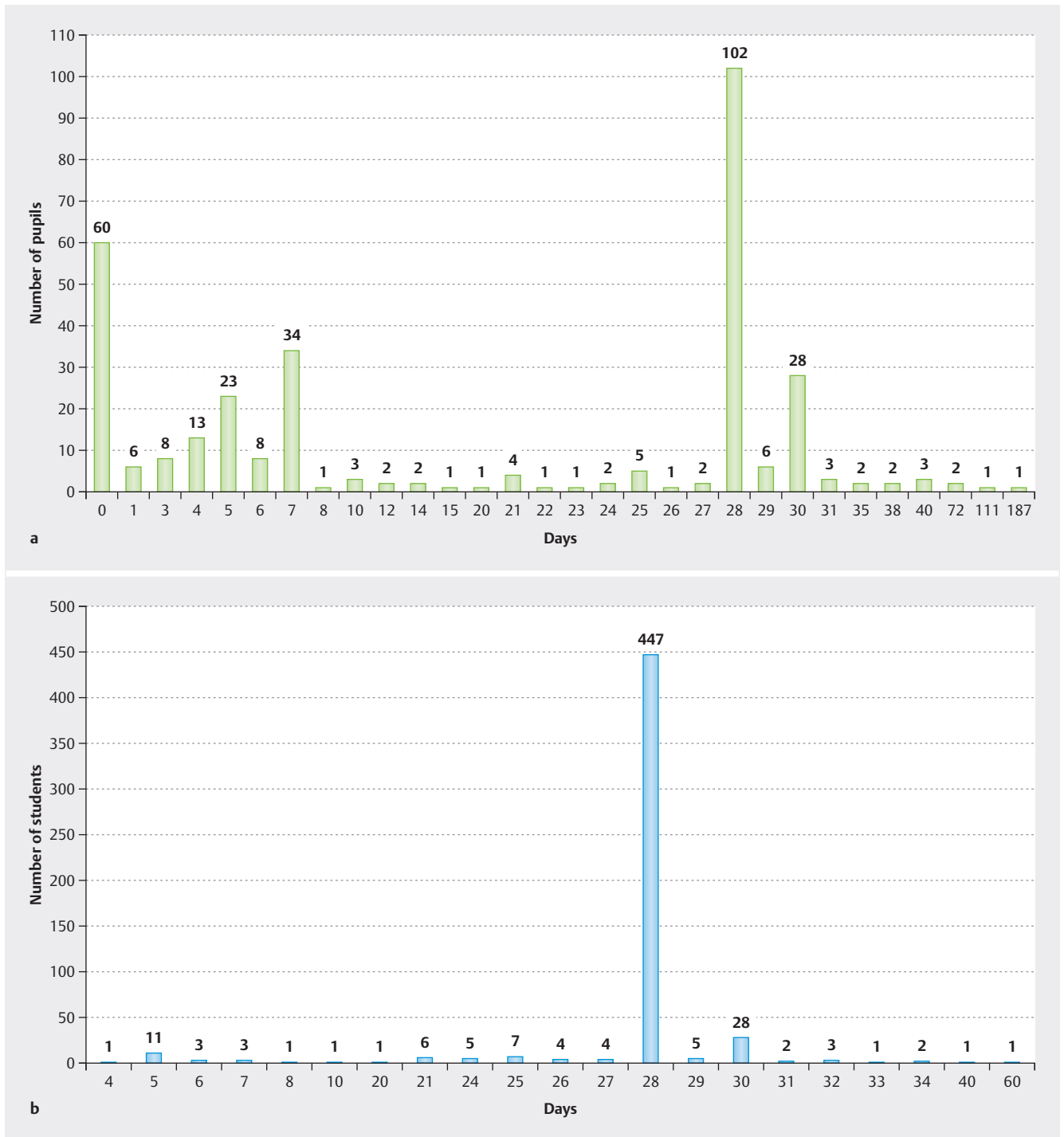
15.2% (56/369) of the pupils and 41.3% (222/537) of the students answered this question correctly. The mean was 31.4 hours (SD = 23.8 hours) for the pupil cohort and 48.3 hours (SD = 23.4 hours) for the student group. The mean reported by participants was statistically significant with a medium effect size ( $t = 10.59$ ,  $p < 0.001$ ;  $g = 0.72$ ) as was the number of correct answers although the effect size was small [ $\chi^2(1) = 70.4$ ,  $p < 0.001$ ,  $\phi = 0.28$ ].

