ORIGINAL ARTICLE

CONTENTS

Trends in cervical cancer epidemiology and vaccination coverage in Ukraine

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ABSTRACT

Aim: To evaluate regional aspects of cervical cancer epidemiology and adherence to vaccination in Ukraine.

Materials and Methods: The data about cervical cancer age-standardised incidence rate in 2014-2019 in Ukraine was obtained from the archives of National Cancer Registry of Ukraine. The data about vaccination coverage were obtained from the reports by the Centre of Public Health of Ukraine.

Results: The average cervical cancer age-standardised incidence rate in Ukraine in 2014-2019 was 14.9 per 100,000. Zhytomyr, Khmelnytskyi and Kirovohrad oblasts exhibited values 20% above the national level. The general trend of cervical cancer incidence at the national level in 2014-2019 was declining (from 15.0 to 14.1). Kyiv, Mykolaiv, Sumy and Chernihiv oblasts exhibited increasing trends in age-standardised incidence rate (>20%). The average zero-dose children proportion in Ukraine in 2016 -2024 was 30.3%. Vaccination coverage in Ukraine has been improving over the observation period in all oblasts.

Conclusions: Ukraine in 2014-2019 was characterised by the decreasing cervical cancer age-standardised incidence rate. Vaccination coverage in Ukraine in 2016-2024 has been improving, which increases the likelihood of a good response to the planned HPV vaccination campaign. Several regions with deviations from the national levels of cervical cancer incidence and vaccination coverage were identified.

KEY WORDS: Cervical cancer, vaccination, human papillomavirus, prevention, public health

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INTRODUCTION

Cervical cancer is the 5th most common type of cancer and is the 6th among the most common causes of death from cancer in the Ukrainian female population [1]. Importantly, cervical cancer is a highly preventable condition. Multiple studies have shown the beneficial impact of human papillomavirus (HPV) vaccination on cervical cancer epidemiology [2,3], and this made possible plans for the complete elimination of cervical cancer [4]. The current National program of immunisation in Ukraine includes HPV vaccination as a recommended, but not a mandatory intervention [5].

AIM

To evaluate regional aspects of cervical cancer epidemiology and adherence to vaccination in Ukraine.

MATERIALS AND METHODS

The data about cervical cancer age-standardised incidence rate (ASIR) in 2014-2019 in Ukraine was obtained from the archives of National Cancer Registry of Ukraine [1]. The data were analysed at the national and regional (by oblast) levels. The data from 2020-2021, despite being available, were not included in the study. COVID-19 pandemic has led to the massive disturbances of the healthcare system in Ukraine, which has led to the distortion of cancer epidemiology data [link]. Average 2014-2019 ASIR (per 100,000), annual average growth rate (AAGR) of ASIR in 2014-2019 (%) and deviation from the national average 2014-2019 ASIR (%) at the regional level were calculated. Vaccination coverage was assessed via calculation of zero-dose children proportion in 2016-2024 in Ukraine at the national and regional (by oblast) levels. The data about vaccination coverage were obtained from the reports by the Centre of Public Health of Ukraine [6]. For operational purposes, Gavi, the Vaccine Alliance defines zero-dose children as those who lack the first dose of diphtheria-tetanus-pertussis-containing vaccine (DTP1) [7]. The data was only available about the proportion of children without the first three doses of DTP (DTP3) in Ukraine [6]. Given the data availability, the zero-dose children proportion was calculated from the number of children without the first three doses of DTP (DTP3). Aver-

