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ORGANIZATION OF PREVENTIVE MEASURES FOR INFECTIVE ENDOCARDITIS IN KAZAKHSTAN: A CROSS-SECTIONAL STUDY AMONG CARDIOLOGISTS

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Abstract

Introduction. The prevention of infective endocarditis (IE) is a crucial aspect of reducing the morbidity and mortality associated with this condition. Recent research on the global burden of disease (GBD) has documented a significant rise in the incidence of IE over the past 30 years. However, certain countries have managed to achieve a reduction in IE rates, prompting inquiries into the efficacy of cardiology services in preventing IE and adherence to established guidelines across various nations. The objective of this study is to identify the necessary initiatives to optimize the functioning of cardiology services for the prevention of IE.

Materials and methods. A cross-sectional study was conducted involving cardiology physicians. The questionnaire was structured using a Likert scale. Statistical analysis was performed using ANOVA and Fisher's methods, and data were analyzed with SPSS software (version 26.0).

Results. A total of 60 cardiology physicians participated in the survey. According to the data, more than half of the participants (85%) indicated the absence of an "Endocarditis Team" within their institutions. A significant majority of respondents (96.7%) emphasized the need to establish an interdisciplinary council. Additionally, 98.3% of the participants acknowledged the importance of creating national guidelines for the prevention of IE.

Conclusions. The results of this study indicate a significant need to optimize the functioning of cardiovascular services with a specific focus on the prevention of IE.

Keywords: Infective endocarditis, cardiologists, cardiac surgeons, antibiotic prophylaxis.

Резюме

ОРГАНИЗАЦИЯ ПРОФИЛАКТИЧЕСКИХ МЕР ПРИ ИНФЕКЦИОННОМ ЭНДОКАРДИТЕ В КАЗАХСТАНЕ: ПОПЕРЕЧНОЕ ИССЛЕДОВАНИЕ СРЕДИ КАРДИОЛОГОВ

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Введение. Профилактика инфекционного эндокардита (ИЭ) является важным аспектом снижения заболеваемости и смертности, обусловленной этим состоянием. Недавние исследования по глобальному бремени болезней зафиксировали значительное увеличение заболеваемости ИЭ за последние 30 лет. Однако некоторые страны достигли снижения показателей ИЭ, что вызывает вопросы об эффективности организации кардиологических служб в профилактике ИЭ и соблюдении установленных рекомендаций в разных странах. Цель

данного исследования — определить необходимые инициативы для оптимизации работы кардиологических служб по профилактике ИЭ.

Материалы и методы. Было проведено поперечное исследование с участием врачей-кардиологов. Анкета была структурирована на основе шкалы Лайкерта. Статистический анализ проводился с использованием методов ANOVA и Фишера. Анализ данных был выполнен с использованием программного обеспечения SPSS (версия 26.0).

Результаты. В опросе приняло участие 60 врачей-кардиологов. Согласно полученным данным, более половины участников (85%) указали на отсутствие "Команды по эндокардиту" в своих учреждениях. Большинство респондентов (96,7%) подчеркнули необходимость создания междисциплинарного совета. Кроме того, 98,3% участников признали важность разработки национальных рекомендаций по профилактике ИЭ.

Заключения. Результаты данного исследования указывают на значительную необходимость оптимизации функционирования кардиологических служб с особым акцентом на профилактику ИЭ.

Ключевые слова. Инфекционный эндокардит, кардиологи, сердечно-сосудистые хирурги, антибиотикопрофилактика.

Түйіндеме

ҚАЗАҚСТАНДА ИНФЕКЦИОНДЫ ЭНДОКАРДИТТІҢ АЛДЫН-АЛУ ЖҮЙЕСІН ҰЙЫМДАСТЫРУ: КАРДИОЛОГТАР АРАСЫНДА ЖҮРГІЗІЛГЕН КӨЛДЕНЕҢ ЗЕРТТЕУ

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Кіріспе. Инфекциялық эндокардиттің (ИЭ) профилактикасы - аурулардың және өлім-жітімнің деңгейін төмендетудің маңызды аспектісі болып табылады. Соңғы 30 жылда дүниежүзілік аурулар жүктемесі бойынша жүргізілген зерттеулер ИЭ-нің жиілігінің айтарлықтай өскенін көрсетті. Алайда кейбір елдер ИЭ деңгейін төмендетуді қамтамасыз ете алды, бұл кардиология қызметінің ИЭ-нің алдын алуын және әр түрлі елдерде қабылданған нұсқаулықтарға жүгінуінің тиімділігін зерделеуге сұрақ туындатады. Бұл зерттеудің мақсаты - ИЭ-нің алдын алу үшін кардиология қызметінің жұмысын оңтайландыру бойынша қажетті бастамаларды анықтау.

