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Economic burden of infective endocarditis in Zhejiang region from 2007 to 2016

Zhenzhu Wu[1†], Yi Chen[2†], Yingying Ma[3†], Tingting Xiao[3] and Yonghong Xiao[3*]

Abstract

Background Infective endocarditis (IE) has attracted widespread public attention. However, studies on its economic burden remain scarce.

Methods This retrospective study aimed to collect data on the clinical characteristics of patients with IE from electronic medical records and estimate the economic burden with disability-adjusted life years (DALYs). Additionally, the changing trend of IE from 2007 to 2016 and differences between native valve endocarditis (NVE) and prosthetic valve endocarditis (PVE) on economic burden were analyzed.

Results There were 407 patients with IE enrolled in this study. The total DALY loss was 1710.2. The average indirect economic burden ranged from $6253.27 to $14766.34 from 2007 to 2016 showing a stable trend, which was 1.67 to 2.46 times the annual per gross domestic product (GDP). Interestingly, the average indirect economic burden for females ranged from $5941.37 to $17261.07 with a significant upward trend during this period ($P=0.035$).The average DALY loss and indirect economic burden were highest in patient aged ≤ 19 (4.82, $21486.12) and lowest in those aged 80–89(0.46, $342.87), decreasing significantly with age(both $P<0.001$). Finally, there were no significant differences in the average DALY loss and indirect economic burden between the PVE group and NVE group during this period (2.69 vs. 2.63, $P=0.740$; $9224.0vs. $11789.4, $P=0.136$).

Conclusions The DALY loss and indirect economic burden associated with IE were notably high, particularly among younger patients and females. These findings highlight the need for targeted preventive care and early interventions, especially for youth and gender-specific strategies, to reduce disparities in IE burden.

Keywords Infective endocarditis, Disability-adjusted life years, Indirect economic burden, Prosthetic valve endocarditis

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Background

Infective endocarditis (IE) has attracted widespread public attention characterized by high morbidity and mortality rates [1]. Its incidence has been estimated to be 13.8 cases per 100,000 persons per year, and IE led to 66,300 deaths worldwide in 2019 [1, 2]. Management of serious complications such as cerebral infarction and heart failure remains challenging. Despite the increased awareness of antibiotic prophylaxis, improvements in antibiotic treatment, advances in diagnostic tools, and the timely surgical interventions, the mortality rate remains as high as 0.87 death cases per 100, 000 populations [2, 3].

As is well documented, prosthetic valve endocarditis (PVE) is the most severe type of IE and develops in 1–6% of patients with valve prostheses [4], with an incidence of 0.3–1.2% per patient-year [1, 3]. With the increasing use of cardiac implant devices and valve prostheses, a marked increase in PVE cases was observed between 1998 and 2013 in real-world observational studies [5]. Indeed, PVE was noted in 21% of cases of IE in a French survey [6], in 20% of cases in the ICE-PCS [7], and in 26% of cases in the Euro Heart Survey [8]. Notably, PVE accounts for 20–30% of all cases of IE [6], and is associated with challenges in diagnosis, determination of the optimal therapeutic strategy, and poor prognosis [1, 4, 9].

Disability-adjusted life year (DALY), a metric widely used to evaluate disease cost, is the sum of the years lived in unhealthy condition due to the disease and the lives lost for deaths [10]. As a metric used to evaluate disease cost, it integrate both morbidity and mortality into a comprehensive metric of health loss, enabling a more holistic perspective on long-term economic impacts compared to traditional methods (e.g., cost-effectiveness analysis or direct cost estimation), which may overlook indirect societal burdens or the value of life years lost. Therefore, it has been extensively used in researches [11, 12] after it first proposed in the Global Burden of Disease (GBD) study [13].