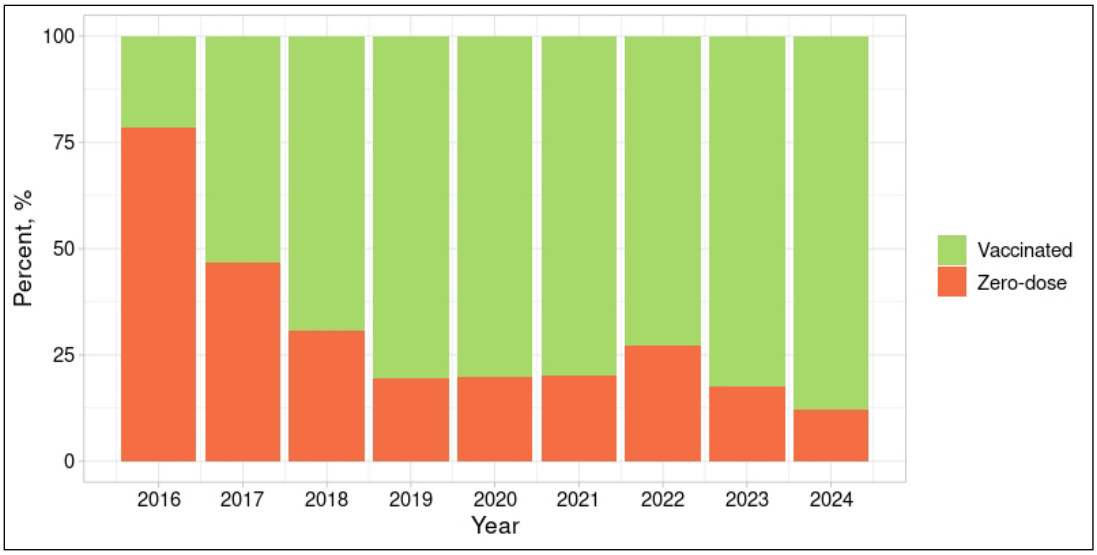

Fig. 1. 2014-2019 average age-standardised cervical cancer incidence rate in Ukraine by oblast

Table 1. Deviation from the national cervical cancer ASIR and its 2014-2019 AAGR by oblast

Oblast	Deviation from the national ASIR, %	2014-2019 ASIR AAGR, %
Crimea	No data	No data
Vinnytsia	-2.1	-37.6
Volyn	-10.7	-26.2
Dnipropetrovsk	1.6	-10.4
Donetsk	No data	No data
Zhytomyr	**42.8**	-6.7
Zakarpattia	7.3	-9.6
Zaporizhzhia	-21.9	-0.9
Ivano-Frankivsk	-11.8	-9.7
Kyiv	10.1	**13.5**
Kirovohrad	**73.5**	-4.5
Luhansk	No data	No data
Lviv	0.1	7.7
Mykolaiv	-0.9	19.7
Odesa	1.1	-30.6
Poltava	6.3	0.0
Rivne	17.7	-23.2
Sumy	-7.4	**21.7**
Ternopil	-4.6	-15.6
Kharkiv	-14.3	1.7
Kherson	-3.8	6.4
Khmelnytskyi	**24.4**	9.6
Cherkasy	3.2	1.3
Chernivtsi	-19.0	-40.4
Chernihiv	-17.9	**33.3**
Kyiv City	-16.8	-2.5

age 2016-2024 zero-children proportion was calculated. Aggregation of oblasts to the country regions was made in the same way as in the study by Sociology Group "Rating" to make possible the between study comparison [8]. The areas defined were Center, East, South and West. The data were taken from open sources after aggregation. Therefore,