Материалдар мен әдістер. Кардиологтарды зерттейтін көлденең зерттеу жүргізілді. Сауалнама Лайкерт шкаласы негізінде құрылды. Статистикалық анализ ANOVA мен Фишер әдістерін пайдалана SPSS бағдарламалық жасақтамасы (26.0 нұсқасы) жүргізілді.

Нәтижелер. Сауалнамаға 60 кардиолог қатысты. Деректерге сәйкес, қатысушылардың жартысынан көбі (85%) жұмыс істейтін мекемелерінде «Эндокардит бойынша команда» жоқ екенін атап өтті. Респонденттердің айтарлықтай көпшілігі (96,7%) дисциплинарлық кеңес құрудың қажеттілігін баса айтты. Сонымен қатар, қатысушылардың 98,3%-ы ИЭ-нің алдын алу бойынша ұлттық нұсқаулықтар әзірлеудің маңыздылығын мойындады.

Қорытындылар. Бұл зерттеудің нәтижелері кардиологиялық қызметтердің жұмысын, ерекше назар аударатын, ИЭ профилактикасын тиімді түрде оңтайландыру қажеттілігін көрсетеді.

Түйінді сөздер. Инфекциялық эндокардит, кардиологтар, жүрек хирургтары, антибиотиктік профилактика.

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Құсаинова Ж., Булегенов Т., Жапар Ж., Абралина Ш., Абильтаев А., Таштемирова О., Абильмажинова Г. Организация профилактических мер при инфекционном эндокардите в Казахстане: поперечное исследование среди кардиологов // *Наука и Здравоохранение*. 2024. Т.26 (5). С. 72-78. doi 10.34689/SH.2024.26.5.009

Құсаинова Ж., Булегенов Т., Жапар Ж., Абралина Ш., Абильтаев А., Таштемирова О., Абильмажинова Г. Қазақстанда инфекциялық эндокардиттің алдын-алу жүйесін ұйымдастыру: кардиологтар арасында жүргізілген көлденең зерттеу // *Ғылым және Денсаулық сақтау*. 2024. Т.26 (5). Б. 72-78. doi 10.34689/SH.2024.26.5.009

Introduction

Infective endocarditis (IE) is a rare infectious disease, with an incidence rate ranging from 7.0 to 14.3 cases per 100,000 population. It is associated with a high mortality rate, reaching approximately 40% within three months following the diagnosis of the condition [23]. Over the past thirty years, there has been a global increase in both morbidity and mortality due to IE [22, 25]. Conversely, several countries have made significant progress in preventing this disease, raising important questions about the effectiveness with which their health systems implement preventive recommendations.

It is important to recognize that, beyond the implementation of guidelines, several other significant factors influence the incidence of IE. Key aspects include fostering a culture of prevention, the introduction of innovative diagnostic tools, and educational programs designed to raise awareness among both healthcare providers and patients. Additionally, ongoing monitoring and research into the effectiveness of prevention protocols, as well as the accessibility of medical care, play crucial roles in this context [2, 9, 13, 17–18, 21]. The interplay of these factors ultimately shapes the organization of cardiological care for patients at high risk of developing IE.

Unfortunately, there is a lack of studies in Kazakhstan and other Central Asian countries that evaluate the effectiveness of preventive measures for IE. This gap in research prompted us to conduct an initial study in this area. The primary objective of the study was to identify the necessary initiatives to optimize the functioning of cardiology services aimed at preventing IE. Additional objectives included exploring the perspectives of cardiology physicians regarding preventative measures and assessing the level of patient awareness about the disease.

Materials and methods

A cross-sectional survey of cardiology physicians was conducted using the online platform Google Forms from March to September 2024. The research topic received approval from the Ethics Committee of Semey Medical University, as documented in Protocol No. 3 dated December 7, 2022.