Previous studies [14–17] on IE primarily focused on its clinical and microbiological characteristics, complications and prognosis, with limited exploration of its economic burden. Research in this area is essential as it addresses a significant gap in the economic evaluation of IE, offering valuable insights to guide cost-effective interventions and evidence-based policy decisions. By advancing the current understanding of IE's economic impact, this study contributes to the growing yet still limited body of literature on this critical topic.

Therefore, this study retrospectively reviewed the indirect economic burden and DALY loss in patients with IE and its trend over the study period, as well as the potential economic burden of PVE in order to expand our understanding of the economic burden of IE and also provide valuable information to inform strategies for infection prophylaxis.

Methods

Patients and study design

This retrospective case-series analysis was conducted at the First Affiliated Hospital of Zhejiang University (Hangzhou, China). The clinical information of patients diagnosed with IE based on the Modified Duke criteria from January 1, 2007, to December 31, 2016, were reviewed. Next, the changing trend in the indirect economic burden and DALY loss of IE from 2007 to 2016 were analyzed. Differences in economic burden and DALY loss between subgroups (e.g., males vs. females, different age group) were also conducted. Afterward, we divided all cases into two groups according to the types of IE, namely the native valve endocarditis (NVE) and PVE group. Lastly, differences in indirect economic burden and DALY loss were compared between the two groups.

Data collection and definition

Data comprising patient demographics, comorbidities, complications, causative pathogens, therapeutic regimen, prognosis were retrieved from the electronic medical record. All patients with IE was categorized into either the NVE group or the PVE group according to the 2023 European Society of Cardiology (ESC) guidelines [1].

Gross domestic product (GDP) per capita was expressed in US dollars ($) and the annual exchange rate used in the study was from the Bank of China [18].

DALYs for IE were calculated as the summation of time lost owing to disability (YLD) for people living in incomplete health conditions due to this disease and the time of life lost (YLL) for deaths owing to the disease, with the formula being DALY = YLD + YLL [19]. YLL and YLD were calculated as follows:

$$YLLs\,[\gamma\,,\,K,\,\beta\,] = KCe\beta\,\alpha\,/(\beta\,+\gamma\,)2$$
$$\{e-(\beta\,+\gamma\,)(L+\alpha\,)[-(\beta\,+\gamma\,)\,(L+\alpha\,)-1]-e-(\beta\,+\gamma\,)$$
$$\alpha\,[-(\beta\,+\gamma\,)\,\alpha\,-1]\}\,+1-K/\gamma\,(1-e-\gamma\,L)$$

$$YLDs\,[\gamma\,,\,K,\,\beta\,] = D\{KCe\beta\,\alpha\,/(\beta\,+\gamma\,)2$$
$$\{e-(\beta\,+\gamma\,)(L+\alpha\,)[-(\beta\,+\gamma\,)\,(L+\alpha\,)-1]-e-(\beta\,+\gamma\,)$$
$$\alpha\,[-(\beta\,+\gamma\,)\,\alpha\,-1]\}\,+1-K/\gamma\,(1-e-\gamma\,L)\}$$

In the formula, γ, β and C represent fixed constants. Specifically, values recommended by the World Health Organization (WHO) [20] were used in this study. γ represents the discount rate, with a value of 0.03, while C denotes the age weight adjustment factor, with a value of 0.1658. β stands for the age weighting function, with a value of 0.04 [20]. D represents the disability weight, α is the age of death or disability, and L represents the number of years lost due to death or duration of disability [20]. According to the GBD provided by the WHO, the value of disability weight (D) fluctuates between 0 and 1

Table 1 The DALY loss and indirect economic burden for total patients of IE

Parameter (median, IQR)	Total *N* = 407	Male *N* = 262	Female *N* = 145	*P* Value
DALY	2.63(1.85–4.24)	2.63(1.76–3.86)	3.09(1.94–4.27)	0.002
Indirect economic burden($)	11789.40(3757.49-17023.74)	11062.83(3115.95-16396.88)	12425.57(4255.04-18514.51)	0.102

