

NHS Performance Indicators

DIRECT STANDARDISATION METHODOLOGY

Age-standardisation facilitates comparisons across geographical areas by controlling for differences in the age structure of local populations. There are two methods of age-standardisation: direct and indirect.

The directly age-standardised rate for an indicator is the number of events that would occur in a standard population (per 100,000) if that population had the age-specific rates of a given area. The rates are standardised to the European Standard Population. The age-standardised rate for an area is defined as follows:

$$\text{Age-standardised rate for an area: } \frac{\sum S_i r_{ia}}{\sum S_i}$$

where S_i are the standard population sizes in the relevant age groups (i) and r_{ia} are the age-specific rates in age groups i in area a .

The age groups used for deriving the standardised rates are as defined in the European Standard Population.

Standardised rates for persons are calculated using rates for all persons (and not male and female rates separately). Unlike SMRs, directly standardised rates can be compared across areas and time periods.

A WORKED EXAMPLE OF THE CALCULATION OF DIRECTLY AGE-STANDARDISED RATES USING THE EUROPEAN STANDARD POPULATION

All Malignant Neoplasms (ICD10 C00-C97) in persons aged under 75

Stage 1: Calculation of age-specific death rates per 100,000 population in area a:

(a) Number of deaths by age group in area a

Year	Under 1	1-4	5-9	10-14	.....	65-69	70-74
2001	0	0	1	1	.....	53	83
2002	0	0	0	0	.....	63	68

(b) Population by age-group in area a

Year	Under 1	1-4	5-9	10-14	.....	65-69	70-74
2001	1900	8200	11100	11800	.....	9300	8300
2002	1900	8200	11100	11800	.....	9300	8300

(c) Age-specific death rates per 100,000 in each age-group/year = (number of deaths divided by population) *100,000

Year	Under 1	1-4	5-9	10-14	.....	65-69	70-74
2001	0	0	9.00	8.45	.....	568.16	996.98
2002	0	0	0	0	.....	675.36	816.80

Stage 2: Calculation of European age-standardised annual rates:

Method: Multiply the death rate for area a of age group/year by the European Standard Population of age group and then sum these "expected" numbers of deaths.

Year	<1	1-4	5-9	10-14	.....	65-69	70-74	Sum of ages under 75	Standard Rates*
2001	0	0	63022	59176	.....	2272625	2990937	11259595	117.29
2002	0	0	0	0	.....	2701422	2450406	10984053	114.42

* Obtained by dividing the sum of expected numbers at ages under 75 by the European Standard Population at ages under 75 (96,000).

Confidence intervals

95% confidence intervals for the age-standardised rates were calculated using a normal approximation and standard errors obtained using the method described by Breslow and Day [1], but modified to use a binomial assumption for the variance of the crude age-specific rates, as described by Bland [2]. This method is likely to be unreliable when there are fewer than 50 cases in an area, hence confidence intervals for rates based on less than 50 cases should be viewed with caution. The lower and upper limits for the rates are denoted by RateLL and RateUL respectively.

$$Rate_{LL/UL} = Rate \pm 1.96 \times 100000 \times \frac{1}{\sum w_i} \times \sqrt{\frac{\sum w_i^2 r_i (1 - r_i)}{n_i}}$$

w_i is the proportion of people of age i in the European Standard Population (Annex 5)

r_i is the age specific rate in the resident population.

n_i is the number of people of age i in the resident population.

References:

1. Breslow NE, Day NE. *Statistical Methods in Cancer Research, Volume II: The Design and Analysis of Cohort Studies*. International Agency for Research on Cancer, WHO. Lyon, 1987: 59
2. Bland M. *An introduction to medical statistics* (3rd edition). Oxford University Press. Oxford 2000: 128

THE EUROPEAN STANDARD POPULATION

The European Standard Population is used to compute the directly age-standardised rates. The same population is used for males, females and all persons.

Age group	European Standard Population
0	1,600
1-4	6,400
5-9	7,000
10-14	7,000
15-19	7,000
20-24	7,000
25-29	7,000
30-34	7,000
35-39	7,000
40-44	7,000
45-49	7,000
50-54	7,000
55-59	6,000
60-64	5,000
65-69	4,000
70-74	3,000
75-79	2,000
80-84	1,000
85+	1,000
Total	100,000

Source: 1991 World Health Annual of Statistics - based on J Waterhouse *et al* (eds). *Cancer Incidence in Five Continents*, Lyon, IARC, 1976 (Vol. 3, page 456).