ORIGINAL ARTICLE

The Current Epidemiology of Injecting Drug Use-Associated Infective Endocarditis in Victoria, Australia in the Midst of Increasing Crystal Methamphetamine Use

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Background	Infective endocarditis (IE) is associated with significant mortality and morbidity despite recent advances in management. Injecting drug use (IDU) remains an important risk factor. Our aim was to evaluate the rates and patient demographics of IE and injecting drug use-associated infective endocarditis (IDU-IE) in Victoria from 2009 to 2014.
Methods	The Victorian Admitted Episode Dataset (VAED) was used to identify a population-based cohort with a diagnosis of IE and IDU-IE between 2009 and 2014 in Victoria. Incidence rates were calculated per 100,000 people/year. Rate ratios were calculated using Poisson distributions, and chi squared (χ^2) test for trend were calculated to identify significant linear trends.
Results	The incidence rate of IE overall has risen significantly from 11.09 to 13.56 per 100,000 people/year from 2009 to 2014 (rate ratio 1.22, 95% confidence interval (CI) 1.10, 1.36, p < 0.001). The incidence of IDU-IE has also risen significantly from 0.92 to 1.76 per 100,000 people/year from 2009 to 2014 (rate ratio 1.93, 95% CI 1.28, 2.90, p = 0.002). The chi squared (χ^2) test for trend of both IE and IDU-IE also suggests a statistically significant linear trend (p = 0.0015 and 0.005 respectively). Descriptive epidemiology revealed men are twice as likely to be affected by IE overall. The elderly were found to be the most affected by IE overall (ages 75 to 79 years) with IDU-IE affecting a much younger age group (ages 30 to 34 years). Validation of hospital coding for IDU-IE was shown to have sensitivity of 77.2% (95% CI 64.8, 86.2).
Conclusions	This study identified that from 2009 to 2014 there has been a significant increase in incidence of both IE overall and IDU-IE in Victoria. These findings highlight the need for the planning of targeted interventions to mitigate the incidence of disease.
Keywords	Infective endocarditis • Injecting drug use • Epidemiology

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Introduction

Infective endocarditis (IE) is associated with significant mortality and morbidity despite recent advances in antimicrobial therapy, surgery and diagnostic accuracy [1]. Infective endocarditis is primarily associated with ageing and predisposing cardiac lesions, but with an increase in injecting drug use (IDU), the incidence has increased in the young. Injecting drug use is an established risk factor for IE [2] and a major risk factor for recurrences, affecting 40% of IDU-IE cases [3].

The pathogenesis of IE involves bacteria in the bloodstream adhering to damaged valvular endothelium and subsequent colonisation causing the characteristic vegetation and infection [1]. In IDU-IE it is hypothesised that injected solid particles cause endothelial damage. Bacteria colonising the skin enter the circulatory system at the site of injection and attach to the injured endothelium [4]. Poor injection hygiene such as un-sterile equipment and lack of skin disinfection may result in high bacterial loads.

The aim of this study is to identify the incidence of IE overall and IDU-IE in Victoria from 2009 to 2014. We analysed the annual number of cases of IE overall and IDU-IE and the temporal trends of disease. We describe the demographics including age and sex. Our study provides a large dataset that is independent from referral bias and provides generalisable results. We have established a dataset and methodology to measure the impact of practice change on incidence of IE overall and in IDU populations in Victoria.

Methods

In Victoria, all hospital admissions and separations in all rural/metropolitan, private/public hospitals are recorded in an administrative database: Victorian Admitted Episode Dataset (VAED) [5]. Retrospective analysis of data obtained from the VAED was performed to identify the number of annual episodes of IE and IDU-IE from 2009 to 2014 in Victoria. The VAED provides a complete data set of the causes and nature of illness and the utilisation of health services by admitted patients in Victoria [5]. The study population included all patient episodes from 2009 to 2014 coded for IE and IDU-IE. The definitions of IE and IDU-IE were based on the ICD-10-AM diagnostic codes. For the principal diagnosis of IE, ICD-10-AM code included I33.0. The ICD-10-AM codes used to define substance abuse/IDU included F11 to 16 and F19. To validate the coding process we also examined medical records of 57 definite cases IDU-IE at two major health services and estimated the sensitivity of coding. The VAED supplied data on annual state episodes of IDU-IE and IE for each financial year. The dataset also included total cases for age and gender from 2009 to 2014. Population estimates were averaged from the end of each financial year. This was done to ensure population at risk figures corresponded to the correct time interval of number of annual episodes as supplied by the VAED. This study was approved by the Barwon Health Human Research Ethics Committee (15/20).

Statistical Analysis

Statistical analysis was performed using STATA version 14 (StataCorp LLC 4905 Lakeway Drive College Station, Texas 77845-4512 USA). Incidence rates were calculated per 100,000 people/year. We corrected for population changes by identifying the number of cases of IE overall and IDU-IE per year in Victoria and using the population at risk as the denominator for comparison of annual rates. At risk populations included the whole population of Victoria for IE overall and the 'working age population' of Victoria, those aged 15 to 65 as defined by the Australian Bureau of Statistics (ABS) [6] for IDU-IE, as no episodes of IDU-IE were identified for those aged over 60 or younger than 20 years. Annual Victorian population estimates for each period were obtained from the ABS and represent the most accurate numbers on state population. Rate ratios (RR) and 95% confidence intervals (CIs) were calculated and compared using Poisson distributions. Poisson regression models were also used to assess temporal trends and compare annual incidence rates of IE overall and IDU-IE. Chi squared (χ^2) test for trends were calculated for both IE overall and IDU-IE to identify the significance of increase in annual incidence rates. Trends in descriptive epidemiology, including proportion calculations of age and gender were also analysed.

Results

The incidence rates of cases of IE overall, significantly increased from 11.09 per 100,000 people/year in 2009/2010 to 13.56 in 2013/2014 (RR 1.22 95% CI 1.10, 1.36, p < 0.001). A larger increase in incidence of IDU-IE was observed from 0.92 per 100,000 people/year in 2009/2010 to 1.76 in 2013/2014 (RR 1.93 95% CI 1.28, 2.90, p < 0.002). Validation of coding of 57 definite cases of IDU-IE showed sensitivity of 77% (95% CI 64.8, 86.2).

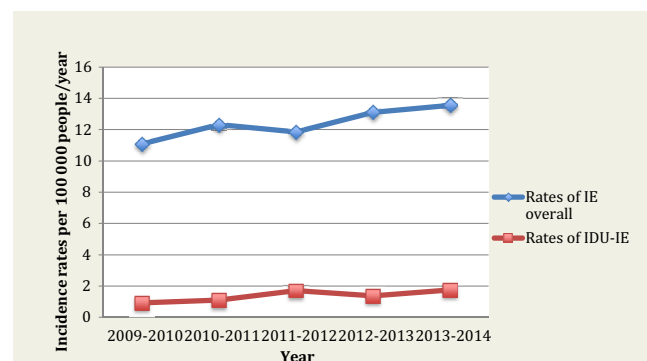These findings are illustrated in Figure 1 and Tables 1 and 2.

Figure 1 Annual incidence rates (per 100,000 people/year) of IE overall and IDU-IE in Victoria from 2009–2014. Populations at risk include the whole Victorian population for IE overall and the working age population (those aged 15 to 65 years) for IDU-IE.