IE: Infective Endocarditis; DALY: Disability-adjusted Life Years; IQR: Interquartile Range

Table 2 AverageDALY and indirect economic burden of patients with IE from 2007 to 2016

Year	Number	DALY(median, IQR)	Indirect Economic Burden$(median, IQR)	Per GDP($)	Time*
2007	28	3.09(1.85–4.49)	6253.27(3991.77-9076.79)	2695.16	2.32
2008	34	3.86(2.23–4.35)	8520.23(5319.48-11031.47)	3470.07	2.46
2009	19	3.09(2.23–4.27)	8735.43(5941.37-11205.06)	3832.53	2.28
2010	44	3.04(2.01–4.27)	10373.04(7321.50-14581.27)	4551.00	2.28
2011	41	2.63(1.85–3.88)	11808.86(8318.80-16340.09)	5616.68	2.10
2012	37	2.69(1.72–3.86)	13568.04(1660.78-18237.93)	6300.36	2.15
2013	53	2.63(1.59–3.50)	14766.34(1118.12-18194.04)	7023.35	2.10
2014	36	3.04(1.52–4.27)	13854.27(1160.19-22106.90)	7636.91	1.81
2015	49	2.69(1.50–4.59)	14301.78(1198.21-23202.02)	8015.22	1.78
2016	66	2.23(1.60–3.59)	13500.11(1289.06-20975.46)	8097.04	1.67
P value		0.214	0.036		

DALYs: Disability-adjusted Life Years; IE: Infective Endocarditis; GDP: Gross Domestic Product

*Time = mean indirect economic burden/ per GDP

depending on the severity of the infection, with values of 0.006 for mild infections, 0.051 for moderate infections, and 0.133 for severe infections [19].

The indirect economic burden was determined by combining DALY, human capital, and productivity weight. In other words, it was calculated as follows: indirect economic burden = DALY × GDP per capita × productivity weight [21, 22]. The productivity weights varied by age groups. The weight was 0.15 for individuals aged 0–14 years, given that they do not contribute to social wealth creation. In contrast, the weights of individuals aged between 15 and 44 years and 45–59 years who were involved in generating social wealth were 0.75 and 0.80, respectively. Finally, the weight dropped to 0.1 for individuals aged ≥ 60 years, reflecting their limited wealth creation capacity [21].

Statistical analysis

We used IBM SPSS Statistics software version 23.0 to perform statistical analyses. Pearson's χ^2 test or Fisher's exact tests was used for categorical variables to perform univariate analysis, while the independent Student's t-test or the Rank sum test was used to compare continuous variables. We used frequencies and percentages to express categorical variables, whereas averages with standard deviations or medians and interquartile ranges were used for continuous variables. We considered $P < 0.05$ as statistical significant.

Results

Patient enrollment

A total of 407 patients with IE diagnosed between January 1, 2007, and December 31, 2016, were included in the present study. The total DALY loss and median DALY loss were 1710.2 and 2.63, respectively (Table 1). Regarding males, 262 cases suffered 1014.3 DALY loss and median DALY loss was 2.63(Table 1). Concerning females, 145 cases experienced 695.93 DALY loss and median DALY loss was 3.09 (Table 1). And female suffered more DALY loss than male {3.094(1.938–4.272) vs. 2.628(1.762–3.860), $P = 0.002$} (Table 1).

The DALY loss for IE from 2007 to 2016

Between 2007 and 2016, the average DALY loss ranged from 2.23 to 3.86 years, with no significant fluctuation observed during this period ($P = 0.214$) (Table 2). Among males, the average DALY loss ranged from 2.23 to 3.66 years, also showing no significant fluctuation ($P = 0.116$) (see supplementary files-Table 1. Similarly, for females, the average DALY loss ranged from 2.50 to 3.90 years, with no significant fluctuation detected ($P = 0.640$) (see supplementary files-Table 1).