### 6. Which contraceptive methods protect against sexually transmitted diseases?

Barrier methods like a condom or a dental dam protect against sexually transmitted infections. Since this was a multiple-choice question, both answers were given a separate point if chosen.

In the pupil cohort, 98.1% (362/369) answered “condom” and 34.1% (126/369) gave “dental dam” as the correct answer. Since multiple choice was an option, 34.1% (n = 126) chose both, 64.0% (n = 236) chose one and 1.9% (n = 7) no right answer.

In the student cohort, 99.8% (536/537) responded “condom” and 57.7% (310/537) “dental dam”. 57.5% (309) gave both options, and 42.5% (228) only one option. No incorrect answers were given.



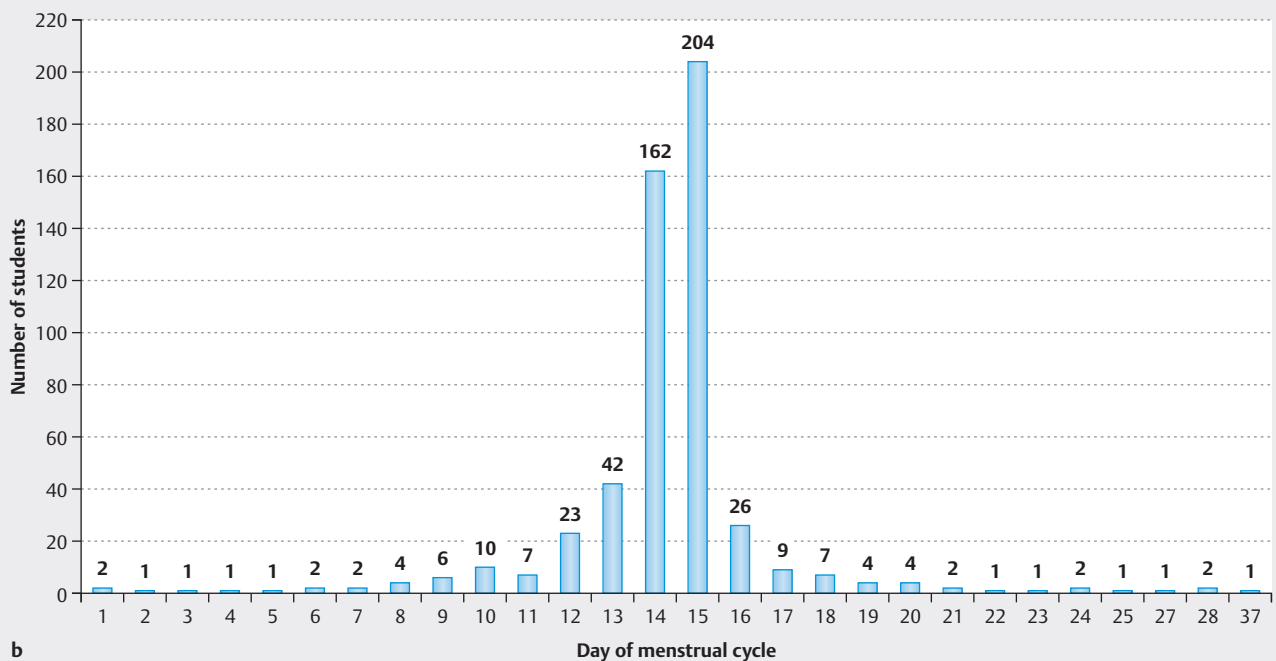
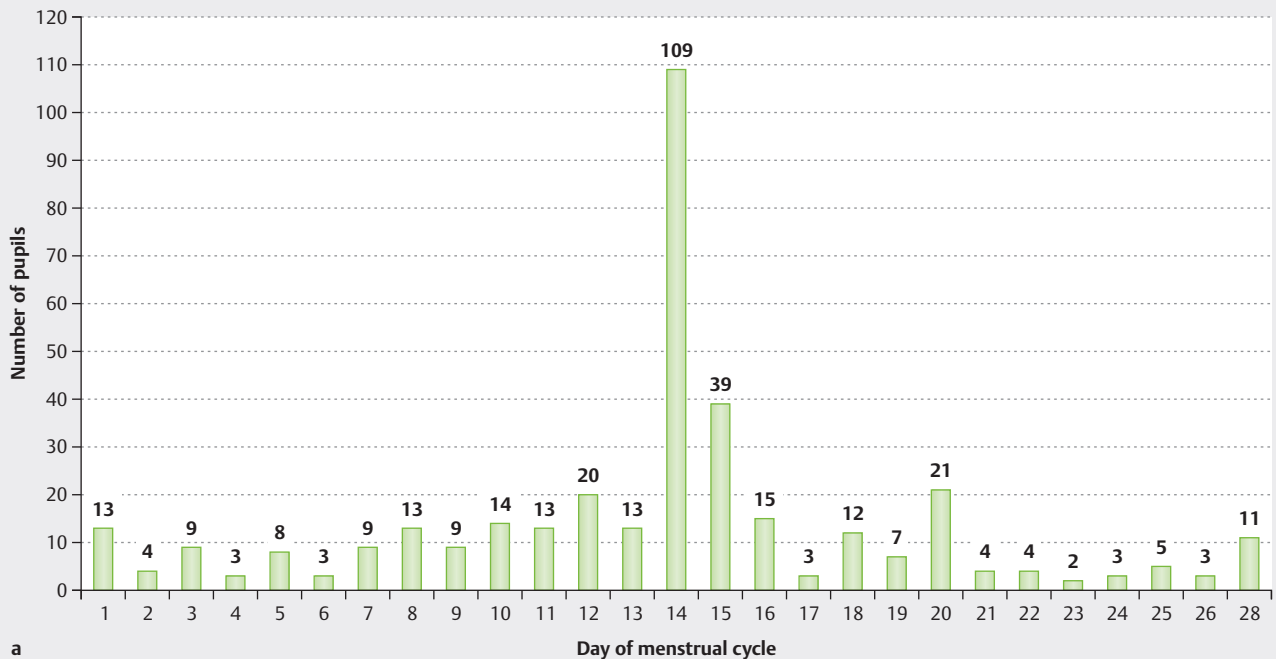
► **Fig. 3** Bar chart of menstrual cycle length. The bar chart above depicts the answers to question 1 “How long is the menstrual cycle?” as given by (a) pupils (n = 369) and (b) students (n = 537). The days reported by respondents are depicted on the horizontal axis and the cumulative number of (a) pupils or (b) students who chose the corresponding answer on the vertical axis.

