

## Prevalence of oral mucosal lesions in a representative population

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**Objective:** The aim of this study was to assess the prevalence and intraoral distribution of oral mucosal lesions in a representative adult population (Study of Health in Pomerania/Germany). **Method and Materials:** The study sample comprised 6,267 randomly selected subjects who were scheduled for examination from 1997 to 2001 (population-based cross-sectional study; response rate: 69%; age range 20 to 81 years). **Results:** The prevalence of oral mucosal lesions was age dependent (5.56% in 20- to 29-year-olds to 19.55% in 70- to 81-year-olds) with an overall prevalence of 11.83%. The prevalence in men (12.20%) was slightly higher than in women (11.40%). Exophytic neoplasia was the most prevalent alteration (3.00%), followed by leukoplakia simplex (prevalence 2.85%). Premalignant lesions were found in 0.57% of the participants, with lichen ruber mucosae contributing the major part (0.48%). Exophytic neoplasia was most often situated in the buccal mucosa, the hard palate, or the mucosa of the lower lip. **Conclusion:** These data stress the importance of screening for oral mucosal lesions, especially because of a predicted increase in the number of elderly persons in industrialized countries. (*Quintessence Int* 2007;38:23–29)

**Key words:** distribution, oral mucosal lesions, prevalence, representative survey

The oral mucosa is exposed to lifelong mechanical, chemical, and thermal stress, which often results in malignant alterations and oral cancer. Oral cancer is the 11th most common cancer worldwide.<sup>1</sup> In spite of the high clinical relevance and suboptimal 5-year survival rates for many patients due to late

detection,<sup>2</sup> very few representative epidemiologic studies exist, which can be explained by the large sample size needed to achieve sufficient data. Thus, many surveys are limited to special, nonrepresentative populations.<sup>3,4</sup>

The World Health Organization has detected this global problem and stresses the importance of oral health, oral cancer, and the role of tobacco consumption.<sup>5</sup> Oral cancer often develops out of premalignant mucosal lesions. Therefore, preventive and screening programs are in need of detailed epidemiologic data on the prevalence, distribution, and risk factors of oral mucosal alterations. Because of a considerable variation in lifestyle around the globe, data from spe-

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cific age groups, populations, or countries<sup>6-10</sup> cannot be generalized. They show great variation in prevalence and distribution, which is also often enhanced by the various classification schemes for oral mucosal lesions or the mode of the examination.

In Germany, the third Study on Oral Health<sup>11</sup> was a national survey on oral health that included oral mucosal lesions, but it was limited to few age groups. Therefore, the aim of this study was to assess the prevalence and distribution of oral mucosal lesions in a representative adult population (Study of Health in Pomerania/Germany).

## METHOD AND MATERIALS

This study was part of the Study of Health in Pomerania (SHIP), a population-based cross-sectional study intended to systematically describe the prevalence and risk factors for diseases common in the population of Pomerania.<sup>12</sup> A sample of 7,008 women and men aged 20 to 79 years was drawn from the cities of Greifswald, Stralsund, and Anklam, and the 29 communities in the surrounding West Pomerania (2,024 km<sup>2</sup>), the most northeasterly region of Germany on the Baltic Sea. The sample selection was carried out in 2 steps. First, of the 3 districts in the region, the 3 cities (17,076 to 65,977 inhabitants) and 12 towns (1,516 to 3,044 inhabitants) were selected, and of the small towns (less than 1,500 inhabitants), 17 out of 97 were drawn at random. Second, from each of the selected communities, subjects were drawn at random from the official inhabitant data files proportionally to the population size of each community and stratified by age and gender.

After 741 neutral dropouts (126 had died and 615 had moved away), the total study sample comprised 6,267 randomly selected subjects (age range 20 to 79 years, response rate 69%, *n* = 4,310) scheduled for examination from October 1997 to May 2001.

The 4,310 participants took part in a comprehensive oral examination<sup>13</sup>; a screening for oral mucosal lesions was possible in 4,210 of them. The examination included all areas of the oral cavity, including the tongue

and lips, and was conducted according to the manual of the German Cancer Association, entitled "Early diagnosis of neoplasia in the maxillofacial area by the practicing dentist."<sup>14</sup> The patient was seated in a dental chair with professional illumination and examined using 2 dental mirrors for the vestibulum (Fig 1), cheeks, and the maxillary and mandibular mucosa. For inspection of the tongue, the tip of the tongue was pulled with gauze to move the sides and base of the tongue into view (Fig 2).

