Original article

Awareness about colorectal cancer among young adults in Poland

Marta Fudalej[1, 2], Julia Pikul[3], Agata Mormul[3], Andrzej Deptała[1, 2], Anna Badowska-Kozakiewicz[1]

[1] Department of Oncology Propaedeutics, Medical University of Warsaw, Warsaw, Poland

[2] Department of Oncology, National Medical Institute of the Ministry of the Interior and Administration, Warsaw, Poland

[3] Students' Scientific Organization of Cancer Cell Biology, Department of Oncology Propaedeutics, Medical University of Warsaw, Warsaw, Poland

ABSTRACT

Purpose: The present study aimed to evaluate the knowledge and awareness level concerning colorectal cancer epidemiology, risk factors, symptoms, and prevention among young people in Poland.

Methods: The knowledge was examined with an anonymous survey between February and March 2021. The data were collected anonymously, and the participation was voluntary. Statistical analysis was performed, and differences were considered significant if the p-value obtained was smaller than the assumed level of significance $p \leq 0.05$.

Results: Respondents were mostly female, living in a city with a population of over 500,000. The results confirmed that education, family/friends' history of CRC, and a place of residence differentiate knowledge and awareness about CRC.

Conclusion: The study acquired information that might guide educators about knowledge deficits among young people in Poland. The survey results revealed a significant knowledge gap between rural and urban inhabitants as well as between medical and non-medical groups.

Key words: oncology, colorectal cancer, survey, prevention

Correspondence:
Agata Mormul, MD
Students' Scientific Organization of Cancer Cell Biology, Department of Oncology Propaedeutics, Medical University of Warsaw, Poland
01-445 Warsaw, 27 Erazma Ciołka
e-mail: Agata.mormull@gmail.com

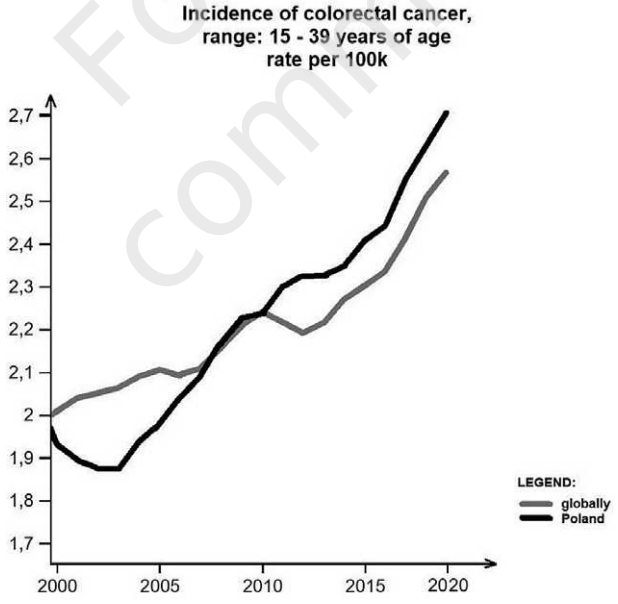
Received:
30.06.2024
Accepted:
10.07.2024

DOI: 10.24292/01.OR.142100724

INTRODUCTION

Colorectal cancer (CRC) is one of the most predominant malignancies among the adult population. In Poland, this type of cancer ranks third in cancer incidence in the male population (following lung and prostate cancer) and second among females (following breast cancer). CRC is most common among patients over 60 and is associated with sporadic mutations [1]. The diagnosis among people under 50 is relatively rare; however, various studies and data from the Institute of Health Metrics and Evaluation indicate a growing incidence in this population (fig. 1) [2, 3]. It creates not only a diagnostic problem but a therapeutic one as well. It is believed that early-onset CRC may be correlated, among other things, with an unhealthy lifestyle, leading to the same level of risk in young as in older people [4, 5]. Risk factors associated with this malignancy encompass incorrect diet, lack of physical activity, obesity, bowel inflammation, or polyps [6–9]. Behaviour changes could significantly affect the CRC incident rate. Changes in lifestyle at a young age influence health in the future; thus, awareness about CRC should be broadened as soon as possible [10].

Figure 1. Incidence of colorectal cancer in the age group 15–39, based on Institute of Health Metrics and Evaluation data.



The World Health Organization (WHO) estimated that 40% of cancers could be avoided by prevention, and 40% could be cured assuming early detection [11]. Most cases of CRC develop from non-malignant precursor lesions called adenomas over a long time, which provides an opportunity for prevention with screening programmes. Identifying premalignant lesions and detecting asymptomatic early-stage malignancies decrease incidence and mortality [12, 13]. In Poland, the CRC screening programme encompasses colonoscopy; nevertheless, people in the risk group submit to testing unwillingly [14, 15]. Moreover, screening coverage in Poland, especially concerning CRC, decreased further during the COVID-19 pandemic [16]. The upward trend in the number of CRC deaths is expected to continue until the 2030s. It highlights the need for increased efforts to optimise educational and screening programmes [17].