The indirect economic burden due to IE from 2007 to 2016

For all cases, the average indirect economic burden was $11789.4 (Table 1). Specifically, the average indirect economic burden was $11062.8 for males and $12425.6 for females (Table 1).However, no significant differences was observed between the two groups {12425.6(4255.0-18514.5) vs. 11062.8(3116.0-16370.0), $P = 0.102$} (Table 1).

The average indirect economic burden ranged from \$6253.27 to \$14766.34 from 2007 to 2016 showing an increasing trend, which was 1.67 to 2.46 times the annual per GDP (Table 2). Of note, the average indirect economic burden for females ranged from \$5941.37 to \$17261.07 with a significant upward trend ($P = 0.035$) (see supplementary files-Table 2). As for males, the average indirect economic burden ranged from \$4809.05 to \$14766.34, but no significant differences was found in this period ($P = 0.127$) (see supplementary files-Table 2).

The DALY loss and indirect economic burden for IE in different age groups

In the age subgroup, the average DALY loss and indirect economic burden were highest in patients aged ≤ 19 (4.82 years and \$21486.12) and lowest in those aged 80–89 (0.46 years and \$342.87), decreasing significantly with increasing age (both $P<0.001$) (Table 3).

Regarding females, the average DALY loss and indirect economic burden were highest in patients aged ≤ 19 (4.82 years and \$28966.55) and lowest in those aged 80–89 (0.49 years and \$373.78), showing a significant decline with age (both $P<0.001$) (see supplementary files-Table 3 and supplementary files-Table 4).

Among males, the average DALY loss were highest in patients aged ≤ 19 (4.80 years) and lowest in those aged 80–89 (0.43 years) ($P<0.001$), while indirect economic burden were highest in those aged 30–39 (4.80 years) and lowest in those aged 80–89 (\$341.13) ($P<0.001$) (see supplementary files-Table 3 and supplementary files-Table 4).

Comparison of clinical characters and economic burden in NVE and PVE cases

There were 370 cases in the NVE group and 37 in the PVE group(Table 4). The mean age was older in the PVE group than in the NVE group (53.57(± 16.9) vs. 47.5(± 15.9); $P = 0.029$).Likewise, the incidence of hospital-acquired infection was higher in the PVE group compared to the NAV group ($P = 0.003$). On the other hand, no significant differences were noted in gender and duration of hospital stay between the two groups ($P = 0.310$ and 0.067, respectively). Similarly, the proportion of patients with comorbidities such as tumor, renal failure, hypertension, and diabetes mellitus was comparable between the two groups. The primary causative organism was streptococci in the NVE group and staphylococci in the PVE group ($P = 0.003$). However, no significant differences was found in the rates of complications between the two groups. The rate of ICU admission and surgical intervention were similar between the two groups ($P = 0.898$ and 0.240, respectively). However, in-hospital mortality was apparently higher in the PVE group than in the NVE group ($P = 0.001$). (Table 4)

The average DALY loss was higher in the PVE group than in the NVE group, but difference was not statistically significant (2.69 vs. 2.63, $P = 0.740$) (Table 4). Similarly, no significant differences was found in the average indirect economic burden between the PVE and NVE group (\$9224.0vs. \$11789.4, $P = 0.136$) (Table 4).

Discussion

IE has garnered widespread attention due to its high morbidity and mortality rates [1]. While previous studies have focused on clinical aspects like treatment and outcomes, research on its economic impact remains limited. To our knowledge, this is the first real-world study to explore the economic impact of IE using DALY, enabling comparisons with other diseases. This study revealed that the DALY loss of IE is comparable to hepatitis B, with younger patients and females experiencing higher DALY loss and indirect economic burden. These results highlight the critical need for healthcare providers to prioritize early diagnosis and implement multidisciplinary care models to mitigate long-term disability and improve patient outcomes. Furthermore, policymakers should allocate resources to enhance access to advanced diagnostic tools and preventive measures, particularly for high-risk populations. Future research should focus on evaluating cost-effective interventions and exploring the socioeconomic determinants of IE to inform targeted