Oral mucosal lesions were classified into 9 clinically relevant groups:

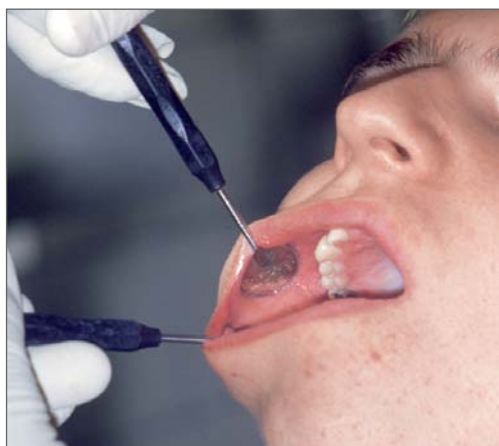
1. Leukoplakia simplex (irregular white, smooth hyperkeratosis mostly of traumatic origin)
2. Leukoplakia verrucosa (white hyperkeratosis with distinct elevation of mucosa) (Fig 3a)
3. Leukoplakia erosiva (white hyperkeratosis with loss of mucosal integrity) (Fig 3b)
4. Erythroplakia (bright, dark-red lesion with little elevation)
5. Lichen ruber (netlike smooth, white lesion that can also be erosive or verrucous)
6. Ulcer of the oral mucosa (major ulcerations with loss of mucosal integrity)
7. Exophytic neoplasia (neoplasms like papilloma, fibroma, or epulis)
8. Herpetiform lesion or aphthous lesion (aphthous ulcerations or erosions)
9. Not classifiable, suspicious change of oral mucosa

For the topographic documentation of the lesion, the computerized classification according to Roed-Petersen and Renstrup<sup>15</sup> was used. Data were entered online into a computerized data bank. In the statistical analysis, frequency distribution values were calculated and subdivided for different age groups and gender.

Participants with suspicious alterations were told to seek advice in a specialized clinic.

## Quality assurance and control

Before the data collection started, the 8 examiners of SHIP were trained by an oral surgeon for the final certification, using 70 slides of different oral mucosal lesions.



**Fig 1** Examination of oral mucosa in the vestibulum, cheeks, and the maxillary and mandibular mucosa.



**Fig 2** Inspection of the tongue for mucosal alterations, pulling the tip of the tongue with gauze to view the base of the tongue



**Figs 3a and 3b** Leukoplakia verrucosa (**a**) and leukoplakia erosiva (**b**) as premalignant oral mucosal lesions.

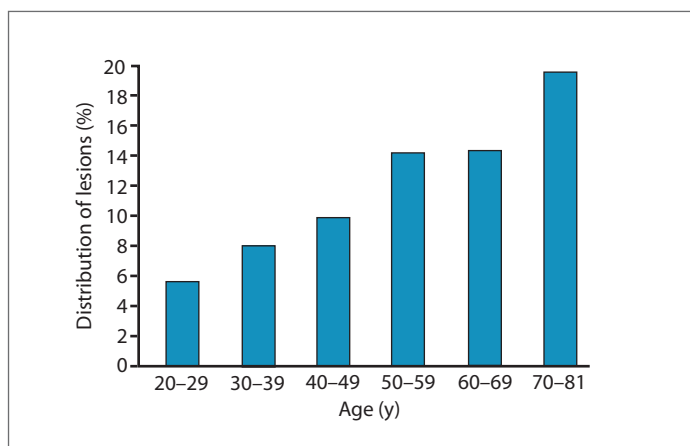


Quality assurance and control during the study consisted of semiannual interim analyses, renewed certifications, and specialist seminars. The interim evaluations checked for implausible examiner differences, implausible data, frequency of entering “data not collectible,” undefined missing entries, and mean examination time per examiner. The results of quality management were reported semiannually to an external Data Safety and Monitoring Committee.

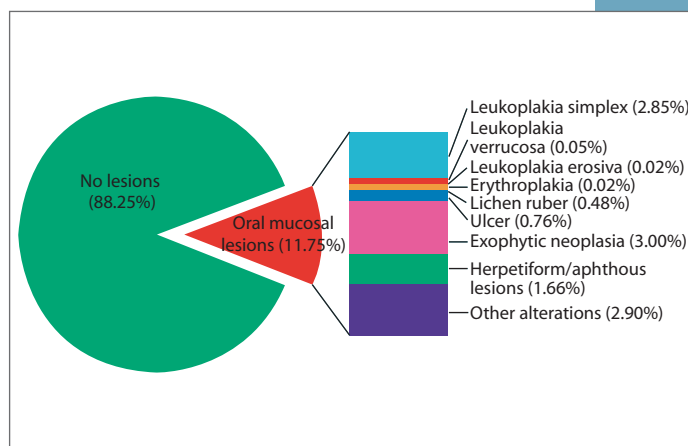
## RESULTS

The 4,210 participants who were examined for oral mucosal lesions (2,109 men; 2,101 women) were 21 to 81 years of age (mean 49 years, median 50 years) at the time of the examination.

