

SHORT REPORT

Increased cardiovascular mortality associated with the turn of the millennium in Los Angeles County, California

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The turn of the millennium attracted levels of public attention and excitement that far surpassed those of previous New Year's changeovers. Concern about the reliability of computer systems, terrorist attacks, and other possible doomsday scenarios contributed to a heightened sense of anticipation worldwide. In addition, the holiday and New Year's season can be simultaneously stressful and joyous. Cardiac morbidity and mortality increases during December and January^{1–3} even in regions with mild climates.⁴ Uniquely increased levels of stress, anxiety, and overindulgence at the turn of the millennium led us to hypothesise that the millennium changeover was associated with an increased number of deaths attributable to cardiac causes. Therefore, we analysed data from death certificates in Los Angeles County, California, to discover if the millennium changeover was associated with increased cardiovascular mortality. This is the first study to our knowledge that investigates the impact of the millennium changeover on cardiac deaths.

METHODS

Daily death certificate data and population data were obtained from the Los Angeles County Department of Health Services Data Collection and Analysis Unit. The data were analysed by deaths attributable to ischaemic heart disease (IHD) and congestive heart disease (CHD). The investigated time periods were 15 December to 31 December and 1 January to 15 January for the year 1999–2000 and the control years 1995–1999 and 2000–2002. For the time periods 1995–1998, International Classification of Diseases, 9th Revision (ICD-9) codes was used. For 1999–2002, International Classification of Diseases 10th Revision (ICD-10) codes were used. The codes for IHD were ICD-9 (410–414, 429.2) and ICD-10 (I20–I25) and for CHD they were ICD-9 (428) and ICD-10 (I50).

We hypothesised that there was a difference in the change in daily rate of death in the time periods around 1 January 2000 compared with the change in daily rate of death for the same time periods in 1996–1998 and 2000–2002 for each of the prespecified causes. This hypothesis was tested by comparing the rate change from the two weeks before 1 January to the two weeks after 1 January for the year 2000

with the average of the changes for the control years. Mortality was expressed as deaths per day per 100 000 people using the 1990–2000 census figures. The analysis of the data was a two way analysis of variance with daily death rate per 100 000 as the unit of analysis and with year and pre/post 1 January as factors in the model.

RESULTS

Table 1 gives the number of deaths and the mortality rates necessary for testing the hypothesis. In the control years, there was a consistently increased rate of death from IHD and CHD in the two weeks after 1 January compared with the two weeks before 1 January. This resulted in an increase in the mean daily rate over the six years from 0.4419 to 0.4749 per 100 000 population for IHD and from 0.0189 to 0.0252 for CHD. In contrast, during 2000 the death rate attributable to IHD was lower in the two weeks after 1 January compared with the two weeks before (0.5897 compared with 0.5427 per 100 000). There was, however, a small increase in CHD (0.0279 compared with 0.0309). The net results of these changing patterns are that the rate change for IHD is statistically significantly different for the millennium than for the average of the six control years in the direction of more pre-1 January mortality for the millennium. The changes in CHD were not statistically significant.

DISCUSSION

We found a consistent and statistically significant increase in IHD death before New Year's Day 2000 compared with previous years. Previously, our group found the rate of cardiac death to be highest during the months of December and January (peaking on New Year's Day) in an analysis of 10 consecutive years.⁴ Therefore, we speculated that the exaggerated excitement and anticipation that accompanied the millennium changeover could have resulted in a similarly exaggerated increase in cardiovascular events.

The heightened attention surrounding the millennium changeover may have been an added source of stress in an

Abbreviations: IHD, ischaemic heart disease; CHD, congestive heart disease

Table 1 Analysis of the pre/post 1 January changes in mortality rates for two categories of cardiac causes for the millennium compared with the four previous and two after (control) years

Cause of death	Pre* control	Post* control	Pre* millennium	Post* millennium	Rate† change difference	p Value‡
IHD	0.4419	0.4749	0.5897	0.5427	0.0802	0.0134
Deaths	4282	4060	973	790		
CHD	0.0189	0.0252	0.0279	0.0309	0.0033	0.5559
Deaths	183	216	46	45		

*Expressed as rate per day per 100000 population. †Estimated from a two way analysis of variance with year and pre/post 1 January as factors. ‡For the hypothesis that the difference in rate change is zero. IHD, ischaemic heart disease; CHD, congestive heart disease.

What this paper adds

This paper is, to our knowledge, the first to investigate the relation of the millennium "hype" and deaths attributable to heart attacks.

already stressful holiday season. Various authors have found that mental stress can induce myocardial ischaemia⁵⁻⁸ and this may have been a contributing factor in the increased number of cardiovascular deaths around the millennium. Previous studies have examined the relation between cardiac deaths and severe stressors such as earthquakes and wars, finding both positive⁹⁻¹² and negative¹³ correlations. While the millennium changeover was certainly not as stressful as an earthquake or a war, the significant increases in cardiac deaths may reflect some degree of "millennium hype".

There are some limitations to our study. We only report on two cardiac causes of death (CHD and IHD). Other causes like stroke may be more sensitive to stress than either of these. Deaths were categorised according to the diagnoses on the death certificates, which can be prone to inaccurate reporting. There were coding changes between the ICD-9, which was used for the 1995-1998 data, and the ICD-10, which was used for the 1999-2002 data. However, these changes resulted in minimal differences in the reporting of cardiac deaths due to cause (personal communication; Louise Rollin, Los Angeles Department of Health Services, 1 November 2002). Also, as we were comparing rate changes within each coding system and two of our control years are post-millennium years this should correct for any bias that may have been introduced by the change in coding system.

In conclusion, mortality attributable to IHD in the two weeks before the turn of the millennium compared with the two post-millennium weeks was increased beyond the levels of New Year's changeovers before and after the millennium, suggesting that circumstantial factors specific to the millennium hype were related to an excess risk of IHD death. This association of IHD with major epoch transitions calls for further research because it may have implications for healthcare policy around these epochs.

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Policy implications

The results of this paper, if confirmed by further research, may have healthcare policy implications.

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