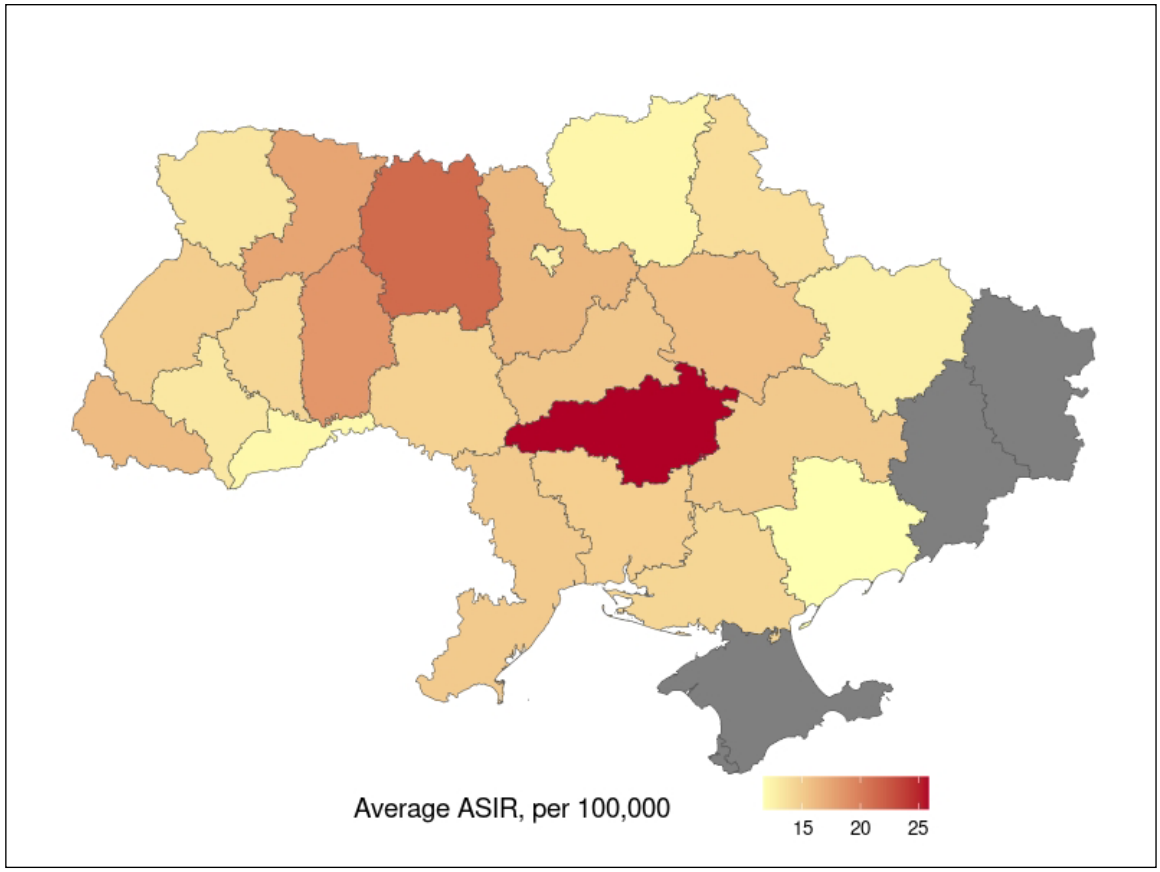

Fig. 2. 2016-2024 average zero-dose children proportion in Ukraine by oblast

Table 2. 2014-2019 average cervical cancer ASIR and 2016-2024 average zero-dose children proportion by region

Parameter	Center	East	South	West	p-value
2014-2019 average ASIR, per 100,000	16.4 (13.5-19.3)	12.8 (NA)	14.2 (13.1-15.3)	15.0 (13.4-16.5)	0.60
2016-2024 average zero-dose children, %	22.0 (17.6-26.4)	35.6 (30.2-41.0)	31.7 (26.3-37.0)	34.5 (31.8-37.2)	<0.01

obtaining personal information from the data in the analysis was not possible and approval of the Ethical Committee was not required.

The data were analysed using LibreOffice and R (version 4.4.2) software [9–11]. Whenever possible, 95% confidence interval for the mean was calculated. The groups were compared using Kruskall-Wallis test. Rank correlation analysis was performed for the values of ASIR and percentage of zero-dose children in Ukraine at the oblast level in 2016-2019, using the method by Hedges and Olkin [12]. In brief, this method implies ranking values of the variables in the study for each oblast, addition of the ranked values into one dataset with a subsequent correlation analysis. Critical value for p was taken <0.05.

RESULTS

The average cervical cancer ASIR in Ukraine in 2014-2019 was 14.9 per 100,000. The map chart with the distribution of cervical cancer ASIR by oblast is presented at Fig. 1. Regional values of cervical cancer ASIR fluctuated between 11.7 and 25.9 per 100,000.