AIM

The study aimed to evaluate the knowledge of and general CRC awareness: its epidemiology, risk factors, symptoms, and prevention among young people in Poland.

MATERIALS AND METHODS

The knowledge was examined with an anonymous survey shared on social media in February and March 2021. The data were collected anonymously, and the participation was voluntary. Informed consent was obtained from all participants for participation in the study. The survey was carried out following relevant guidelines and regulations. According to the Polish law for research and local ethics committee recommendation, ethical approval for retrospective survey research and non-invasive studies conducted on routinely collected anonymous data is not required. Research as part of the teaching process as part of the assessment of the learning outcomes does not have to be consulted by the Committee Bioethical, regardless of the methodology used, as long as they do not have signs of a medical experiment following the Act on the Professions of Physician and Physician Dentist art. 21. The study was acknowledged by the Bioethics Committee of the Medical University of Warsaw (AKBE/145/2022). The authors drafted the original questionnaire through a literature review and revised it by a panel of clinicians. The part assessing the participants' knowledge of CRC consisted of twenty closed questions. Eighteen questions were single choice, and two, about symptoms and risk factors, were multiple choice (tab. 1). The maximum score to achieve was 16 points. In single-choice questions, participants were given one point for every correct answer. In questions with multiple correct answers, one point was given only when all correct answers were chosen. When the part was chosen correctly – for example, 4 correct out of 6, the person was given 2/3 (0.67) of a point. Subsequently, the results were converted to the percentage scale – the participants could gain from 0 to 100%. The questionnaire also encompassed demographic information, including sex, age, educational level, medical education (medicine, dental medicine, pharmacy, health sciences, nursing), residence, and family or friends' history of CRC.

Table 1. Survey questions with correct answers.

	Question	Correct answer
1	Who suffers from colorectal cancer (CRC) more often?	Men
2	In what age group is the disease most common?	Over sixty
3	Please evaluate the incidence of CRC in male population in Poland	Third place after lung cancer and prostate cancer
4	Please evaluate the incidence of CRC in female population in Poland	Second place after breast cancer
5	Do you think that CRC is characterised by a high mortality rate?	Yes
6	Do you think that the mortality rate in a country is associated with a prevention program?	Yes
7	How many new cases of CRC are identified in Poland annually?	15–20 thousand
8	How many people die of CRC in Poland annually?	10–15 thousand
9	What is the overall survival rate within 5-years for CRC?	29–49%
10	Is there a screening programme for CRC in Poland?	Yes
11	Are there screening programmes for other cancers in Poland?	Yes
12	Is this possible that CRC might develop without causing any symptoms?	Yes
13	Please choose symptoms associated with CRC (multiple choice)	Iron deficiency anaemia Abdominal pain Changed rhythm of bowel movement Weight loss General weakness Blood in stool
14	Please choose CRC risk factors (multiple choice)	Obesity Smoking Lack of physical activity Alcohol abuse Genetic factors Polyps
15	In which part of the large intestine is the cancer the most commonly located?	Colon
16	Where are distant metastases most common?	Liver
17	What are the possible treatment options for CRC?	All (chemotherapy, radiotherapy, surgery)
18	Do you know what it is the "*per rectum*" examination?	Yes
19	Have you heard about CRC in the media?	Yes
20	Have you heard about prevention actions associated with CRC?	Yes

Statistical analysis

Descriptive statistics helped summarise the descriptive information about the respondents and their responses to questions regarding their awareness and knowledge of CRC and the screening programmes. The Kolmogorov–Smirnov test [18] detected if variables followed a given distribution in a population. All categorical and continuous variables were compared by chi-square heterogeneity tests and Student's t-tests of independence. The effect size was measured with Cohen's d [19]. Moreover, a one-way analysis of variance with F distribution was performed in some comparisons. Subsequently, statistical analysis encompassed *post-hoc* tests. Differences were considered statistically significant if the *p*-value obtained was smaller than the assumed level of significance $p < 0.05$. The Statistical Package for Social Science (SPSS) version 25.0 was used for the analysis [20].

RESULTS

DEMOGRAPHY

Respondents (n=1546) were mainly female (81.4%) and living in a city with a population of over 500 thousand (36.8%). The mean age of the participants was 23.1 (standard deviation [SD]: 3.71, range: 18–35) years. 53.8% of interviewees had medical education, including the following faculties: medicine, dentistry, dietetics, obstetrics, medical analysis, public health, pharmacy, nursing, and electro-radiology. 29.9% of respondents claimed to have a friend or family member who had CRC. Detailed characteristics of the participants are presented in table 2.

The general level of knowledge

The survey questions presented a diversified difficulty level. The easiest questions were associated with the mortality rate of CRC and Polish prevention programmes (84.5% correct answers). The most challenging question concerned epidemiological issues – CRC incidence among women in Poland (only 18.6% correct answers) and the most common age of morbidity (22.4% correct answers). Responses to the two multiple-choice questions are presented in figures 2 and 3 (fig. 2, 3).