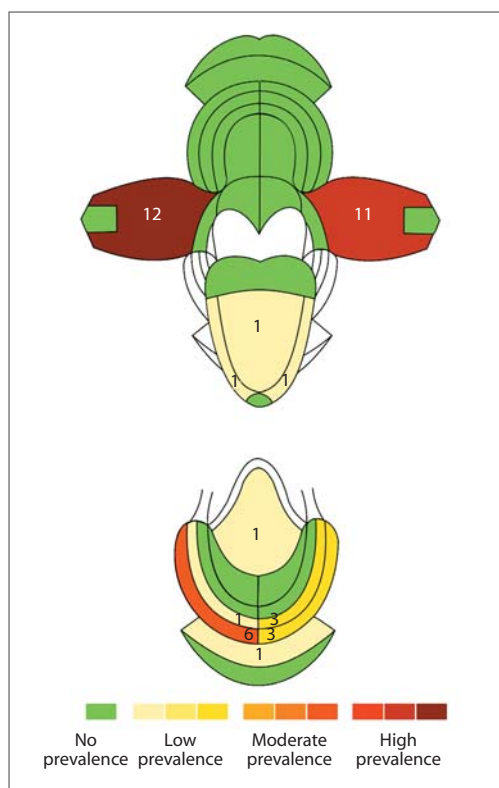
In 498 participants, relevant alterations of the oral mucosa were found. The prevalence of oral mucosal lesions was clearly associated with age, ranging from 5.56% in 20- to



**Fig 4** Age-dependent distribution of oral mucosal lesions (n = 498 participants).



**Fig 5** Prevalence of different oral mucosal lesions (n = 4,210 participants).



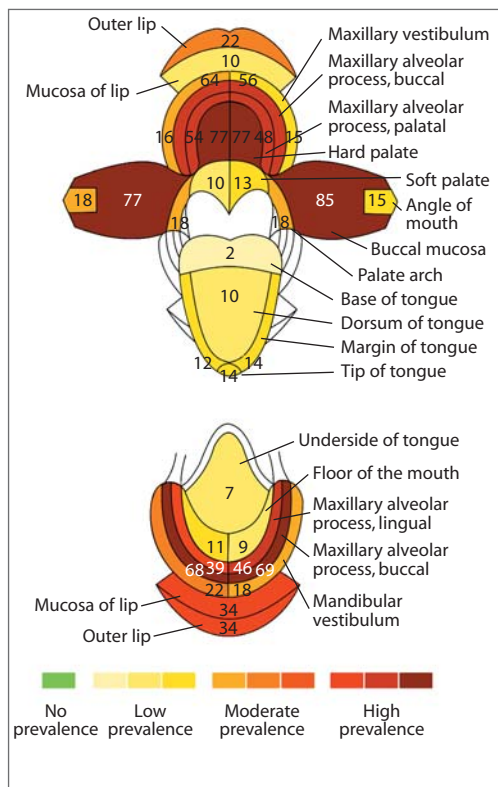
**Fig 6** Site-specific distribution of premalignant oral mucosal lesions (n = lesions; including leukoplakia erosiva and verrucosa, erythroplakia, and lichen ruber). Modified after Roed-Petersen and Rentrup.<sup>15</sup>

29-year-olds to 19.55% in 70- to 81-year-olds (Fig 4; chi-square test,  $P < .001$ . The overall prevalence was 11.83%. The prevalence in men (12.20%) was slightly higher than in women (11.40%), but herpetiform and aphthoid lesions clearly dominated in women (2.09% versus 1.20%, chi-square test,  $P = .008$ ).

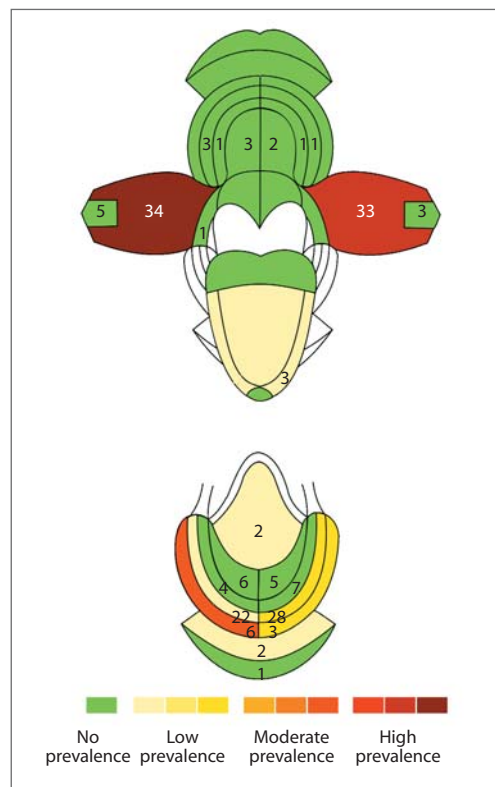
Exophytic neoplasia was the most prevalent alteration (prevalence 3.00%), followed by leukoplakia simplex (prevalence 2.85%) (Fig 5). Premalignant lesions (Fig 6) such as leukoplakia verrucosa, leukoplakia erosiva, erythroplakia, and lichen ruber mucosae were found in 0.57% of the participants, with lichen ruber mucosae contributing the major part (0.48%).