Prior to the commencement of the survey, respondents were informed about the study's objectives. The inclusion criteria specified that participants had to be current cardiology physicians, with no age restrictions. The survey was conducted anonymously and on a voluntary basis. Following approval from the institution's management, the head of the department disseminated the questionnaire through a group work chat. In total, the survey was distributed to four regional cardiological centers and four cardiology departments within hospitals for further distribution among cardiology physicians. As a result, we received responses from seven out of the eight medical institutions that were contacted.

The questionnaire comprised 16 questions; five introductory questions collected demographic information about the respondents, including gender, age, work experience, region, and specialty. The main section contained 11 questions focused on measures for preventing IE, as well as physicians' opinions on existing guidelines and the organization of cardiology services for combating IE. The questionnaire utilized a Likert scale for responses. In developing the questionnaire regarding antibiotic

administration prior to invasive dental procedures for the prevention of IE, we based our framework on the guidelines established by the Ministry of Health of the Republic of Kazakhstan, as outlined in Protocol No. 11 dated July 20, 2020 [3]. Additionally, international recommendations from the European and American Cardiological Associations on the prevention of IE were taken into account [4, 24].

An essential step in the development of the questionnaire was the involvement of a "Focus group" to create a high-quality tool for more accurate and efficient data collection. The development process consisted of six stages: The first stage involved coordinating with participants regarding the study's purpose and the criteria for selecting respondents. The second stage involved providing participants with a preliminary list of questions to assess their relevance and importance. The third stage included a discussion and revision of the questions. The fourth stage focused on discussing the questionnaire's structure, the sequence of questions, and the grouping of items for improved clarity. The fifth stage involved pilot testing the questionnaire within a small group to gather feedback. The final stage consisted of refining the questionnaire based on the feedback received and obtaining the focus group members' consensus on the final version.

The focus group comprised eight participants: two cardiac surgeons, two cardiologists, two dentists, and two public health specialists. The average age of the participants was 49 ± 5.2 years, and more than half (75%) held a scientific degree and a professional title. Participants were randomly selected from various medical institutions. Discussions with focus group members at each stage of the questionnaire development were conducted using social media platforms.

The normality of the distribution of quantitative data was assessed using the Kolmogorov-Smirnov test. Based on the results, data were presented as mean and SD (standard deviation). Qualitative data were presented in absolute numbers and percentages. The analysis of quantitative data was conducted using the ANOVA method, while the Fisher's method was employed for the analysis of nominal variables. Statistically significant differences were considered present when $p < 0.05$. Statistical analysis was performed using SPSS software (version 26.0).

Results

The study included 60 cardiology doctors from Kazakhstan, of whom 55% were women, with an average age of 38 ± 0.9 years. Cardiologists represented the largest group among respondents, comprising 71.7% of the total. The average work experience of the participants was 10 ± 0.8 years. According to the classification based on work experience, 40% of practitioners had 11–20 years of experience, while 5% had more than 20 years of experience (Table 1).

Table 1. Baseline characteristics

Parameters		n (%)
Gender	Female	33 (55)
	Male	27 (45)
Profile	Cardiologist	43 (71.7)
	Cardiac surgeons	17 (28.3)
Years of Experience	≤5	17 (28.3)
	6–10	16 (26.7)
	11–20	24 (40)
	>20	3 (5)

According to the survey, 48.3% of respondents indicated that they "sometimes" encountered patients with IE in their practice, while 33.3% reported meeting these patients "often" and 18.3% "rarely". Respondents stated that cases of IE associated with the use of injectable drugs and bacteremia following invasive dental procedures were particularly common, reported by 31.7% of the doctors, respectively. Other contributing factors included upper respiratory tract infections, chronic heart disease, and the presence of prosthetic heart valves, which collectively accounted for 36.7%. Additionally, 95% of the surveyed doctors believed that patients at high risk for developing IE were poorly (≤ 5) informed about the potential risks associated with the condition, as assessed on a 10-point scale (Table 2).

In our study, we investigated the organization of an "Endocarditis team" within medical institutions. The results indicated that 85% of respondents reported that such a team was not organized in their hospitals, while only 6.7% confirmed its existence. Additionally, 8.3% of respondents were unsure whether this team was available at their medical facility (Table 2).

In terms of adherence to guiding principles, 90% of doctors reported following the ESC recommendations, while 10% adhered to the American Heart Association (AHA) recommendations (Table 2). Regarding their views on international recommendations for the prevention of IE, 91.6% of the physicians expressed that they were "completely in agreement" with the ESC/AHA guidelines and deemed their application acceptable for the population of Kazakhstan. Furthermore, more than half (13.4%) of the respondents "agreed" that the National Institute for Health and Care Excellence (NICE) recommendations could also be applicable to this population. Notably, 13.3% of the respondents found it challenging to provide a definitive answer (Table 3).