Table 3 AverageDALY and indirect economic burden of patients with IE for different age groups

Age group(year)	Number	DALY, mean	Indirect economic burden\$, mean
≤ 19	12	4.82(4.80–4.87)	21486.12(13497.95-28966.55)
20–29	56	4.27(4.27–4.56)	19625.84(14581.27-25680.53)
30–39	65	3.86(3.45–3.86)	18194.04(11789.03-20975.26)
40–49	74	2.69(2.63–3.04)	13964.18(10373.04-16894.72)
50–59	87	2.23(1.85–2.23)	11310.93(8120.48-14447.78)
60–69	73	1.49(1.49–1.59)	1049.93(729.28-1210.44)
70–79	34	0.87(0.71–4.68)	613.03(489.30-2845.45)
80–89	6	0.46(0.43–1.29)	342.87(243.57-859.97)
P value		<0.001	<0.001

DALYs: Disability-adjusted Life Years; IE: Infective Endocarditis

Table 4 Features and economic burden of the patients with NVE and PVE

Variable, *n*(%)	NVE *N* = 370	PVE *N* = 37	*P* value or Z value
Male	241(65.1)	21(56.8)	0.310
Age, mean ± SD	47.5(± 15.9)	53.57(± 16.9)	0.029
Length of hospital stay(day),	18(11–30)	26(12.5–56.0)	0.067
Prior antibiotic use	288(80.9)	33(89.2)	0.268
Intravenous drug abuse	3(0.8)	0	1.000
Type of IE			0.003
Community-acquired	332(89.7)	27(73.0)	
Hospital-acquired	38(10.3)	10(27.0)	
Underlying heart disease	185(50.0)	36(97.3)	0.000
Congenital heart disease	102(27.6)	3(8.1)	0.005
Rheumatic heart disease	51(13.8)	18(48.6)	0.000
Comorbidities			
Chronic obstructive pulmonary disease	5(1.4)	1(2.7)	0.483
Cancer	11(3.0)	1(2.7)	1.000
Hemodialysis	12(3.2)	2(5.4)	0.369
Liver cirrhosis	4(1.1)	0	1.000
Hypertension	72(19.5)	10(27.0)	0.274
Diabetes mellitus	36(9.7)	1(2.7)	0.231
Vegetation	327(88.4)	23(62.2)	0.000
≤ 10 mm	79(21.4)	11(29.7)	
10–20 mm	189(51.1)	8(21.6)	
20–30 mm	48(13.0)	3(8.1)	
>30 mm	11(3.0)	1(2.7)	
Perivalvular abscess	28(7.6)	2(5.6)	1.000
Causative organism			0.003
Streptococci	91(24.6)	0	
Staphylococci	71(19.2)	9(24.3)	
Enterococci	4(1.1)	1(2.7)	
Fungus	3(0.8)	0	
Others	26(7.0)	7(18.9)	
Complications			
Heart failure	193(52.2)	22(59.5)	0.397
Embolic events	114(30.8)	11(29.7)	0.892
Cerebral hemorrhage	21(5.7)	2(5.4)	1.000
Cerebral embolism	68(18.4)	6(16.2)	0.745
Renal insufficiency	75(20.3)	6(16.2)	0.556
Hepatic insufficiency	62(16.8)	10(27.0)	0.119
Pulmonary arterial hypertension	103(28.1)	13(36.1)	0.314
Admit to ICU	226(61.1)	23(62.2)	0.898
Surgical treatment	217(58.6)	18(48.6)	0.240
In-hospital mortality	33(8.9)	10(27.0)	0.001
DALYs, median (IQR)	2.63(1.85–3.90)	2.69(1.54–6.34)	0.740
Indirect economic burden($),median(IQR)	11789.4(4689.8-17261.1)	9224.0(762.4-15948.3)	0.136

NVE: Native-valve Endocarditis; PVE: Prosthetic Valve Endocarditis; IE: Infective Endocarditis; DALY: Disability-adjusted Life Years; IQR: Interquartile Range; SD: Standard Deviation. ICU: Intensive Care Unit

public health strategies and reduce the overall disease burden.