The localization of all 1,103 oral mucosa alterations is shown in Fig 7, with the mucosa of the cheeks, hard palate, alveolar processes, and the lips being the most frequently affected areas. Leukoplakia simplex as a single entity was predominantly found in the mucosa of the cheeks and the buccal aspect of the mandibular alveolar process (Fig 8), while ulcers were mostly present on both alveolar processes and the mandibular vestibulum. Exophytic neoplasia was most frequently found in the buccal mucosa, the hard palate, or the mucosa of the lower lip.

As expected, herpetiform or aphthous alterations were predominantly on the outer lip, and premalignant lesions in the buccal mucosa.



**Fig 7** Site-specific distribution of oral mucosal lesions (n = 1,103 in 498 participants). Modified after Roed-Petersen and Rentrup.<sup>15</sup>



**Fig 8** Site-specific distribution of leukoplakia simplex (n = 181 lesions). Modified after Roed-Petersen and Rentrup.<sup>15</sup>

## DISCUSSION

At 68.8%, the response rate of SHIP was equivalent to other surveys on oral mucosal lesions, eg, in Sweden.<sup>6,16</sup> The age range is comprehensive for adults, and the sample size of over 4,000 participants is higher compared to previous German studies.<sup>12,17,18</sup> Such high numbers are needed to acquire sufficient data for realistically reflecting the prevalence and distribution of oral mucosal lesions.<sup>7,18</sup>

The relatively homogeneous age and gender distribution of SHIP correlates with the Swedish and other German studies.<sup>6,11,16</sup>

The examination was similar to other surveys, eg, in Hungary,<sup>18</sup> Sweden,<sup>6</sup> or the United States,<sup>7</sup> to avoid differences in the detection rate by the mode of examination. For an optimal diagnosis, cytologic or histologic examinations would have been necessary, but this exceeds the scope of population-based surveys.

The classification of oral mucosal lesions in SHIP was clinically and epidemiologically oriented, favoring, for example, the robust classification for leukoplakia by Sugár and Bánónczy<sup>19</sup> over the more detailed registration of the Malmö conference of 1983.<sup>20</sup> Nevertheless, a differentiation between erosive leukoplakia and an erythroplakia seems to be difficult for examiners, but because of the low prevalence, this is only of clinical, but not epidemiologic, relevance.

The overall prevalence of 11.83% for oral mucosal lesions in this representative North German sample of SHIP is similar to Swedish data,<sup>15</sup> while another representative study in Germany found an extremely high value of 66.2%.<sup>10</sup> This can be explained by the inclusion of nonpathologic morphologic alterations such as Fordyce granules, lingua plicata, lingua geographica, or hairy tongue. A representative Malaysian survey showed a slightly lower prevalence of 9.7%,<sup>8</sup> and a Cambodian survey only 4.9%.<sup>21</sup>



The results of SHIP confirm the increase in prevalence with age.<sup>7,10,22</sup> The distribution among the different oral mucosal lesions is equivalent to other studies. For instance, the prevalence of leukoplakia simplex (2.85%), which is one of the most frequent and well-examined mucosal alterations, is in the range of studies conducted in Japan (2.5%),<sup>23</sup> the United States (2.9%),<sup>7</sup> Slovenia (3.1%),<sup>24</sup> and Sweden (3.6%).<sup>6</sup> The Pomeranian data support the site predilection for leukoplakia simplex, premalignant lesions, ulcers, and exophytic neoplasia.<sup>23,25–27</sup> This is also true for herpetiform or aphthous alterations, in spite of registering them in 1 category.

The prevalence of premalignant lesions was 0.57%. Lichen ruber mucosae comprises the major proportion (0.48%) and has a lower potential for developing into oral cancer.<sup>28</sup> Thus, 0.09% of the participants showed premalignant lesions (leukoplakia verrucosa, leukoplakia erosiva, erythroplakia), representing an increased risk for oral cancer.<sup>29,30</sup>

These data from SHIP stress the importance of an early diagnosis of oral mucosal lesions in screenings by dental professionals,<sup>31</sup> as the prevalence of such lesions is clinically relevant. The data also provide useful information on the most common locations. Because of the demographic development in many industrialized countries toward an increasing number of elderly persons, the prevalence of oral mucosal lesions is projected to rise up to 34% in 2040,<sup>32</sup> and will increase the importance of this topic and oral cancer.

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