Among the surveyed respondents, 71.7% agreed with the stance on reducing antibiotic prophylaxis (AP) due to antibiotic resistance. Furthermore, 86.7% of the respondents concurred that AP should be reserved only for invasive dental procedures, citing the risk of developing IE due to bacteremia following these interventions (Table 3).

The results of the survey revealed that 96.7% of the surveyed physicians expressed the necessity for creating

an interdisciplinary council comprising cardiologists, cardiac surgeons, and dentists. Furthermore, 98.3% of cardiology specialists highlighted the importance of developing a locally adapted version of the guidelines for the prevention of IE (Table 3).

Table 2.

Survey results on clinical experience and practices related to IE.

Questions	n (%)
In your clinical practice, how frequently do you encounter patients diagnosed with IE?	
Never	–
Rarely (less than once a year)	11 (18.3)
Sometimes (1-5 times a year)	29 (48.3)
Often (more than 5 times a year)	20 (33.3)
Always	–
Based on your clinical experience, what are the most common risk factors for IE that you have observed in your patients?	
Patients who inject drugs	19 (31.7)
Patients after invasive dental procedures	19 (31.7)
Patients with chronic heart disease	9 (15)
Patients with a prosthetic heart valve	10 (16.7)
Patients with upper respiratory tract infection	3 (5)
How aware do you believe high-risk patients are about the potential risk of developing IE? Please rate their awareness on a scale from 1 to 10, where 1 is «not aware at all» and 10 is «very aware»	
≤ 5	57 (95)
6 – 7	2 (3.3)
8 – 10	1 (1.7)
What guidelines for the prevention of IE are applied in your clinical practice?	
ESC	54 (90)
AHA	6 (10)
NICE	–
Does your institute have a designated interdisciplinary team for the management of IE, commonly known as an «Endocarditis Team»?	
Yes	4 (6.7)
No	51 (85)
Don't Know	5 (8.3)

Table 3.

Survey results on the acceptability of recommendations for the prevention of IE in Kazakhstan.

Questions	Completely Disagree	Partially Disagree	Difficult to say, agree or not	Partially Agree	Absolutely Agree
	n (%)	n (%)	n (%)	n (%)	n (%)
How acceptable do you find the latest ESC/AHA recommendations for IE for the population of Kazakhstan?	1 (1.7)	–	4 (6.7)	29 (48.3)	26 (43.3)
How acceptable do you find the latest NICE recommendations for IE for the population of Kazakhstan?	27 (45)	17 (28.3)	8 (13.3)	7 (11.7)	1 (1.7)
In your opinion, how necessary is AP for patients undergoing invasive dental procedures in order to prevent IE?	4 (6.7)	4 (6.7)	–	12 (20)	40 (66.7)
Do you support the recommendation to reduce AP for certain procedures due to concerns about antibiotic resistance?	7 (11.7)	3 (5)	7 (11.7)	28 (46.7)	15 (25)
Do you support the development of national guidelines for the prevention of IE?	–	–	1 (1.7)	27 (45)	32 (53.3)
Do you support the establishment of an interdisciplinary council that includes dentists among other healthcare professionals?	–	–	2 (3.3)	36 (60)	22 (36.7)

Table 4.

The incidence of IE in clinical practice among practitioners, relative to their years of experience

How frequently do you encounter cases of IE in your practice?	Clinical experience of practitioners, years,		p
	M±SD	95% CI	
Never	–		0.2
Rarely	9.2±6.01	5.12–13.24	
Sometimes	9.8±7.04	7.08–12.44	
Often	12.8±5.7	10.14–15.46	
Always	–		

We compared the length of service in relation to the frequency of IE cases encountered in clinicians' practice. The results indicated that there was no statistically significant difference in the incidence of IE cases between younger and more experienced specialists ($p=0.2$) (Table 4).

A comparative analysis was conducted regarding the frequency of support for the development of national recommendations on the prevention of IE based on the endorsement of AP prior to invasive dental procedures. Statistically significant results were obtained, with an odds ratio of 14 (95% CI: 5.4–35.9), $p < 0.001$ (Table 5).

Table 5.

Support for national recommendations on IE prevention.