There were oblasts where average ASIR is >20% higher than national level: Zhytomyr, Khmelnytskyi and Kirovohrad oblasts (Table 1). The general trend of cervical cancer incidence at the national level in 2014-2019 was declining (from 15.0 to 14.1, -6.0% AAGR). However, in several oblasts the strong increasing trend was observed (2014-2019 AAGR >10%): Kyiv (13.5%), Mykolaiv (19.7%), Sumy (21.7%) and Chernihiv (33.3%).

The average zero-dose children proportion in Ukraine in 2016 -2024 was 30.3%. The map chart with the distribution of zero-dose children proportion by oblast is presented at Fig. 2. Regional values of zero-dose children proportion fluctuated between 10.8% and 39.5%.

The proportion of zero-dose children in Ukraine in 2023-2024 was higher than in 2016-2018 (Fig. 3). This tendency was observed both at national and regional levels. In 2022 the proportion of zero-dose children was higher than in the nearest preceding and consequent years.

The Central region of Ukraine was characterised by the highest average cervical cancer ASIR and the lowest average proportion of zero-dose children (Table 2). Noteworthy, that Kirovohrad oblast had the highest

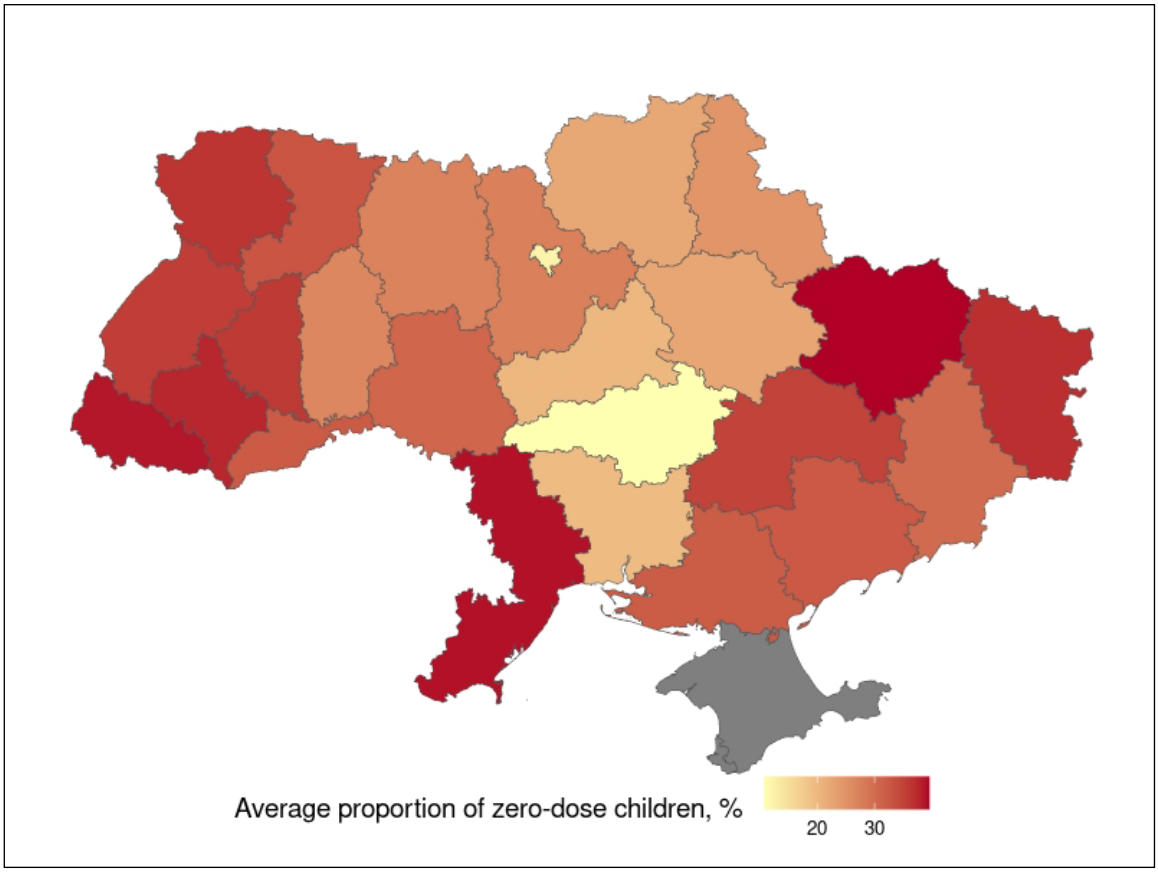

Fig. 3. Proportion of zero-dose children in Ukraine in 2016-2024

average cervical cancer ASIR (25.9 per 100,000) and the lowest average zero-dose children proportion (10.8%). By contrast, the Eastern region demonstrated the lowest average cervical cancer ASIR together with the highest average proportion of zero-dose children. There was a statistically significant difference in the proportion of zero-dose children between the studied regions ($p<0.01$).

The correlation analysis of cervical cancer ASIR and zero-dose children percentage in 2016-2019 after ranking of the values at the oblast level revealed a weak positive correlation: $r(\rho) = 0.24$, $p = 0.01$. A heatmap for depiction of the association between the ranks of two variables is at Fig. 4.

DISCUSSION

