Validity of Self-Reported Passive Smoking Evaluated by Comparison with Smokers in the Same Household

Kotaro Ozasa, Akane Higashi, Miwa Yamasaki, Kyohei Hayashi and Yoshiyuki Watanabe

Validity of self-reported passive smoking among nonsmokers was evaluated by comparing it with data from smokers in the same household. Eight hundred and ninety-four males and 990 females responded to a lifestyle survey for a cohort study. Subjects consisted of all members aged 20 years or older in each household. One hundred and thirty-six males and 692 females nonsmokers within this group were examined for self-reported passive smoking. It should be noted that guests' smoking was also considered because the question about passive smoking included that when guests visited although guests' smoking could not be evaluated.

Four percent of nonsmokers who reported passive smoking almost every day lived in households without smokers. This value was considered a misclassification of negative passive smoking as positive unless these subjects were visited by smoking guests almost every day. Eight percent of nonsmokers who reported no passive smoking had a spouse who smoked and 18% of these subjects also had other smokers in the same household. The misclassification rate for positive passive smoking as negative was thought to be 8% or higher although it was possible that the smoking spouse smoked only outside the home and that household members may live in different structures at the same site. The validity was thought to be fair in comparison with similar previous studies in Western countries. J Epidemiol, 1997; 7 : 205-209.

validity, misclassification, passive smoking, self-administered questionnaire, household

Exposure to environmental tobacco smoke (ETS) is difficult to measure accurately since it is not a direct consequence of actions by the exposed subject. A method of evaluating the validity of self-reported passive smoking is comparison of self-reports with evidence of other smokers living in the same household, such as spouse, other household members, or colleagues from work. The evidence was collected by interview, questionnaire, or other methods. Reliability studies mainly involving test-retest methods have also been done. These studies show that assessing smoking by a spouse or other household members by an interview or questionnaire can be substantially reliable or valid.

Validity studies of self-reported passive smoking measuring biological marker levels in physiological fluid (e.g. cotinine in urine or plasma) as a gold standard have been reported recently. As many of these studies could not show strong quantitative associations between the extent of self-reported passive smoking and the level of biological markers, the utility of self-reports may decrease for passive smoking. However, biological markers can only provide a measurement for exposure within a limited time of the measurement and it cannot represent the long-term exposure to passive smoking. These problems could be resolved by defining risk factors studied not as exposure to ETS but as the smoking status of someone else living in the same household. However, it is inevitable that the definition would include undefined conditions other than ETS. These two choices in the definition of passive smoking represent a trade-off relationship.

The purpose of this study is to evaluate the validity of self-reported passive smoking by a self-administered questionnaire used in a cohort study of risk factors for lifestyle related diseases. Biological markers were not measured in the subjects of the survey. We attempted to evaluate validity by an alternative method. In this study, concordance of answers for passive smoking in a self-administered questionnaire were compared.

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with answers regarding the smoking habits of the spouse or other household members.

**MATERIALS AND METHODS**

Residents of a rural town, who were aged 20 years or older, were surveyed regarding their smoking habits and passive smoking condition using a self-administered questionnaire. Since persons aged 19 years or younger are legally prohibited from smoking, they were considered unable to smoke freely at home and were excluded, and therefore, the subjects surveyed were considered adequate for this study. Subjects were selected using the population registry with permission from the town office. Respondents to the survey included 1,393 males and 1,636 females comprising 61% and 65% of the male and female population 20 years of age or older, respectively (Table 1). Surrogate answers were excluded from this study because surrogates could affect the responses for other persons to make them consistent with their own responses. Households in which all members responded to the survey for themselves were selected for analysis. Thus, 894 males and 990 females (62% of 3,029 respondents) were analyzed.

Smoking status was determined by the question "Do you smoke?", and current smokers, ex-smokers and nonsmokers were identified. However, it included no sub-questions asking places where they smoked for current smokers. The question about passive smoking at home was "Are you exposed to environmental tobacco smoke at home due to smoking by other household members? (include guests if your home has frequent quests)", and the frequency of exposure to ETS was asked.