	Development of a national recommendation for the prevention of IE		p
	Yes, n (%)	OR (95% CI)	
Should antibiotic prophylaxis be implemented prior to invasive dental procedures?	52 (92.9)	14 (5.4–35.9)	<0.001*

* – there are statistically significant differences in the indicators ($p < 0.05$)

Discussion

Our study allowed us to draw several key conclusions: Firstly, the need to create an interdisciplinary "Endocarditis Team" at the national level was identified. Second, physicians emphasized the necessity of developing national guidelines for the prevention of IE specifically tailored for the population of Kazakhstan. Third, more than half of the doctors confirmed the practical application of the recommendations from ESC/AHA and 91.6% found them among alternative recommendations for local adaptation in Kazakhstan. Fourth, the need to raise awareness among patients from the high-risk group of IE has been identified.

In order to improve cardiological services in the prevention of IE in Kazakhstan, an assessment of the needs for organizing appropriate measures was conducted. The clinical significance of the endocarditis team has been demonstrated in several observational studies [5–6, 10, 19]. However, in our study, only 6.7% of respondents indicated the presence of an "Endocarditis Team" in medical institutions. The overwhelming majority of respondents (96.7%) considered it necessary to create and involve an "Endocarditis Team" in clinical practice at the national level. "Endocarditis Teams" are a mandatory step in optimizing management and improving treatment outcomes. Primarily, the "Endocarditis Team" includes a number of highly

qualified specialists of various profiles who are involved in making important decisions regarding patient health. Especially in the selection of those who can benefit from urgent valvular surgery. Since in some patients with a severe clinical course, the condition may worsen during valve surgery, which can lead to a fatal outcome. The "Endocarditis team" is not directly involved in the prevention of IE, but it is important in the prevention of repeated cases of IE, early diagnosis, and reduction of mortality [1, 7, 11].

Among the respondents surveyed, more than 90% noted the need to create adapted guidelines on the prevention of IE for Kazakhstan. Some countries have adapted the recommendations to take into account the characteristics of their populations, which has allowed them to reduce the incidence and mortality of IE. Examples include adapted versions of the recommendations developed for the population of Japan and South Korea [12, 16]. The development of national recommendations makes it possible to take into account all the characteristics of the disease for a specific ethnic group, since the epidemiological profile of IE has a different character depending on the socio-demographic status of the country. For example, in the USA, the epidemiological profile of patients is predominantly young, since studies have revealed an annual increase in injecting drug use among young people [9]. Meanwhile, studies on the incidence of IE in East Asian countries have revealed a trend among the elderly population [14]. Based on the positive experience and results of global research, we must consider their practice and take into account the characteristics of our population [14, 22, 25]. Initially, an epidemiological study of the incidence of IE in Kazakhstan should be conducted and, based on its results, a local adapted guide for the prevention of IE should be developed.

During our study, one of the issues of interest to us was the application of the recommendation for the prevention of IE by cardiological doctors, as well as their individual opinion on the acceptability of the recommendation for the population of Kazakhstan. As a result, 90% of doctors followed the ESC recommendations, and the rest of the respondents applied the recommendations from the AHA in practice. However, according to the protocol of the Order of the Ministry of Health of the Republic of Kazakhstan No. 11 dated July 20, 2020 [3], doctors are recommended to prescribe antibiotics as a preventive measure against IE before invasive dental procedures in accordance with the guidelines from ESC [4]. Nevertheless, we have identified a small individual discrepancy in the implementation of the recommendation in clinical practice. These results can be explained by the similarity of the principles of AP assignment between them, unlike NICE [20]. As a result of the survey, 91.6% "agreed" with the ESC/AHA recommendations and considered them acceptable for local adaptation and application.

In our study, we also sought to evaluate clinicians' perceptions regarding the level of awareness among high-risk patients about the potential risks of developing IE. According to the respondents, 95% of high-risk patients were inadequately informed about the risks associated with IE, as assessed on a 10-point evaluation scale. These findings align with those of B. Maharaj, who reported that only 12.2% of patients received the necessary information

regarding AP prior to tooth extraction, thus remaining unaware of the potential risks of the disease. This highlights a concerning gap in knowledge among patients at risk for IE regarding preventive measures [15]. Given the life-threatening consequences of IE, it is imperative to enhance patient awareness of these risks to effectively combat the incidence of the disease.