Previous studies on DALY in infectious diseases have reported median per-case losses of 0.01, 2.79, 2.74 and 3.58DALY for influenza, hepatitis B, invasive pneumococcal disease and tuberculosis, respectively [23]. In our study, we found the median per-case DALY losses of IE was 2.63 from 2007 to 2016 close to hepatitis B. As anticipated, while the DALY values for IE were extremely high herein, they are considered reasonable. DALY refers to the summation of time lost owing to disability for people living in incomplete health conditions due to this disease and the time of life lost for deaths owing to the disease. Considering that IE has a long-term effect and higher

mortality rate than other infectious diseases, its associated DALY values were significantly elevated. Hence, allocating more attention and resources to address IE is not only justified but also critical for improving patient outcomes and reducing healthcare costs.These results emphasize the need for early diagnosis, multidisciplinary care, and improved access to diagnostics and prevention. Future research should explore cost-effective interventions and socioeconomic factors to guide public health strategies.

In this study, the average DALY loss ranged from 2.23 to 3.86 years, remaining stable over time, consistent with IE incidence trends in our prior research [24]. This stability may reflect improved healthcare access, advancements in diagnostic technologies, and the implementation of preventive measures. Additionally, changes in treatment protocols and patient demographics could also contribute to this trend. Further research is needed to explore the relative impact of these factors on the burden of IE.However, the global incidence and DALY loss of IE is projected to exponentially increase according to Lin et al.'s research [25]. In this study, the average indirect economic burden ranged from $6253.27 to $14766.34 from 2007 to 2016, which was1.67 to 2.46 times the annual per GDP. As the data were from a single high-expertise center in China, the IE burden in regions with limited resources may be even greater. However, the single-center, retrospective design limits generalizability, as it may not fully reflect the heterogeneity of IE burden across diverse populations and healthcare settings. These findings highlight the substantial economic burden of IE on patients and governments. To address this, healthcare providers should prioritize early diagnosis and multidisciplinary care, while policymakers should improve access to diagnostics and prevention, especially in underserved areas. Researchers are encouraged to conduct multicenter studies to explore regional disparities.

Since life expectancy varies by gender, which is one of the critical factors influencing DALY and indirect economic burden, we conducted subgroup analysis stratified by gender. Subgroup analysis revealed that females experienced significantly higher DALY loss compared to males ($P < 0.05$), while no significant difference was observed in indirect economic burden between the two groups ($P = 0.102$). Notably, although the incidence of IE was lower in females than in males, the mortality rates were similar [24]. The higher DALY loss in females may be attributed to their longer life expectancy, which amplifies the cumulative impact of disability, as well as potential gender-specific disparities in timely diagnosis and treatment. This trend aligns with the findings of Lin et al. [25], who projected that the disease burden on females would surpass that on males by 2030.

These findings highlight the substantial burden of IE in females and underscore the need for targeted interventions. Healthcare providers should adopt gender-sensitive strategies, such as enhanced screening and early intervention, to address these disparities. Policymakers should improve healthcare access for women, especially in underserved areas, and promote awareness of IE symptoms and risks. Additionally, researchers are encouraged to explore the underlying causes of gender disparities and develop targeted interventions to reduce the impact of IE on females.

