

**Table 2.4 Meta-analysis of smokeless tobacco use and oral and pharyngeal cancer,**

| Type of ST (region) <sup>a</sup> | Adjustments/restrictions <sup>b</sup> | Number of estimates (RR/OR ids) | Random-effects RR/OR (95% CI) | Heterogeneity |      |                       |
|----------------------------------|---------------------------------------|---------------------------------|-------------------------------|---------------|------|-----------------------|
|                                  |                                       |                                 |                               | $\chi^2$      | I2   | <i>P</i> ( $\chi^2$ ) |
| Any                              | Overall                               | 41                              | 1.79 (1.36–2.36)              | 335.6         | 88.1 | < 0.001               |
|                                  | Smoking-Adjusted                      | 19                              | 1.36 (1.04–1.77)              | 69.5          | 74.1 | < 0.001               |
|                                  | Smoking- and alcohol-adjusted         | 10                              | 1.07 (0.84–1.37)              | 12.5          | 28.0 | 0.186                 |
|                                  | Never smokers                         | 9                               | 1.72 (1.01–2.94)              | 15.9          | 49.7 | 0.044                 |
|                                  | Never smokers – alcohol-adjusted      | 3                               | 1.87 (0.82–4.27)              | 0.6           | 0.0  | 0.731                 |
| Any (USA)                        | Overall                               | 31                              | 2.16 (1.55–3.02)              | 275.8         | 89.1 | < 0.001               |
|                                  | Smoking-Adjusted                      | 12                              | 1.65 (1.22–2.25)              | 33.6          | 67.3 | < 0.001               |
|                                  | Smoking- and alcohol- adjusted        | 6                               | 1.04 (0.80–1.35)              | 1.8           | 0.0  | 0.875                 |
|                                  | Never smokers                         | 5                               | 3.33 (1.76–6.32)              | 3.5           | 0.0  | 0.476                 |
|                                  | Never smokers – alcohol-adjusted      | 2                               | 1.58 (0.52–4.81)              | 0.4           | 0.0  | 0.512                 |
| Snuff (Scandinavia)              | Overall                               | 7                               | 0.97 (0.68–1.37)              | 14.5          | 58.8 | 0.024                 |
|                                  | Smoking-Adjusted                      | 7                               | 0.97 (0.68–1.37)              | 14.5          | 58.8 | 0.024                 |
|                                  | Smoking- and alcohol-adjusted         | 4                               | 1.10 (0.64–1.90)              | 10.7          | 71.9 | 0.014                 |
|                                  | Never smokers                         | 4                               | 1.01 (0.71–1.45)              | 2.2           | 0.0  | 0.524                 |
|                                  | Never smokers – alcohol-adjusted      | 1                               | 2.30 (0.67–7.92)              | –             | –    | –                     |
| Published since 1990             | Overall                               | 18                              | 1.28 (0.94–1.76)              | 81.7          | 79.2 | < 0.001               |
|                                  | Smoking-Adjusted                      | 14                              | 1.00 (0.83–1.20)              | 18.5          | 29.8 | 0.139                 |
|                                  | Smoking- and alcohol- adjusted        | 10                              | 1.07 (0.84–1.37)              | 12.5          | 28.0 | 0.186                 |
|                                  | Never smokers                         | 7                               | 1.24 (0.80–1.90)              | 7.5           | 20.1 | 0.277                 |
|                                  | Never smokers – alcohol-adjusted      | 3                               | 1.87 (0.82–4.27)              | 0.6           | 0.0  | 0.731                 |

<sup>a</sup> For each study/sex, the RR/OR smokeless tobacco was included if available, otherwise that for chewing tobacco or snuff was used.

<sup>b</sup> Smoking-adjusted includes estimates for smokers and non-smokers combined, adjusted for smoking if available, and estimates for never smokers otherwise.

CI, confidence interval; OR, odds ratio; RR, relative risk; ST, smokeless tobacco  
Lee and Hamling, (2009)