Seasonality of sudden infant death syndrome in mainland Britain and Ireland 1985–95

A S Douglas, P J Helms, I T Jolliffe

Abstract

By the end of 1995 four years had passed since the dramatic fall in the incidence of sudden infant death syndrome (SIDS), following the “back to sleep” campaign. This time lag permitted a more definitive epidemiological reassessment than had been possible before. The extent of seasonal variation from 1992–5 fell by about half, occurring mainly as a single step down in 1992. The fall was relatively greater in winter than in summer. Before 1992 the extent of seasonal variation (amplitude) was greater in those age ≥ 5 months compared with those aged < 4 months. Since 1992 the falls in incidence and amplitude have been greater in the younger group, suggesting that SIDS deaths in younger and older babies may have different causes.

(Arch Dis Child 1998;79:269–270)

Keywords: sudden infant death syndrome; seasonality; epidemiological reassessment

We have reported before¹ that seasonality continues to feature in sudden infant death syndrome (SIDS) despite the fall in incidence since 1992. The earlier report was provisional, the data finishing in 1993. With larger numbers over a longer time period (to the end of 1995) it is now possible to confirm or refute this conclusion and to examine changes by age at death, as others have suggested different reasons for SIDS above and below 4–5 months of age.²–⁴

Methods

Monthly data (1985–95) on SIDS were collected from England/Wales, Scotland, Northern Ireland, and Eire. These were deaths in Code 798.0 of the International Classification of Diseases (ICD), 9th revision. Individual years were examined and comparisons were also made by aggregating and comparing blocks of years.

A sine curve was fitted to monthly data using the technique first described by Halberg et al,¹ further details of which can be found in our earlier publication.¹ This is equivalent to fitting a cosine or sine curve to the data. The results provide multiple correlation coefficient (R) and the angular position in the year where the fitted sinusoidal regression line has its highest value. The extent of the seasonal variation (amplitude A) for each year is described as the percentage above the monthly mean (100%) for that year of the highest value of the sine curve.

Separate cosine curves were fitted for each year and in each case a second harmonic was added to assess the adequacy of the simple cosine curve. In all years except one there was no evidence that the second order term improved the fit, and the “significant” result for that year could easily have arisen by chance.

Results

DEATHS AT ALL AGES

During the years 1985–95 there were 13 860 deaths (England and Wales 11 260, Scotland 1143, Northern Ireland 447 and Eire 1010). The numbers in the successive years were 1985 (1643); 1986 (1881); 1987 (1873); 1988 (1901); 1989 (1633); 1990 (1467); 1991 (1189); 1992 (666); 1993 (575); 1994 (554); 1995 (478). Mean monthly rates expressed per 1000 live births in these years are available from the authors.

Table 1 shows that the mean annual rate of SIDS remained stable from 1986–8, started to fall in 1989–91, and then fell precipitously in 1992, with the subsequent low level being mainly sustained but with some minor further decline.

The amplitude of seasonality behaved in a similar way (table 1 and fig 1) with an abrupt fall in 1992, this being a “step-down” to a new level which was, in the main, sustained. The 1994 data did not show a significant

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Table 1  Cosinor analysis SIDS rates