The presented article summarises the trend of cervical cancer age-standardised incidence rate in 2014-2019 and vaccination coverage in 2016-2024 in Ukraine. At the national level there was a general declining trend in cervical cancer ASIR, as well as the decrease in proportion of zero-vaccinated children over the observed years. Several oblasts and regions that did not fit the described trends were identified.

Similarly to the neighbouring countries, Ukraine experiences the gradual decline in cervical cancer ASIR [13,14]. This is likely due to the ongoing programs for the cervical cancer screening and HPV vaccination that are functioning in different way in different countries [13–16]. The average cervical cancer ASIR in Ukraine is higher than in Hungary (12.6), Poland (11.3), Republic of Moldova (14.2) or Slovakia (12.9), and is lower than in Romania (21.7, per 100,000) [17]. The understanding of the underlying reasons for these differences will make possible designing mitigation strategies for improving the patients' outcomes.

It is worth mentioning that Ukraine has the ongoing national program of cervical cancer screening and prevention. The recommendations on prevention are regularly updated [18] and aligned with the World Health Organisation position on the subject. The current version of the national vaccination calendar includes HPV vaccination as a recommended one [5]. Moreover, a new redaction of the national vaccination calendar is under preparation [19]. It suggests, among other, mandatory HPV vaccination of children. To address the possible obstacles and timely designing of communication campaigns the Ukrainian Centre of Public Health in cooperation with the U.S. Centre for Disease Control and Prevention launched a survey of HPV vaccination attitudes in Ukraine [20].

Some regions may be dealing more effectively with cervical cancer incidence due to the regional initiatives like in the paper by Kostyuchenko et al. (2018) [21]. While there is a certain degree of autonomy in healthcare politics implementation, all key decisions are made at the national level by the Ministry of Health