In this study, a comparative analysis was conducted to examine the frequency of support for the development of national recommendations on the prevention of IE in relation to the endorsement of AP prior to invasive dental procedures. Statistically significant results were obtained, $p < 0.001$ (Table 5). These findings indicate that respondents who support the development of national recommendations for the prevention of IE are approximately 14 times more likely to endorse AP prior to invasive dental procedures compared to those who do not support such recommendations. These results underscore the crucial role of establishing a solid methodological framework for the prevention of IE in the context of dental interventions. They suggest that professionals who recognize the necessity for national guidelines are also more inclined to adopt preventive measures such as AP. This phenomenon may be attributed to a heightened awareness of the risks associated with IE, which fosters a greater propensity for endorsing preventive strategies. Consequently, to further reduce the incidence of IE, it is imperative to enhance educational programs for healthcare providers and improve their understanding of the importance of AP. The development and implementation of national recommendations could represent a significant step toward enhancing clinical practice and patient safety.

Our study also has a limitation: the absence of comparable studies in Kazakhstan and neighboring countries prevented us from comparing our results with other research conducted in the region. Given this limitation, as well as the fact that this study is the first of its kind in Kazakhstan, a more comprehensive investigation with a sufficiently large sample size is needed for future research.

Conclusion

In summary, our study has identified several critical aspects that require attention to optimize the cardiological service dedicated to the prevention of IE. The findings underscore the necessity of developing national recommendations for the prevention of IE to ensure their consistent application across clinical practice. Additionally, the establishment of an interdisciplinary council, referred to as the Endocarditis Team, is essential for optimizing management strategies and improving treatment outcomes at the national level. Furthermore, the low level of awareness among high-risk patients regarding the potential risks associated with IE presents a significant barrier to combating the incidence of the disease. To address these challenges, comprehensive measures must be implemented to enhance the quality and accessibility of cardiology services, as well as to foster a culture of prevention among both patients and healthcare providers through the active engagement of medical specialists in preventive initiatives.

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Literatura:

1. Albano D., Dondi F., Gazzilli M., Giubbini R., Bertagna F. Meta-analysis of the diagnostic performance of 18F-FDG-PET/CT imaging in native valve endocarditis. *JACC Cardiovasc Imaging*. 2021 May. 14(5):1063–5.
2. Alkhouli M., Alqahtani F., Alhajji M., Berzingi C.O., Sohail M.R. Clinical and economic burden of hospitalizations for infective endocarditis in the United States. *Mayo Clin Proc*. 2020 May. 95(5):858–66.
3. Clinical protocols of the Ministry of Health of the Republic of Kazakhstan – 2019. <https://diseases.medelement.com/disease/ostryi-i-podostryi-endokardit-infektsionnyi-endokardit-2019/16483> (Accessed: 27.07.2024)
4. Delgado V., Ajmone Marsan N., De Waha S., Bonaros N., Brida M., Burri H., et al. 2023 ESC guidelines for the management of endocarditis. *Eur Heart J*. 2023 Oct 14. 44(39):3948–4042.
5. El-Dalati S., Cronin D., Riddell J., Shea M., Weinberg R.L., Washer L. et al. The clinical impact of implementation of a multidisciplinary endocarditis team. *Ann Thorac Surg*. 2022 Jan. 113(1):118–24.
6. Elad B., Perl L., Hamdan A., Yahav D., Atamna A., Shaked H. et al. The clinical value of the endocarditis team: insights from before and after guidelines implementation strategy. *Infection*. 2022 Feb. 50(1):57–64.
7. Freitas-Ferraz A.B., Tirado-Conte G., Vilacosta I., Olmos C., Saez C., Lopez J. et al. Contemporary epidemiology and outcomes in recurrent infective endocarditis. *Heart*. 2020. 106:596–602.
8. Geirsson A., Schranz A., Jawitz O., Mori M., Feng L., Zwischenberger B.A. et al. The evolving burden of drug use associated infective endocarditis in the United States. *Ann Thorac Surg*. 2020. 110:1185–92.
9. Giannitsioti E., Pefanis A., Gogos C., Lekkou A., Dalekos G.N., Gatselis N. et al. Evolution of epidemiological characteristics of infective endocarditis in Greece. *Int J Infect Dis*. 2021 May. 106:213–20.
10. Gibbons E.F., Huang G., Aldea G., Koomalsingh K., Klein J.W., Dhanireddy S. et al. A multidisciplinary pathway for the diagnosis and treatment of infectious endocarditis. *Crit Pathways Cardiol*. 2020 Dec. 19(4):187–94.
11. Havers-Borgersen E., Butt J.H., Ostergaard L., Bundgaard H., Smerup M., Bruun N.E. et al. Recurrent infective endocarditis versus first-time infective endocarditis after heart valve surgery. *Clin Res Cardiol*. 2020. 109:1342–51.
12. Korean Society of Infectious Diseases, Korean Society for Chemotherapy, Korean Society of Clinical Microbiology, Korean Society of Cardiology, Korean Society of Thoracic and Cardiovascular Surgery. Clinical guideline for the diagnosis and treatment of cardiovascular infections. *Infect Chemother*. 2011. 43:129.
13. Lean S.S.H., Jou E., Ho J.S.Y., Jou E.G.L. Prophylactic antibiotic use for infective endocarditis: a