Subgroup analysis by age showed that the highest mean DALY loss and average indirect economic burden were observed in patients aged ≤ 19 and lowest in those aged 80–89, showing a significant decline with age.This pattern can be explained by both biological and socioeconomic factors. Biologically, younger individuals, particularly those aged ≤ 19, are more susceptible to severe disease progression and long-term complications due to their developing immune systems, while their longer life expectancy increases cumulative disability impact. In contrast, older adults (aged 80–89) often have shorter remaining life expectancy and competing mortality risks, reducing long-term impact of IE. Socioeconomically, younger patients may face greater indirect economic losses from disrupted education and career development, whereas older individuals, often retired, are less affected by productivity losses. These findings highlight the need for targeted interventions, such as early diagnosis and aggressive management in younger populations, to mitigate the disproportionate burden of IE in this age group.

Furthermore, the rate of nosocomial infections was higher in the PVE group than in the NVE group [1, 26]. S*treptococci* were the predominant causative organism in the NVE group, while *staphylococci* was more common in the PVE group, consistent with previous studies [15, 27]. Although no differences were observed in comorbidities or complications rates between the two groups, the in-hospital mortality was higher in the PVE group, aligning with earlier studies reporting the in-hospital mortality rate of 20–40% in patients with PVE [1, 3, 5]. However, no significant differences were found in the average DALY loss and indirect economic burden between the PVE and NVE group in this study, potentially due to the limited number of PVE cases.Therefore, large-scale studies are needed to further evaluate the economic impact of PVE.

Nevertheless, this study has several limitations. First, as a single-center retrospective study, the geographically restricted data may introduce bias. Given the variations in healthcare access and economic development across China, our results may not fully represent the national situation. Second, the lack of data on direct economic costs, such as transportation, nutrition, and outpatient

expenses, limits the comprehensiveness and generalizability of our findings. Third, key parameters like disability weights and GDP per capita were based on fixed constants, preventing sensitivity analysis and potentially introducing uncertainties into the results. Future studies should incorporate variable or region-specific data for these parameters to improve robustness. Finally, the limited number of PVE cases may have contributed to the lack of statistical significance in some results. Therefore, multicenter, large-scale cohort studies are needed to address these limitations.

Conclusions

In summary, this real-world study revealed that the DALY loss of IE is comparable to hepatitis B, with younger patients and females experiencing higher DALY loss and indirect economic burden. These findings highlight the substantial economic burden of IE in the Zhejiang region. However, the results may not be generalizable to other regions. Future research should expand to nationwide multi-center studies and evaluate the cost-effectiveness of prevention strategies, such as early diagnosis and targeted prophylaxis, to inform evidence-based interventions and reduce the burden of IE across diverse populations.

Abbreviations

IE	Infective endocarditis
DALY	Disability-adjusted life years
NVE	Native-valve endocarditis
PVE	Prosthetic valve endocarditis
GDP	Gross domestic product
ICE-PCS	International collaboration on endocarditis-prospective cohort study
GBD	Global burden of disease
ESC	European society of cardiology
YLD	Years lost due to disability
YLL	Years of life lost
WHO	World health organization
ICU	Intensive care unit
SD	Standard deviation
IQR	Interquartile range

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12879-025-10846-1.

Supplementary Material 1

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Author contributions

Z W and Y C designed the study and created study protocols. Z W, Y C and Y M performed the data collection, data analysis and drafts the manuscript. T X performed data collection, made data analysis and reviewed the manuscript. Y X supervised the study development, reviewed the manuscript and made critical revision to the paper. All authors have read and approved the submitted version.

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Data availability

The datasets used and analyzed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate

This study was approved by the Clinical Research Ethics Committee of the First Affiliated Hospital of Zhejiang University School of Medicine (Approval No. Zheda Yiyuan Lun Shen 2023 Yan Di 1040 Hao-Kuai). The Ethics Committee of the First Affiliated Hospital of Zhejiang University School of Medicine reviewed the study protocol and waived the requirement for written informed consent due to the retrospective nature of the study and the use of anonymized patient data. All procedures were performed in accordance with the ethical standards of the Declaration of Helsinki and its later amendments.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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