Only two respondents gained a maximum score of 16 points. The lowest score was achieved by one respondent and reached 1.63 points (10.19% of correct answers). The mean score equalled 9 points (56.3%). The average single-choice question score was

Table 2. Descriptive characteristics of the participants.

	Studied group (n=1546)	Women (n=1258)	Men (n=288)
Variable	**n (%)**		
Residence			
Village	350 (22.64%)	296 (23.53%)	54 (18.75%)
Small city (<10k)	75 (4.86%)	60 (4.77%)	15 (5.21%)
Medium city (10k–100k)	252 (16.30%)	201 (15.98%)	51 (17.71%)
City (100k–500k)	300 (19.40%)	243 (19.32%)	57 (19.80%)
Big city (>500k)	569 (36.80%)	458 (36.40%)	111 (38.53%)
Education			
Vocational education	3 (0.19%)	3 (0.24%)	0 (0.00%)
Primary education	62 (4.01%)	53 (4.21%)	9 (3.13%)
Secondary education	72 (4.66%)	57 (4.53%)	15 (5.21%)
Higher education	405 (26.20%)	334 (26.55%)	71 (24.65%)
Still studying	1004 (64.94%)	811 (64.47%)	193 (67.01%)
Education			
Medical	832 (53.82%)	691 (54.93%)	141 (48.96%)
Non-medical	714 (46.18%)	567 (45.07%)	147 (51.04%)
Family/friends history of CRC			
Yes	462 (29.88%)	397 (31.56%)	65 (22.57%)
No	1084 (70.12%)	861 (68.44%)	223 (77.43%)

Figure 2. Distribution of correctly chosen CRC symptoms.

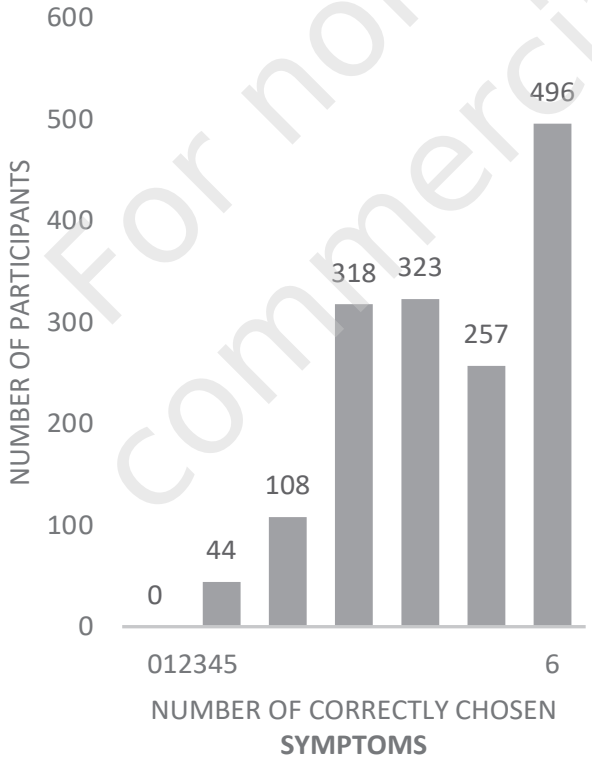
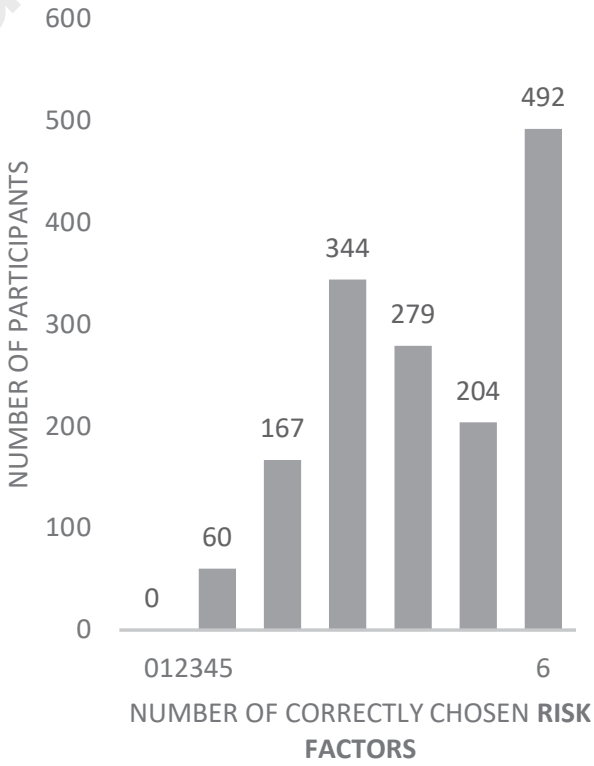


Figure 3. Distribution of correctly chosen CRC risk factors.



8.71 points (SD 2.63). In both multiple-choice questions, participants predominantly chose all 6 correct answers (mean 4.38, SD 1.43, and mean 4.21, SD 1.54, respectively).