The number of times the correct answer “condom” was given was statistically significant with a negligible effect size [ $\chi^2(1) = 7.3$ ,  $p = 0.01$ ,  $\phi = 0.09$ ]; similarly, the number of times “dental dam” was given was also statistically significant with a small effect size [ $\chi^2(1) = 48.72$ ,  $p < 0.001$ ,  $\phi = 0.23$ ].

### 7. What is the most important risk factor for infertility?

The most important risk factor for infertility is female age [22, 23]. Other options to choose from included male age, smoking, long-term use of the contraceptive pill, stress, and unknown.

In the pupil cohort, 41.5% (153/369) and 58.7% of the student cohort (315/537) answered this question correctly, which was sta-



► **Fig. 4** Bar chart on the probability of pregnancy depending on the timepoint of intercourse during the menstrual cycle. The bar chart above depicts the answers to question 2 “At what time during the menstrual cycle is it likely that pregnancy will occur with unprotected sexual intercourse (click on the timeline)?” as given by (a) pupils ( $n = 369$ ) and (b) students ( $n = 537$ ). The day of the menstrual cycle given by respondents is on the horizontal axis and the cumulative number of (a) pupils or (b) students who chose the corresponding answer is shown on the vertical axis.

tistically significant with a small effect size [ $\chi^2(1) = 25.9$ ,  $p < 0.001$ ,  $\phi = 0.17$ ]. The top three answers given were female age (41.5%), unknown with 20.6%, and smoking with 15.4% in the pupil subgroup compared to female age (58.7%), stress (17.1%) and smoking (10.1%) in the student subgroup.