Validity of self-reported passive smoking was evaluated by the following procedure. Nonsmokers were selected and current smokers in the same household of the nonsmoker were identified. The relation of the smoker to nonsmoker was checked in the population registry. Household members were classified as spouse or other members because a household defined by the population registry sometimes consisted of two couples (two generations) and they sometimes lived in different structures at the same site. The response of nonsmokers who answered that they were exposed to ETS at home (i.e., self-reported passive smoking) were then compared with responses from current smokers in the same household.

**RESULTS**

Smoking habits of the subjects are shown in Table 2. Current smokers included 514 males and females, ex-smokers included 269 over all, and nonsmokers comprised 828. Non smokers who reported passive smoking included 403 males and females, while 241 subjects reported no passive exposure.

Eighty-one percent of nonsmokers (328/403) who reported passive smoking had at least one current smoker in the same household (Table 3). Specifically, 96% of nonsmokers (163/169) reporting exposure to ETS almost every day had smoking household members. In 2/3 of these (109/163), the smoker was the spouse. However, only 63% of nonsmokers (83/132) who reported being exposed to ETS less than once a week had household members who smoked, and in less than half of these (38/83), the smoker was the spouse. Association of passive smoking frequency with both the presence of household smokers and the spouse's smoking was highly significant by chi-square test (p<0.01).

Twenty-six percent of nonsmokers (62/241) who did not report being exposed to ETS had at least one current smoker in the same household. Eight percent of these (19/241) had a spouse who was a current smoker and 18% (43/241) had other household members who were current smokers. The proportion of nonsmokers without smoking household members who reporting exposure to ETS almost every day (4%, 6/169) was significantly smaller (p<0.05 by chi-square test) than that of nonsmokers having a smoking spouse who reported no exposure to ETS (8%, 19/241).

**DISCUSSION**

Validity of passive smoking have been evaluated by several methods. Biological markers (such as cotinine) have been utilized as the gold standard for determining the ETS exposure level [40]. From these studies the measurement of cotinine in urine or plasma was thought to be less valid for indicating the extent of ETS exposure of nonsmokers than reports from the subjects themselves or by smokers living with the subjects. Urinary cotinine, however, was highly valid for identifying actual smokers. Significantly, Becher et al [4] showed that husband's smoking mainly influenced the urinary cotinine level in...
Validity of Passive Smoking  

Table 2. Distribution of smoking habits among respondents to the survey.

<table>
<thead>
<tr>
<th></th>
<th>Male</th>
<th>Female</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current Smokers</td>
<td>458</td>
<td>56</td>
<td>514</td>
</tr>
<tr>
<td>Ex-smokers</td>
<td>247</td>
<td>22</td>
<td>269</td>
</tr>
<tr>
<td>Non-smokers</td>
<td>136</td>
<td>692</td>
<td>828</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Reported Passive smoking at home among nonsmokers</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>40</td>
<td>99</td>
</tr>
<tr>
<td></td>
<td>363</td>
<td>182</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Smokers in the same household confirmed by questionnaire</th>
<th>Self-reported passive smoking</th>
<th>7/w</th>
<th>1-6/w</th>
<th>Some</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current smokers</td>
<td>Yes</td>
<td>328</td>
<td>192</td>
<td>136</td>
<td>75</td>
</tr>
<tr>
<td>spouse</td>
<td></td>
<td>163</td>
<td>109</td>
<td>54</td>
<td>6</td>
</tr>
<tr>
<td>other than spouse</td>
<td></td>
<td>36</td>
<td>17</td>
<td>19</td>
<td>6</td>
</tr>
<tr>
<td>No current smokers</td>
<td></td>
<td>83</td>
<td>38</td>
<td>45</td>
<td>49</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>403</td>
<td>169</td>
<td>51</td>
<td>132</td>
</tr>
</tbody>
</table>

Note: 7/w= almost every day, 1-6/w= once to 6 times a week, some.= sometimes.
Number of "no answers for frequency of passive smoking" were omitted.