<table>
<thead>
<tr>
<th></th>
<th>All ages</th>
<th>&lt;4 months</th>
<th>≥5 months</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>R</td>
<td>p</td>
<td>A</td>
</tr>
<tr>
<td>1985</td>
<td>0.91</td>
<td>&lt;0.001</td>
<td>47.5</td>
</tr>
<tr>
<td>1986</td>
<td>0.96</td>
<td>&lt;0.001</td>
<td>49.6</td>
</tr>
<tr>
<td>1987</td>
<td>0.95</td>
<td>&lt;0.001</td>
<td>48.2</td>
</tr>
<tr>
<td>1988</td>
<td>0.98</td>
<td>&lt;0.001</td>
<td>38.2</td>
</tr>
<tr>
<td>1989</td>
<td>0.98</td>
<td>&lt;0.001</td>
<td>43.3</td>
</tr>
<tr>
<td>1990</td>
<td>0.95</td>
<td>&lt;0.001</td>
<td>43.1</td>
</tr>
<tr>
<td>1991</td>
<td>0.94</td>
<td>&lt;0.001</td>
<td>43.6</td>
</tr>
<tr>
<td>1992</td>
<td>0.86</td>
<td>&lt;0.01</td>
<td>23.6</td>
</tr>
<tr>
<td>1993</td>
<td>0.89</td>
<td>&lt;0.001</td>
<td>28.5</td>
</tr>
<tr>
<td>1994</td>
<td>0.47</td>
<td>NS</td>
<td>15.4</td>
</tr>
<tr>
<td>1995</td>
<td>0.78</td>
<td>&lt;0.05</td>
<td>20.4</td>
</tr>
</tbody>
</table>

Accepted 4 February 1998
seasonality, but this returned in 1995 with an overall 20% amplitude.

When the sine curve model was fitted to 1985–95, to 1985–91, and to 1992–5 separately, there was an extremely significant improvement (p < 0.0001) in the fit for the separate models, confirming that the seasonality curves had indeed changed from 1992 onwards. Although seasonal amplitude fell by about half from 1992 onwards, there was still strong evidence (p < 0.0001) for the persistence of seasonality in the later years.

A further question was whether the seasonal variation had stabilised from 1992. Fitting separate cosine curves to the two pairs of years 1992–3 and 1994–5 showed no significant improvement compared with the single curve for 1992–5 (p = 0.16). Hence on the basis of data available so far, there is no evidence of further change in seasonality after 1992, the year of the large fall in incidence.

In a comparison of the monthly rates between 1986–9 (4 years) and 1992–5 (4 years) the percentage falls by month were as follows: January 71%, February 72%, March 74%, April 66%, May 63%, June 55%, July 40%, August 59%, September 59%, October 66%, November 74%, December 75%. The fall in winter was relatively greater than in summer. The average rates per 1000 live births were 2.21 (1986–9) and 0.71 (1992–5), a fall of about two thirds (68%). Over the same years the amplitude fell by half (51%).

**DEATH AT ≤ 4 AND > 5 MONTHS**

The results of separate analyses for ≤ 4 months and ≥ 5 months of age are also given in table 1. With two exceptions (1990 and 1991), the amplitude was greater in the older age group. The 4 years 1986–9 (well before the precipitous rate fall) were compared with 1992–5. The rate reduction for both age groups was again about two thirds, (≤ 4 months 69% and ≥ 5 months 63%); amplitude reductions were greater in the younger age group than in the older (≤ 4 months 55%; ≥ 5 months 36%).

The acrophase peak dates for those aged ≤ 4 months are earlier than ≥ 5 months; except in 1994, the one year with non-significant sinusoidal seasonality (table 1).

**Discussion**

While the persistence of seasonality in SIDS has been questioned, this study uses a rigorous statistical analysis to demonstrate that despite the dramatic fall in rate, seasonal variation still occurs. Seasonality remains an aetiological clue and the differing seasonality features by age of death may provide clues as to causation. The findings by age at death are less certain but provide support for the suggestion by others that there may be more than one at risk population of SIDS babies with differing aetiological factors.

The following agencies supplied data:

- National Sudden Infant Death Syndrome Register, Sudden Infant Death Association, George’s Hall, The Children’s Hospital, Temple Street, Dublin (Bernadette Kiberd, Tom Matthew).
- General Register Office for Scotland, Ladywell House, Ladywell Road, Edinburgh EH2 7TF (Jack Arrundale).
- ASD was supported by funding arising from the Maryland Medical Research Institute. Dr Margaret Moffat did some of the computing and Mrs Muriel Burnett and Mrs Nicki Duncan the typing. Dr John Rawles constructed the cosinor programme.

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Arch Dis Child 1998 79: 269-270
doi: 10.1136/adc.79.3.269

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