Gender and level of knowledge

Three statistically significant differences were obtained in single-choice questions. Men more frequently chose correct answers on the age of morbidity (p=0.006), while women on Polish screening programmes for other cancers (p=0.001) and CRC treatment (p=0.008). The effect size of the correlation mentioned above was low. In multiple-choice questions, women obtained correct CRC symptoms more often, with a very low size effect (p=0.029, Cohen's d=0.15). For other questions, the analysis proved no statistically significant differences. Generally, no significant gender-dependent differences were obtained in CRC knowledge described by achieved points.

Residence and level of knowledge

One-way analysis of variance revealed that the place of residence differentiates knowledge about CRC (F=6.91, p <0.001). *Post-hoc* tests confirmed that village inhabitants scored fewer points in comparison to the inhabitants of a city (p <0.001) and a big city (p=0.001). Moreover, inhabitants of medium-sized cities received fewer points than big-city occupants (p=0.011). Analysis of particular questions proved that village inhabitants chose fewer risk factors and CRC symptoms than a city (p=0.012, p=0.016, respectively) and big-city occupants (p <0.001). The definitions of a small, medium, city, and big city are described in table 2.

Friends/family history and level of knowledge

Respondents with a CRC-diagnosed person in their social surroundings had a higher level of knowledge on the subject (95%CI: 1.89–5.39, p <0.001). However, the effect size was low (Cohen's d=0.23). Having analysed the correct answers to the single and multiple-choice questions, we noticed that this group achieved better outcomes with a low effect size (tab. 3).

Medical education and level of knowledge

The most significant difference was noticed when comparing medical and non-medical participants. The general knowledge, as described by points gathered, was higher in medical than in non-medical interviewees (95%CI: 2.58–3.01, p <0.001) with a high effect size (Cohen's d=1.28). Medical respondents scored more points in single-choice and multiple-choice questions and chose the correct answer in 10 out of 14 single-choice questions more often than the other group. Both results are statistically significant (tab. 4).

DISCUSSION

The prevalence of CRC among people under 40 has increased rapidly over the previous two decades [2, 3]. CRC incidence at an early age may be correlated with modern dietary factors and epidemic obesity [8, 21]. Emphasis on medical education is integral to the strategy to lower CRC incidence. Therefore, we should intensify the effort to raise awareness of CRC symptoms, risk factors, and screening programmes among young people. Numerous studies worldwide confirm that young people's knowledge about CRC is inadequate [22–25]. Hussain et al. (2021) [23] assessed Pakistan's university students' overall knowledge and attitude as quite good; however, their practices regarding CRC were deficient. Studies conducted among university students in the Caribbean Territory suggested that predictors for poor knowledge of CRC are frequent or excessive alcohol consumption, low physical activity, and male gender. They linked poor overall understanding with a small number of awareness-raising programmes and educational materials available for the students at the tertiary education level in the Caribbean [22]. Our study is not the first to underline the inadequate level of knowledge in Polish society. The analysis conducted by Rucinska et al. (2021) [10] in Polish high schools revealed that students did not associate cancer development with an unhealthy lifestyle, nor were they familiar with cancer risk factors. Various studies suggest that social media campaigns may change the attitude towards cancer screening and early diagnosis [26–28]; nevertheless, current trends focus less on CRC. This subject is discussed less frequently than malignancies such as breast cancer, prostate cancer, testicular cancer, or cervical cancer [26]. Noar et al. revealed the significant role of public figures in raising society's

Table 3. Differences in the number of correct answers between group with family/friend history of CRC and group without family/friend history of CRC.

	Family/friend history of CRC (n = 462)		**Without family/friend history of CRC (n = 1084)**			95%CI		
	M	SD	M	SD	p	LL	UL	Cohen's d
Number of correct answers to the closed questions	9.11	2.63	8.54	2.62	**<0.001**	0.29	0.86	0.22
Number of correctly chosen symptoms	4.57	1.40	4.29	1.44	**<0.001**	0.12	0.43	0.19
Number of correctly chosen risk factors	4.37	1.50	4.15	1.55	**0.008**	0.06	0.39	0.15

Abbreviations: n – number of participants in the group; M – mean; 95%CI – 95% confidence interval; SD – standard deviation; p – statistical significance; LL – lower limit; UL – upper limit; Cohen's d – size effect.

Table 4. Differences in the number of correct answers between medical and non-medical group.

	Medical background (n=832)		**Non-medical background (n=714)**			**95%CI**		
	M	SD	M	SD	p	LL	UL	Cohen's d
Number of correct answers to the closed questions	9.95	2.27	7.26	2.27	**<0.001**	2.45	2.91	1.18
Number of correctly chosen symptoms	5.00	1.25	3.65	1.27	**<0.001**	1.23	1.49	1.08
Number of correctly chosen risk factors	4.87	1.33	3.45	1.41	**<0.001**	1.27	1.55	1.03

Abbreviations: n – number of participants in the group; M – mean; 95%CI – 95% confidence interval; SD – standard deviation; p – statistical significance; LL – lower limit; UL – upper limit; Cohen's d – size effect.

awareness. Famous people can influence society's stand and thus its behavioural patterns [29, 30]; however, medical educators should fight confusing misinformation spread by some individuals [31].