#### 8. What is the most important risk factor for miscarriage?

The most important risk factor for miscarriage is female age [24]. Other response options were male age, smoking, long-term use of the contraceptive pill, stress, excessive physical activity, and unknown.



A total of 20.3% (75/369) of pupils compared to 45.4% (244/537) of students answered this question correctly, which was statistically significant with a small effect size [ $\chi^2(1) = 60.46$ ,  $p < 0.001$ ,  $\phi = 0.26$ ]. The top three possible answers given by the pupil cohort were smoking (33.1%), female age (20.3%) and unknown (17.9%), closely followed by excessive physical activity (17.6%). In the student subgroup, the leading answer was female age (45.4%) followed by smoking with 22.0%, and stress with 15.5%.

### 9. At what age does a woman's fertility begin to decrease?

Female fertility begins to decrease at around 30–35 years of age [25, 26].

11.9% of pupils (44/369) and 56.1% (301/537) of students identified the proper answer, which was statistically significant with a medium effect size [ $\chi^2(1) = 180.62$ ,  $p < 0.001$ ,  $\phi = 0.45$ ]. Pupils tended to overestimate female fertility with a decrease in fertility starting at 42.6 years of age ( $SD = 9.27$  years). In the student cohort, a mean of 35.9 years ( $SD = 5.4$  years) was chosen ( $t = 12.36$ ,  $p < 0.001$ ;  $g = 0.92$ ). There also was a significant gender difference between males, who selected a lower age than females ( $37.9 \pm 6.7$  vs.  $40.7 \pm 10.4$ ,  $t = 3.83$ ,  $p < 0.001$ ;  $g = 0.36$ ).

### 10. What symptoms can occur when suffering from endometriosis?

This question was a multiple-choice question with correct response options including menstrual pain, pain during intercourse, gastrointestinal problems, pain during defecation, and pain while urinating [27]. Irrespective of how many correct answers were given, the maximum point was 1.

In the pupil cohort, 23.8% (88/369) gave at least one correct answer. The answer chosen most often was menstrual pain with 21.1%, followed by unknown with 20.3%, and heavy menstrual bleeding with 17.9%. All four correct answers were chosen by 3.8%, three by 5.1%, two by 7.9%, and one by 7.0%.

In the student cohort, 89.9% (483/537) gave at least one correct answer. When we considered the answers chosen most often by this subgroup, menstrual pain was identified as a symptom by 86.8%, followed by heavy menstrual bleeding (76.4%), and dyspareunia (76%). All four answers were given by 40.2%, three by 17.9%, two by 21.6%, and one by 10.2%.

When the number of correct answers in the pupil and student cohorts were compared, a statistically significant large effect size was observed [ $\chi^2(1) = 410.01$ ,  $p < 0.001$ ,  $\phi = 0.67$ ].

## Discussion

This prospective cross-sectional online survey was designed to assess pupils' and students' knowledge of reproductive health issues including fertility, gynecological diseases, and contraception. Pupils were found to have less knowledge of the surveyed topics than university students. Furthermore, females, persons who had had sexual intercourse, and persons studying medicine demonstrated a significantly better knowledge of the topics.

When the questions were analyzed for the pupil cohort, the three questions with the lowest number of correct answers were:

“At what age does a woman's fertility begin to decrease?” with 11.9%, “What is the period of time during which emergency contraception can be taken to prevent pregnancy?” with 15.2%, and “What is the most important risk factor for miscarriage?” with 20.3%. In the student cohort, the questions: “What is the period of time during which emergency contraception can be taken to prevent pregnancy?” with 41.3%, “Which is the most important risk factor for miscarriage?” with 45.4% and “At what age does a woman's fertility begin to decrease?” with 56.1% had the lowest rates of correct answers. The question with the highest number of correct answers in both cohorts was “Which contraceptive methods protect against sexually transmitted diseases?” with 98.1% of correct answers in the pupil and 99.8% in the student cohort, respectively. This shows that knowledge was lowest with regards to fertility issues and emergency contraception whereas the knowledge of how to prevent sexually transmitted infections was high.