Questions about passive smoking in our cohort study included a question about passive smoking at home which was examined in this study and another question about passive smoking at places other than the home. As biological markers were not measured in this survey, an alternative validity study should be performed. Some types of validity were examined in some previous epidemiological studies in Western countries prior to the studies using biological markers. Kolonel et al. showed that an exact agreement between subjects and their spouses on smoking habits was 96%. This suggested good validity of self-reporting for passive smoking by a spouse. Sandler et al. showed that agreement between the subject's recall of their parent's smoking habits during their childhood and their mother's recall was 93-95% for the mother's smoking, and 85% for the father's smoking. Leren et al. showed perfect agreement between the wife's recall after her husband's death and records of smoking habits by the husband himself. As for reliability studies, they showed high reliability for smoking by the spouse.

Therefore, we attempted a validity study based on our survey by referring to these previous studies. Concordance of answers for passive smoking in a self-administered questionnaire with answers of spouse or other household members for their smoking were examined in this study. The validity of responses about passive smoking at places other than the home could not be examined because the smoking habits of others than household members could not be confirmed. Furthermore, some methodological problems remained. First, misclassification of actual smokers as nonsmokers could not be examined. We thought that the rate was small despite Lee's study. Most married women in our study were housewives and were thought to spend considerable time at home because the geographical area of our study was rural, and they did not seem to be untruthful about their smoking habits in the survey. Second, households defined by the population registry sometimes consist of two couples (two generations) and they sometimes lived in different structures at the same site, therefore, household members of current smokers were classified as the non-smoking wives. The low validity was thought to be due to the fact that the reports represented a relatively long term exposure, while biological measurement indicates exposure during a limited past just prior to the measurement, and that the reports did not evaluate ETS exposure from anyone not considered in the survey. Besides, Lee showed that the misclassification rate of actual smokers as nonsmokers among Japanese women was very much higher than the rates reported in Western women and that "marriage to a smoker" was not associated with cotinine level.
spouse or other.

It is impossible to examine misclassification of negative passive smoking as positive in the case of self-reported passive smoking without smokers in the same household because smoking by guests could not be confirmed. Therefore validity was estimated by concordance of the frequency of self-reported passive smoking due to the presence of smokers in the same household and the relationship to the nonsmoker (spouse or other). Significant association of passive smoking frequency with these two factors was observed. This supports the hypothesis that nonsmokers exposed more frequently to ETS were exposed by smoking of household members, especially by the spouse's smoking, and those exposed to ETS less frequently were exposed due to guests' smoking. Only 4% of nonsmokers who reported passive smoking almost every day did not have smokers in the same household. The misclassification rate was estimated as 4% unless they were visited by smoking guests almost every day.

Eight percent of nonsmokers without self-reported passive smoking had a spouse who was a current smoker, which is either misclassification of negative passive smoking as positive or the possibility that the spouse only smoked outside their home. However, the latter possibility was considered small because this study area was rural and families were thought to spend many hours together at home. If the question on smoking included a sub-question asking whether they smoked at home (inside their house), we could have determined passive exposure more accurately. Regarding 59 nonsmokers without self-reported passive smoking who had smoking household members other than the spouse, some of these may have been misclassified because it was doubtful that all of them lived in different structures from the smokers or had family members who smoked outside their home only. Therefore, the misclassification rate was estimated to be 8% or more and may be larger than that reported in Western countries. This rate was also significantly (p<0.05) larger than the rate for reverse misclassification (=4%). It seemed that differential misclassification tended to be higher for negative self-reported passive smoking.

Subjects of this study is a part of a large-scale cohort study which consisted of around fifty areas of study fields. Most of the areas are rural, however, other characteristics may be different because they distributed around all over Japan. Therefore, the conclusion of this study can be applicable for the whole cohort in a limited situation.

ACKNOWLEDGEMENT

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