Our study revealed no significant difference in CRC knowledge between genders. Female participants scored higher in only a few questions than their male counterparts, similar to a few other studies [25, 32]. However, our results suggest that young people are unaware of CRC morbidity in the female population – only 18.6% of the respondents chose the correct answer, indicating that CRC is the second most common cancer in women. Similar observations were made by Rocke et al., in which only half of the respondents believed the development of CRC to be equally dangerous in all genders [22]. Some analyses concerning CRC confirmed that women knew more about the subject than men [22, 23, 33, 34]. Recent studies suggest that more women are diagnosed with right-sided CRC at a more advanced stage [35]. It might be partially associated with hormonal status. In older women, the lack of oestrogen increases the risk of microsatellite instability-high CRC, which more often demonstrates the right-sided prevalence [36, 37]. In the review by Kim et al. (2015) [38], the authors proposed sex- and gender-specific strategies for screening, treatment and prevention to reduce the morbidity and mortality of CRC in women due to numerous differences between genders.

We indicated that people from rural areas have less knowledge of CRC than those living in huge cities. Similar results were obtained in several studies in different countries [39–42]. It was proven that patients in rural areas suffering from symptomatic CRC had longer diagnostic processes and health system intervals than urban patients [43]. The need to travel for a long distance was correlated with increased odds of stage IV CRC [44]. Nevertheless, studies conducted in Iran and China claimed significant differences between the urbanisation level and the incidence rate of CRC. In this analysis, a higher incidence rate was associated with a higher urbanisation level [45, 46]. The authors linked these differences with urban lifestyle (low physical activity, processed food) and obesity. Nevertheless, despite the lower reported incidence ratio in rural areas, disparities in access to information, screening, and prevention techniques should be reduced.

Our study confirmed the correlation between knowing people diagnosed with CRC and higher awareness in this population. Experiencing relative suffering from CRC resulted in greater knowledge of symptoms and risk factors. This group of respondents chose the answer describing the possibility of a symptomless course of CRC significantly more frequently. The systemic review conducted in 2016 by Honein-AbouHaidar et al. [14] revealed that people who experienced CRC tend to spread knowledge about the disease and motivate others to be screened. Personal contact with someone diagnosed with CRC contributes to a better understanding of the problem. However, it seems that symptoms presented by CRC are embarrassing for individuals; thus, they try to avoid this subject.

Medical participants tend to be more knowledgeable about CRC risk factors and symptoms. In our study, 91.2% of medical respondents perceived CRC screening programmes as an essential and meaningful part of preventing cancer-related deaths. This attitude is significantly different in the non-medical group. Therefore, we might conclude that the attitude towards screening programmes is associated with knowledge and awareness. As shown in table 5, the knowledge gap between medical and non-medical is significant; however, some aspects, such as epidemiology or a personalised approach to the patients, could be improved. Researchers from other countries presented similar conclusions [24, 32, 33, 47, 48]. On the other hand, various studies from the Middle East underline limited knowledge and poor attitudes towards CRC screening among medical students [11, 49, 50].

The uniform curriculum in academic oncology was introduced in 2010 in Polish universities; nevertheless, oncological education at Polish medical universities is evaluated as fragmented and poorly coordinated [51]. Modern educators agree that the information and attitudes acquired in medical schools are critical to future practice habits. The US introduced an enhanced cancer education curriculum for medical students in the 1990s. Two independent reports have proven that students developed long-lasting cancer prevention and detection strategies in college. Moreover, the reports showed positive effects of an enhanced cancer prevention curriculum on medical students' knowledge, counselling, and screening skills [52, 53].

Clinical practice is the most influential in acquiring confidence in primary cancer prevention and detection techniques. Clinical students (fourth-, fifth-and sixth-year students) achieve better results in tests concerning oncological awareness [33]. In the experiment conducted by Hauer et al. (2008), students with more experience performed better in history taking, physical examination, and counselling during interaction with the simulated, standardised patient with CRC diagnosis [24]. Therefore, developing curricula that include more diverse clinical experiences

Table 5. Differences in the number and percentage of correct answers to the single-choice questions between medical and non-medical groups.