So far, few studies have compared the knowledge of pupils and that of university students for this topic. Surveys into pupils' knowledge of fertility are especially rare. A Canadian study which included 772 high school students (377 female, 392 male) with a mean age of 17.5 years showed that the issue of infertility was known to 79% of participants; however, the Canadian infertility rate was underestimated [28]. Another Canadian study focusing on female undergraduate students ( $n = 360$ , age range 18–42 years) showed that women's age was identified as the strongest risk factor for infertility by only 45.5% of all participants and as the strongest risk factor for miscarriage by only 24.7% of all participants [18]. Our results showed similar percentages: less than half of the pupils correctly identified female age as a risk factor for infertility (41.5%) and for miscarriage (20.3%) compared to students, where the respective rates were 58.7% and 45.4%.

Regarding female fertility, pupils expected a decline in fertility at an average age of 42.6 years compared to students who expected a decline from 35.9 years. Both cohorts thus misstated the age at which the decline of female fertility becomes relevant [25, 26]. Moreover, females estimated the decline in fertility as starting significantly later (40.7 years) than males did. In a population-based internet survey in Denmark and the United Kingdom (1237 participants, 1000 females and 237 males), males overestimated the age at which female fertility and the chance of pregnancy declines. It should be mentioned that – compared to our study – the latter cohort was older (43% were 25–34 years old) and the educational status was primarily postgraduate (45%) [14].

This misperception of fertility and female age can be due to the presence in the media of stories of older mothers which do not report on the use of assisted reproductive technologies. This can create false images of fertility at an advanced age.

When students studying medicine were compared with those studying for non-medical degrees, the medical students had significantly higher scores, as was also shown in another publication [15]. In our study, 70.8% female and 67.4% male participants wish to have children in the future. The proposed mean age for having a first child for females was 26.3 years in the pupil group and 28.3 years in the student group whereas for males it was 26.8 years in the pupil and 29.1 years in the student group. These

results are in line with a German online survey [15], a Danish cross-sectional study [16], and a Canadian survey, where 63.7% of participants planned to get pregnant between 25–30 years of age [18]. Factors affecting the decision to postpone pregnancy or not included stable partnership, good economic status, and having completed education [15, 29]. Other possible socio-political reasons could be state legislations on parental leave, childcare allowance, options for and costs of childcare.

The age at which respondents wished to have their first child given above does not match the current mean age in Austria, which is 31.5 years for women and 34.3 years for men [4].

Sexual education plays a major role in providing knowledge on gynecological issues and reproductive medicine. A survey by the German Federal Centre for Health Education (Bundeszentrale für gesundheitliche Aufklärung = BzGA) of 3556 teenagers (aged 14–17 years) showed that only 12% of female and 2% of male pupils received sexual education from physicians, and that teachers and parents were the leading sources of information [30]. The International Planned Parenthood Federation and the German Federal Centre for Health Education have proposed that sexual education should start in childhood and continue into adolescence and adulthood. The Austrian Society for Family Planning and the Ministry for Family and Youth recommend including sexual education in the training of teachers and kindergarten teachers [31]. The aim is to prevent the lack of knowledge identified in this prospective cross-sectional study, especially with regards to fertility and the decline in fertility.

To our knowledge, this is the first study comparing pupils' and students' knowledge of gynecological and reproductive medicine.

A strength of this study is the large number of participants. Moreover, 40% of our study cohort consisted of pupils, which allowed us to perform a valid comparison between pupils' and students' responses.

This study is limited by the higher number of participating females compared to males, especially in the student group, which could be due to the higher number of female medical students in Tyrol (54.7% female students vs. 45.3% male students enrolled to study medicine at the Medical University of Innsbruck in 2021/2022). In addition, most questions looked at female aspects of reproduction, due to the complexity of menstrual cycles, the earlier decline in fertility, and as well as our decision to focus on those topics.

## Conclusion

In conclusion, the results show a significant deficit in terms of knowledge of reproductive health issues, especially fertility. It is important to start sexual education in childhood and to teach especially male pupils about fertility, gynecological diseases, and contraception in order to avoid such knowledge gaps and to make self-determined sexuality possible.

## Conflict of Interest

The authors declare that they have no conflict of interest.

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