systematic review and meta-analysis. *BMJ Open*. 2023 Aug 22. 13(8):e077026.

14. Li H.L., Tromp J., Teramoto K., Tse Y.K., Yu S.Y., Lam L.Y., et al. Temporal trends and patterns of infective endocarditis in a Chinese population: a territory-wide study in Hong Kong (2002-2019). *Lancet Reg Health West Pac*. 2022 Mar 4. 22:100417.

15. Maharaj B., Vayej A.C. Awareness and knowledge of prophylaxis for infective endocarditis in patients with severe rheumatic heart disease. *SADJ*. 2013 Mar. 68(2):68, 70–1.

16. Nakatani S., Ohara T., Ashihara K., et al. JCS 2017 guideline on prevention and treatment of infective endocarditis. *Circ J*. 2019. 83:1767–809.

17. Nappi F., Martuscelli G., Bellomo F., Avtaar Singh S.S., Moon M.R. Infective endocarditis in high-income countries. *Metabolites*. 2022 Jul 25. 12(8):682.

18. Otto C.M., Nishimura R.A., Bonow R.O., Carabello B.A., Erwin J.P., Gentile F. et al. 2020 ACC/AHA guideline for the management of patients with valvular heart disease: a report of the American College of Cardiology/American Heart Association Joint Committee on Clinical Practice Guidelines. *Circulation*. 2021 Feb. 143(5).

19. Pizzi M.N., Fernández-Hidalgo N. Optimizing the diagnostic workup of infective endocarditis: an urgent need for studies focused on defining the decision-making process. *J Nucl Cardiol*. 2020 Apr. 27(2):609–11.

20. Quan T.P., Muller-Pebody B., Fawcett N., Young B.C., Minaji M., Sandoe J. et al. Investigation of the impact of the NICE guidelines regarding antibiotic prophylaxis

during invasive dental procedures on the incidence of infective endocarditis in England: an electronic health records study. *BMC Med*. 2020. 18:84.

21. Sengupta S., Prendergast B., Furnaz S., Ronderos R., Almaghraby A., Asch F.M. et al. Socio-economic variations in the clinical presentation, etiology and outcome of infective endocarditis in the ESC-EORP EURO-ENDO (European Infective Endocarditis) registry: a prospective cohort study. *Eur Heart J*. 2021 Oct. 12:42.

22. Sun J., Qiao Y., Zhao M., Magnusson C.G., Xi B. Global, regional, and national burden of cardiovascular diseases in youths and young adults aged 15–39 years in 204 countries/territories, 1990–2019: a systematic analysis of Global Burden of Disease Study 2019. *BMC Med*. 2023 Jun 26. 21(1):222.

23. Williams M.L., Doyle M.P., McNamara N., Tardo D., Mathew M., Robinson B. Epidemiology of infective endocarditis before versus after change of international guidelines: a systematic review. *Ther Adv Cardiovasc Dis*. 2021 Jan. 15:175394472110026.

24. Wilson W.R., Gewitz M., Lockhart P.B., Bolger A.F., DeSimone D.C., Kazi D.S. et al. Prevention of viridans group streptococcal infective endocarditis: a scientific statement from the American Heart Association. *Circulation*. 2021 May 18. 143(20):e963–78.

25. Yang X., Chen H., Zhang D., Shen L., An G., Zhao S. Global magnitude and temporal trend of infective endocarditis, 1990–2019: results from the Global Burden of Disease Study. *Eur J Prev Cardiol*. 2022 May 27. 29(8):1277–86.

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