Question		Medical background	Non-medical background	*p*-value
		Correct answers		
Who suffers from colorectal cancer (CRC) more often?	*N*	742	558	***p* <0.001**
	%	89.20%	78.20%	
In what age group is the disease most common?	*N*	249	97	***p* <0.001**
	%	29.90%	13.60%	
Please evaluate the incidence of CRC in male population in Poland	*N*	555	364	***p* <0.001**
	%	66.70%	51.00%	
Please evaluate the incidence of CRC in female population in Poland	*N*	159	129	*p*=0.599
	%	19.10%	18.10%	
Do you think that CRC is characterised by a high mortality rate?	*N*	666	553	*p*=0.213
	%	80.00%	77.50%	
Do you think that the mortality rate in a country is associated with a prevention program?	*N*	759	547	***p* <0.001**
	%	91.20%	76.60%	
How many new cases of CRC are identified in Poland annually?	*N*	407	282	***p* <0.001**
	%	48.90%	39.50%	
How many people die of CRC in Poland annually?	*N*	228	165	*p*=0.053
	%	27.40%	23.10%	
What is the overall survival rate within 5-years for CRC?	*N*	383	289	***p*=0.028**
	%	46.00%	40.50%	
Is there a screening programme for CRC in Poland?	*N*	457	77	***p* <0.001**
	%	54.90%	10.80%	
Are there screening programmes for other cancers in Poland?	*N*	754	461	***p* <0.001**
	%	90.60%	64.60%	
Do you think that CRC might be characterised by an asymptomatic course?	*N*	657	368	***p* <0.001**
	%	79.00%	51.50%	
In which part of the large intestine is the cancer the most commonly located?	*N*	282	128	***p* <0.001**
	%	33.90%	17.90%	
Where are distant metastases most common?	*N*	514	430	*p*=0.532
	%	61.80%	60.20%	
What are the possible treatment options for CRC?	*N*	695	432	***p* <0.001**
	%	83.50%	60.50%	
Do you know what it is the „per rectum" examination?	*N*	768	307	***p* <0.001**
	%	92,30%	43,00%	

than those found locally may become necessary. US studies suggest creating a simulation-based clinical setting with a diverse patient population reflecting various healthcare needs [32]. Another approach assumes learning by watching clinicians discuss their attitudes to screening and communicating with patients. In 2020, a 90-minute session for second-year medical students was conducted. Promoters provided a short lecture on colon cancer screening, and subsequently, a panel of practising gastroenterologists and a primary care physician discussed their approaches to 6 hypothetical cases [54]. As a result, students gained clinical knowledge and communication skills.

Study limitations encompass the basis of cross-sectional data; thus, causal inferences cannot be established. The survey tool was not a standardised questionnaire. Voluntary participation in the survey could result in respondents with biases selecting themselves into the sample. Due to the voluntary nature of the study, the compared groups were unequal. The percentage of medical respondents is higher than average; therefore, the poor knowledge level for CRC may be higher for the entirety of the population.

CONCLUSIONS

The present study, conducted among young Polish society (age range: 18–25), acquired information that might aid educators in providing proper knowledge on CRC to young Polish society to minimise their educational deficit. The survey revealed a significant knowledge gap between rural and urban inhabitants as well as medical and non-medical groups. There is a need to improve CRC awareness and healthy lifestyle campaigns among young adults.