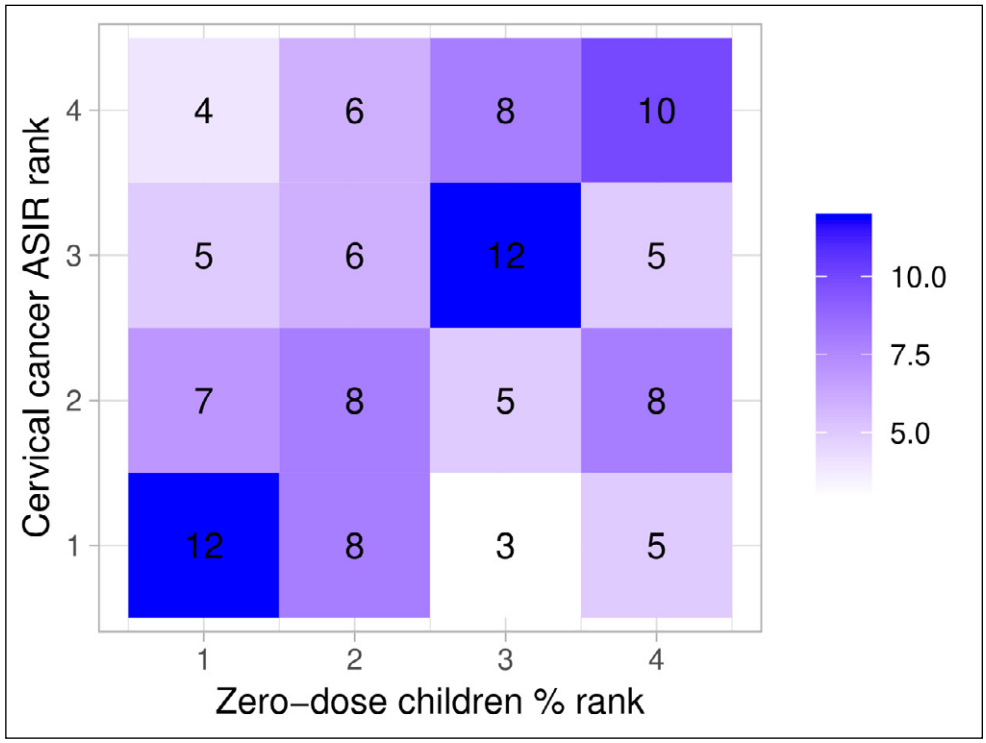

Fig. 4. Heatmap for association between ranked cervical cancer ASIR and ranked zero-dose children percentage in Ukraine in 2016-2019

of Ukraine and National Health Service of Ukraine. Due to that, significant deviation from the national average ASIR and its temporal trend require clarification of its possible causes.

Interestingly, the region with the lowest zero-dose children proportion had the highest cervical cancer average ASIR, and vice versa. However, the authors would like to argue against the possible conclusion about negative association between vaccination and cervical cancer incidence. Firstly, the proportion of zero-dose children may be considered as a proxy marker of vaccination attitude in adults, but is not equivalent to it. Therefore, the results of the announced study of the attitude to the HPV vaccination in Ukraine is to be awaited for more definite conclusions [20]. It is noteworthy that the results of the presented study correspond with the Rating study in 2021, where Southern and Eastern regions exhibited the largest proportion of coronavirus vaccine critics [8]. Secondly, due to the data availability, it was not possible to get the data on vaccination coverage for the period before the data on cervical cancer incidence. Cervical cancer is a chronic condition, and HPV infection is one of its risk factors. Therefore, it would be more accurate to study associations vaccination coverage during years that precede assessment of cervical cancer incidence. Thirdly, vaccination coverage, assessed via zero-dose children proportion, improved over time, approaching the levels of herd immunity (for diphtheria and pertussis) [22] in the latest years. It may be a result of the medical reform in Ukraine [23], when the position of family doctor was introduced. Also, it may be attributed to the successful communication campaign in response to the drop in vaccination coverage in Ukraine in 2014-2016 [24]. Regardless of the reason, such findings promise a good response to the planned HPV vaccination campaign. An increase of zero-dose children proportion in 2022 (Fig. 3) is likely related to the full-scale russian military invasion of Ukraine. Finally, there was a statistically significant positive association between cervical cancer ASIR and zero-dose children proportion. Despite isolated cases of unexplained discrepancy between cervical cancer ASIR and vaccination coverage, the general trend indicated favourable impact of vaccination on the cervical cancer incidence.

Cervical cancer is a problem of societies where the female population does not have sufficient access to screening programs [25]. In this regard Ukraine has a potential for improvement, as according to 2019 WHO data only 57% of Ukrainian females underwent cervical cancer screening in the last 5 years [26]. Actions for increasing adherence to prevention behaviours are needed together with the HPV vaccination campaign.

CONCLUSIONS

Ukraine in 2014-2019 was characterised by the decreasing cervical cancer age-standardised incidence rate, which was comparable to the neighbouring countries. Vaccination coverage in Ukraine in 2016-2024 has been improving, which increases the likelihood of a good response to the planned HPV vaccination campaign. Several regions with deviations from the national levels of cervical cancer incidence and vaccination coverage were identified.

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CONFLICT OF INTEREST
The Authors declare no conflict of interest

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