Short Communication: Sex ratio at birth and war in Croatia (1991–1995)

O. Polasek¹,²,⁴, I. Kolcic¹, B. Kolaric³ and I. Rudan¹,²

¹Department of Medical Statistics, Epidemiology and Medical Informatics, ‘Andrija Stampar’ School of Public Health, Medical School, University of Zagreb, Rockefellerova 4, 10 000 Zagreb, Croatia, ²Department of Public Health Sciences, University of Edinburgh Medical School, Teviot Place, Edinburgh EH8 9AG, UK and ³Croatian Institute of Public Health, Rockefellerova 7, 10 000 Zagreb, Croatia

²To whom correspondence should be addressed. E-mail: opolasek@snz.hr

BACKGROUND: We have investigated sex ratio at birth (expressed as the proportion of males) in Croatia before, during and after the war (1991–1995). METHODS: Data for each of 21 counties in Croatia (861 516 births) were collected and pooled into two groups: the first, consisting of the counties unaffected by the war, and the second, comprising the counties affected by war events. Odds ratios of being born as a male were calculated, with being born in a county exposed to war defined as the risk factor. RESULTS: No significant deviations from the expected ratio of 0.514 were found in pre-war, wartime or post-war period at the national level. The ratio was 0.515 during the pre-war and wartime periods, and 0.514 in the post-war period. Comparison of the ratios in the three periods in both affected and unaffected counties revealed no significant increase in the sex ratio. The only significant increase in the sex ratio was registered in two counties unaffected by the warfare. CONCLUSIONS: This study indicates that warfare did not cause a detectable increase of the sex ratio at birth in Croatia, in contrast to what might have been predicted based on earlier reports in the literature.

Key words: birth/male proportion/sex ratio/war

Introduction

Unfavourable environmental conditions are believed to be associated with decrease of sex ratio at birth, a phenomenon described in the case of earthquakes (Fukuda et al., 1998), severe periconceptional events (Hansen et al., 1999) or economic decline (Catalano, 2003). In contrast to this, increase in the sex ratio related to war was reported by a number of authors (James, 1987; Graffelman and Hoekstra, 2000), and hypothetically caused by earlier fertilizations due to higher coital rates during wartime (James, 2003). However, several recent papers on the sex ratio related to warfare failed to confirm such an increase (Ansari-Lari and Saadat, 2002; Zorn et al., 2002).

The war in Croatia began in 1991, and was marked by fierce warfare in distinct parts of the country during 1991–1993. Among 21 administrative counties of Croatia, 10 were involved in the warfare, while the remaining counties were either involved in moderate warfare or were entirely spared. During most of 1993 and 1994, a ‘status quo’ remained with about a third of Croatia’s territory occupied, until the two short military actions in 1995 led to a full reintegration of the occupied territories (Labar et al., 2004). In this paper, we investigated sex ratio at birth during pre-war, wartime and post-war Croatia.

Materials and methods

Data on all live births, routinely collected and published by the Central Bureau of Statistics of the Republic of Croatia, for the years 1986–2002, were used in this study.

As the current administrative territorial subdivision into counties has only been in place since 1993, the data for smaller territorial units (‘Opcina’) for the period 1986–1992 was compiled and merged to correspond to the current scheme, not affecting the methods of collection or interpretation of statistical data.

Study periods were defined as: pre-war (1986–1990), wartime (1991–1997), and post-war (1998–2002). Although the war itself took place from 1991 to 1995, the war duration was extended for 2 years to allow for a post-war effect on the sex ratio, as suggested by Graffelman and Hoekstra (2000). The data on live births during wartime was obtained from the unaffected counties and the unoccupied parts of the affected counties (as data from the occupied territories were not available). The likely decrease in absolute number of births during the war period should not affect the conclusions of the paper, as all our results are expressed as proportions, insensitive to fluctuations in absolute numbers. Male proportions were calculated and used in the analyses (although many papers refer to the sex ratio, the widely used measure is the proportion of males at birth). The odds ratios (OR) of being a male were calculated, and being born in the county affected by warfare considered as the risk factor (Ansari-Lari and Saadat, 2002).
Results

A total of 861,516 births were recorded in Croatia during the period under study. Calculated sex ratios exhibit constant patterns with average values of $0.515 \pm 0.001$ in the pre-war period, $0.515 \pm 0.003$ in the wartime period, and $0.514 \pm 0.001$ in the post-war period. The comparison of the pre-war and wartime periods yielded no change in the sex ratio [OR = 0.9988, 95% confidence interval (CI) 0.9938–1.0038]. Similar results were obtained when wartime was compared to the post-war period (OR = 1.0043, 95% CI 0.9988–1.0097).

The analyses at the level of specific counties showed substantial variation. However, a significant increase in the sex ratio was observed only in two counties unaffected by the warfare: Krapina County (pre-war to wartime OR = 1.0339, 95% CI 1.0057–1.0622, wartime to post-war OR = 1.0955, 95% CI 1.0647–1.1262) and Varazdin County (pre-war to wartime OR = 0.9647, 95% CI 0.9400–0.9894, wartime to post-war OR = 1.0375, 95% CI 1.0111–1.0639).

Comparison of affected versus unaffected counties revealed no significant difference (affected: pre-war to wartime OR = 1.0040, 95% CI 0.9959–1.0122, wartime to post-war OR = 0.9968, 95% CI 0.9877–1.0060; unaffected: pre-war to wartime OR = 0.9956, 95% CI 0.9892–1.0019, wartime to post-war OR = 1.0085, 95% CI 1.0018–1.0153) (Figure 1).

Discussion

Many factors have been used to explain change in the sex ratio related to warfare, but equivocal explanation has not yet been presented. The warfare itself was treated as the sex ratio increasing factor, and papers exhibiting sex ratio decrease were treated as aberrant (James, 2003).

Similar sex ratios in affected and unaffected counties in Croatia, alongside the significant increase observed only in two unaffected counties, suggest that warfare did not cause any detectable increase in the sex ratio in the 1991–1995 war in Croatia. This is despite 5 years of warfare (long risk exposure), and tens of thousands of casualties, devastation of one-third of the country’s infrastructure, and up to $1 \times 10^6$ displaced persons and refugees (high risk intensity) (Labar et al., 2004). Although the duration and intensity of the war in Slovenia (10 days in duration, relatively few casualties, minor damage to infrastructure) were not comparable to the war in Croatia, Zorn et al. (2002) described a decline in sex ratio at birth after the 10 days of the war in Slovenia, concluding that acute psychological stress caused a decrease in sex ratio from 0.518 in 1991 (pre-war) to 0.504 in 1992 (post-war). The absence of the increase in sex ratio is therefore a common conclusion to both studies, although they used different approaches and methods.

Investigation into the sex ratios of remaining Balkan countries affected by the recent warfare remains to be performed. Should the findings from those countries support the observation of wartime-related stability or decrease of the sex ratio, it could be hypothesized that factors other than exposure to warfare itself caused the observed increase in the sex ratio at birth in previous papers.

References


Submitted on February 3, 2005; resubmitted on March 29, 2005; accepted on April 22, 2005