ORCID:
Agata Mormul – ID – http://orcid.org/0009-0008-7793-4799

References

1. Wojciechowska U, Didkowska J. Zachorowania i zgony na nowotwory złośliwe w Polsce (Cancer morbidity and mortality rates in Poland). http://onkologia.org.pl/raporty/.
2. Patel SG, Ahnen DJ. Colorectal Cancer in the Young. Curr Gastroenterol Rep. 2018; 20(4):15.
3. Campos FG. Colorectal cancer in young adults: A difficult challenge. World J Gastroenterol. 2017; 23(28): 5041-4.
4. Mauri G, Sartore-Bianchi A, Russo AG et al. Early-onset colorectal cancer in young individuals. Mol Oncol. 2019; 13(2): 109-31.
5. Siegel RL, Jakubowski CD, Fedewa SA et al. Colorectal Cancer in the Young: Epidemiology, Prevention, Management. Am Soc Clin Oncol Educ Book. 2020; 40: 1-14.
6. Keum N, Giovannucci E. Global burden of colorectal cancer: emerging trends, risk factors and prevention strategies. Nat Rev Gastroenterol Hepatol. 2019; 16(12): 713-32.
7. Dekker E, Tanis PJ, Vleugels JLA et al. Colorectal cancer. Lancet. 2019; 394(10207): 1467-80.
8. Deptała A. Nowotwory dolnego odcinka przewodu pokarmowego (Cancers of lower digestive tract). In: Onkologia. Podręcznik dla studentów medycyny. Pomoc dydaktyczna dla lekarzy specjalizujących się w onkologii. Stec R, Deptała A (eds). AsteriaMed, Gdańsk 2021: 171-83.
9. Zaręba K, Cummings K, Dorf J et al. Assessment of selected parameters of the nutritional status of patients undergoing surgery for colorectal cancers. Medical Studies/Studia Medyczne. 2022; 38(3): 199-204.
10. Rucinska M, Sroda R, Wilk O et al. Polish High School Students' Knowledge about Cancer. Int J Environ Res Public Health. 2021; 18(9): 4765.
11. Althobaiti A, Jradi H. Knowledge, attitude, and perceived barriers regarding colorectal cancer screening practices and risk factors among medical students in Saudi Arabia. BMC Med Educ. 2019; 19(1): 421.
12. Young GP, Senore C, Mandel JS et al. Recommendations for a step-wise comparative approach to evaluating new screening tests for colorectal cancer. Cancer. 2016; 122(6): 826-39.
13. Zacharakis G, Almasoud A, Aldossari K. Colorectal cancer screening challenges in Saudi Arabia. A comprehensive review article. Archives of Medical Science - Civilization Diseases. 2022; 7(1): 24-32.
14. Honein-AbouHaidar GN, Kastner M, Vuong V et al. Systematic Review and Meta-study Synthesis of Qualitative Studies Evaluating Facilitators and Barriers to Participation in Colorectal Cancer Screening. Cancer Epidemiol Biomarkers Prev. 2016; 25(6): 907-17.
15. McLachlan SA, Clements A, Austoker J. Patients' experiences and reported barriers to colonoscopy in the screening context – a systematic literature review. Patient Educ Couns. 2012; 86(2): 137-46.
16. Koczkodaj P, Kamiński M, Ciuba A et al. Cancer screening coverage in Poland – from bad to better to the worst during the SARS-CoV-2 pandemic. Archives of Medical Science. 2021; 17(4): 1132-3.
17. Czaderny K. Increasing deaths from colorectal cancer in Poland – Insights for optimising colorectal cancer screening in society and space. Ann Agric Environ Med. 2019; 26(1): 125-32.
18. Berger V, Zhou Y. Kolmogorov–Smirnov Test: Overview. Wiley StatsRef Stat Ref Online 2014.
19. Becker LA. Effect Size 2000. https://www.uv.es/~friasnav/EffectSizeBecker.pdf.
20. IBM Corp. Released 2017. IBM SPSS Statistics for Windows, Version 25.0. IBM Corp., Armonk, NY, 2017.
21. Hubbard JM, Grothey A. Adolescent and young adult colorectal cancer. J Natl Compr Canc Netw. 2013; 11(10): 1219-25.
22. Rocke KD. Colorectal Cancer Knowledge and Awareness Among University Students in a Caribbean Territory: a Cross-sectional Study. J Cancer Educ. 2020; 35(3): 571-8.
23. Hussain I, Majeed A, Rasool MF et al. Knowledge, attitude, preventive practices and perceived barriers to screening about colorectal cancer among university students of newly merged district, Kpk, Pakistan – A cross-sectional study. J Oncol Pharm Pract. 2021; 27(2): 359-67.
24. Hauer KE, Wilkerson L, Teherani A. The relationship between medical students' knowledge, confidence, experience, and skills related to colorectal cancer screening. J Cancer Educ. 2008; 23(4): 209-13.
25. Imran M, Sayedalamin Z, Alsulami SS et al. Knowledge and Awareness of Colorectal Cancer among Undergraduate Students at King Abdulaziz University, Jeddah, Saudi Arabia: a Survey-Based Study. Asian Pac J Cancer Prev. 2016; 17(5): 2479-83.
26. Plackett R, Kaushal A, Kassianos AP et al. Use of Social Media to Promote Cancer Screening and Early Diagnosis: Scoping Review. J Med Internet Res. 2020; 22(11): e21582.
27. Al-Naggar RA, Bobryshev YV. Knowledge of colorectal cancer screening among young Malaysians. Asian Pac J Cancer Prev. 2013; 14(3): 1969-74.
28. Ruco A, Dossa F, Tinmouth J et al. Social Media and mHealth Technology for Cancer Screening: Systematic Review and Meta-analysis. J Med Internet Res. 2021; 23(7): e26759.
29. Noar SM, Willoughby JF, Myrick JG et al. Public figure announcements about cancer and opportunities for cancer communication: a review and research agenda. Health Commun. 2014; 29(5): 445-61.
30. Ayers JW, Althouse BM, Noar SM et al. Do celebrity cancer diagnoses promote primary cancer prevention? Prev Med. 2014; 58: 81-4.
31. Wang Y, McKee M, Torbica A et al. Systematic Literature Review on the Spread of Health-related Misinformation on Social Media. Soc Sci Med. 2019; 240: 112552.
32. Boehler M, Advani V, Schwind CJ et al. Knowledge and attitudes regarding colorectal cancer screening among medical students: a tale of two schools. J Cancer Educ. 2011; 26(1): 147-52.
33. Pietrzyk Ł, Torres A, Denisow-Pietrzyk M et al. What Do We Know About Education in Colorectal Cancer Prevention?-Survey Among 1130 Medical Students. J Cancer Educ. 2017; 32(2): 406-12.
34. Ustundag H, Zengin N, Andsoy II et al. Awareness of health sciences students about colorectal cancer risk factors. Eur J Cancer Care (Engl). 2019; 28(3): e13016.
35. Hansen IO, Jess P. Possible better long-term survival in left versus right-sided colon cancer – a systematic review. Dan Med J. 2012; 59(6): A4444.
36. Missiaglia E, Jacobs B, D'Ario G et al. Distal and proximal colon cancers differ in terms of molecular, pathological, and clinical features. Ann Oncol. 2014; 25(10): 1995-2001.

37. Newcomb PA, Zheng Y, Chia VM et al. Estrogen plus progestin use, microsatellite instability, and the risk of colorectal cancer in women. Cancer Res. 2007; 67(15): 7534-9.
38. Kim SE, Paik HY, Yoon H et al. Sex- and gender-specific disparities in colorectal cancer risk. World J Gastroenterol. 2015; 21(17): 5167-75.
39. Odukoya O, Fayemi M. A Rural-Urban Comparison of Knowledge, Risk- Factors and Preventive Practices for Colorectal Cancer among Adults in Lagos State. Asian Pac J Cancer Prev. 2019; 20(4): 1063-71.
40. Su TT, Goh JY, Tan J et al. Level of colorectal cancer awareness: a cross sectional exploratory study among multi-ethnic rural population in Malaysia. BMC Cancer. 2013; 13: 376.
41. Sessa A, Abbate R, Di Giuseppe G et al. Knowledge, attitudes, and preventive practices about colorectal cancer among adults in an area of Southern Italy. BMC Cancer. 2008; 8: 171.
42. Alyabsi M, Alhumaid A, Allah-Bakhsh H et al. Colorectal cancer in Saudi Arabia as the proof-of-principle model for implementing strategies of predictive, preventive, and personalised medicine in healthcare. Epma J. 2020; 11(1): 119-31.
43. Bergin RJ, Emery J, Bollard RC et al. Rural-Urban Disparities in Time to Diagnosis and Treatment for Colorectal and Breast Cancer. Cancer Epidemiol Biomarkers Prev. 2018; 27(9): 1036-46.
44. Schlottmann F, Gaber C, Strassle PD et al. Health care disparities in colorectal and esophageal cancer. Am J Surg. 2020; 220(2): 415-20.
45. Enayatrad M, Yavari P, Etemad K et al. Association of Urbanization Levels and Colorectal Cancer Incidence in Iran. Int J Cancer Manag. 2018; 11(8): e68476.
46. Wen D, Zou W, Wen X et al. Urban-rural disparity in colorectal cancer incidence and increasing trend in relation to socioeconomic development and urbanisation in China. J Int Med Res. 2018; 46(10): 4181-96.
47. Papanikolaou IS, Sioulas AD, Kalimeris S et al. Awareness and attitudes of Greek medical students on colorectal cancer screening. World J Gastrointest Endosc. 2012; 4(11): 513-7.
48. Kulkarni V, Darshan BB, Unnikrishnan B et al. Colorectal Cancer: How Familiar Are Our Future Doctors with the Cancer of Tomorrow? Biomed Res Int. 2018; 2018: 7462101.
49. Aga SS, Khan MA, Alsulimani EF et al. Knowledge & Awareness regarding colorectal cancer among health and allied students of King Saud Bin Abdulaziz University for Health Sciences, Jeddah. J Family Med Prim Care. 2021; 10(6): 2284-92.
50. Mhaidat NM, Al-Husein BA, Alzoubi KH et al. Knowledge and Awareness of Colorectal Cancer Early Warning Signs and Risk Factors among University Students in Jordan. J Cancer Educ. 2018; 33(2): 448-56.
51. Matkowski R, Szelachowska J, Szewczyk K et al. Improvements in undergraduate oncology education introduced at Polish medical universities between 2004 and 2010 under Poland's "National Program for Combating Neoplastic Diseases". J Cancer Educ. 2014; 29(3): 428-33.
52. Wilkerson L, Lee M, Hodgson CS. Evaluating curricular effects on medical students' knowledge and self-perceived skills in cancer prevention. Acad Med. 2002; 77(10 Suppl): S51-3.
53. Geller AC, Prout MN, Miller DR et al. Evaluation of a cancer prevention and detection curriculum for medical students. Prev Med. 2002; 35(1): 78-86.
54. Dilly CK, Craven HJ, Molleston JP. Perspectives on Colon Cancer Screening-A Physician Panel Discussion for Preclinical Medical Students. MedEdPORTAL. 2020; 16: 11019.

Funding
The authors declare that no funds, grants, or other support were received during the preparation of this manuscript.

Competing interests
The authors have no relevant financial or non-financial interests to disclose.

Author contributions
All authors contributed to the study conception and design. Material preparation, data collection and analysis were performed by Marta Fudalej and Julia Pikul. The first draft of the manuscript was written by Marta Fudalej, Julia Pikul, and Agata Mormul. Review and editing was performed by Andrzej Deptała and Anna Badowska-Kozakiewicz. All authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

Data availability
The data for this survey were collected anonymously to ensure the confidentiality of respondents. All information derived from the survey is fully documented and presented within the article.

Ethics approval
The study was acknowledged by the Bioethics Committee of the Medical University of Warsaw (AKBE/145/2022).

Consent to participate
Informed consent was obtained from all individual participants included in the study. Participating in the survey was voluntary.

Consent to publish
Not applicable.