Relationship between Smoking History and Annual Medical Checkup Attendance in Undergraduates

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Abstract

Even though smoking is closely related to drinking and other negative health behaviors, there are few papers on the relationship between smoking and checkup attendance. We investigated whether smoking histories related to differences in annual checkup attendance.

We obtained undergraduate students’ smoking histories at annual medical checkups at a mid-sized private university in Japan. We examined a dataset containing the data for all 17,831 male and 2,740 female undergraduates from a typical Japanese university’s regular spring medical checkups for every year from 2008 to 2013; it included whether an undergraduate had attended the checkup and had ever smoked. We investigated the number of times undergraduates attended the checkup by gender, survey year, student’s year of study, and smoking history.

Compared to undergraduates who had never smoked, those who currently or historically smoked attended significantly fewer annual checkups. The difference was more remarkable among men.

The results suggested that more could be done to encourage undergraduates who smoke to have checkups, which could provide an opportunity for smoking cessation advice and treatment.

Key words: Smoking, checkup, attendance, undergraduates, friendships

Introduction

Regular checkup rates are high for Japanese children and students but low for adults1).

Specifically, the rates for the early childhood exams are quite high, at 90%2,3). School checkups from kindergarten through high school are part of the school curriculum, so almost all students have the checkup. The checkup rate at universities is quite high, but not as high as the almost 100% rate for school checkups through high school4). Most of the university checkups occur during the orientation period at the beginning of the school year. However, because undergraduates are free to choose a time convenient for them, it is also possible to avoid a checkup completely.

The checkup rate for homemakers and self-employed people is only 34.3%5). On average, the checkup rate for workers at their places of employment is 88.5%, but rates vary widely by company6). In addition, the rates for cancer screenings are low7,8).

Meanwhile, regarding tobacco use in Japan, in 1966, 83.7% of men and 18.0% of women smoked9). In 2014, the same survey showed rates of 30.3% for men and 9.8% for women—in 50 years, the rates declined drastically9). Smoking may be closely linked with other negative health behaviors10,11). There are a few papers on the relationship between smoking and checkup attendance for elderly people12,13). However, we could not find studies on young people.

In summary, checkup rates vary, smoking rates decreased considerably, and many factors are related to smoking. Thus, in this study performed at a mid-sized private Japanese university, we used data spanning six years from the university’s annual medical checkups assessing whether undergraduates had ever been smok-
ers. In a previous study, using the same dataset\(^4\), we showed that undergraduates who did not graduate within 4 years had higher smoking rates in the fourth year than those who did graduate within 4 years. In this study, we empirically investigated whether differences in undergraduates’ annual medical checkup attendance related to their smoking histories.

**Methods**

1. **Study site**

The school that participated in the study is a four-year private university in Hiroshima Prefecture, although undergraduates can be enrolled for up to eight years. The university has only the department of economics, and is a typical middle-sized university in Japanese provincial cities.

2. **Annual medical checkups**

Every year, this university hires a specialist company to provide medical checkups at the beginning of every school year (April). Just before the checkups, undergraduates have to respond to a medical history questionnaire composed of smoking and drinking history, medical history, and 30 subjective symptom items. The school’s internet bulletin board, posters, and individual emails encourage undergraduates to attend the checkups. All undergraduates can take the checkups once a year.

3. **Study subjects**

Table 1 shows the demographic information of all registered undergraduates (23,402: 20,466 men, 2,936 women) at the university by survey year, gender, and year of study.

The subjects were 20,571 undergraduates (17,831 men, 2,740 women) who participated in the annual checkups from the beginning of the school year 2008 through May 30, 2013. We obtained student’s year of study, gender, survey year, and answer to the question on whether the undergraduate had ever been a smoker. We did not obtain the detailed academic record of each undergraduate for the study.

4. **Smoking history**

The checkup questionnaire included a question on whether the undergraduate had ever been a smoker. Undergraduates were instructed to indicate whether they “never smoked,” “used to smoke,” or “currently smoke.” Then, for the analysis, “used to smoke” and

| Year of study | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | Total |
|---------------|------|------|------|------|------|------|-------|
| **Men**       |      |      |      |      |      |      |       |
| 1st Year      | 851  | 923  | 905  | 767  | 763  | 674  | 4,883 |
| 2nd           | 808  | 830  | 913  | 882  | 758  | 740  | 4,931 |
| 3rd           | 807  | 789  | 807  | 880  | 851  | 737  | 4,871 |
| 4th           | 787  | 790  | 769  | 773  | 849  | 820  | 4,788 |
| 5th           | 96   | 98   | 102  | 112  | 124  | 150  | 682   |
| 6th           | 24   | 31   | 36   | 42   | 35   | 204  | 82    |
| 7th           | 13   | 13   | 14   | 15   | 14   | 13   | 82    |
| 8th           | 3    | 4    | 7    | 2    | 4    | 5    | 25    |
| **Total**     | 3,389| 3,478| 3,553| 3,467| 3,405| 3,174| 20,466|
| **Women**     |      |      |      |      |      |      |       |
| 1st Year      | 118  | 139  | 131  | 115  | 131  | 105  | 739   |
| 2nd           | 122  | 113  | 137  | 127  | 114  | 124  | 737   |
| 3rd           | 118  | 121  | 111  | 133  | 119  | 113  | 715   |
| 4th           | 121  | 116  | 116  | 109  | 131  | 115  | 708   |
| 5th           | 3    | 5    | 1    | 4    | 10   | 11   | 34    |
| 6th           | 1    | 0    | 0    | 1    | 0    | 1    | 3     |
| **Total**     | 483  | 494  | 496  | 489  | 505  | 469  | 2,936 |
“currently smoke” were counted as “smoking history: yes” and “never smoked” as “smoking history: no.”

5. Statistical analyses

5.1 Checkup attendance rates

We calculated checkup attendance rates by comparing the data of all registered undergraduates by gender, survey year, and year of study. The rates of check-up attendance times were objective, because they were counted from the checkups company’s data.

5.2 Smoking and checkup attendance

We divided data by gender, survey year, year of study, and history of smoking. We counted the number of undergraduates having the maximum number of checkups and the number who had fewer than the maximum. We then performed chi-square tests. Specifically, we used the following procedure.

• Undergraduate data records were divided into groups by gender.
• These were then divided into groups by survey year.
• The maximum length of time an undergraduate could be enrolled at the university was eight years. We divided the undergraduates by year of study and smoking history (Y/N); for each group, we counted the undergraduates who had the maximum number of checkups and those who did not.

Finally, $2 \times 2$ contingency tables were completed. For example, for third-year undergraduates who enrolled in 2010, the results included data for their first to third years of study. The maximum number of checkups they could have had was three. They were divided into groups having had the maximum three checkups and those who only had a checkup one or two times.

• The $2 \times 2$ contingency tables of second-year undergraduates and above were combined into one by survey year (2009–2013). For undergraduates in 2008 and first-year undergraduates in every survey year, the results included only the first data.
• Chi-square tests were used to determine a relationship between smoking history (Y/N) and whether those undergraduates had the maximum number of checkups. The statistical functions of Microsoft Excel 2010 were used for the analyses. However, Fisher’s exact tests of SPSS were performed when expectations were less than five.

6. Institutional review board approval

This study was approved by the Hiroshima University Epidemiology Research Ethical Review Committee (Daieki-748 July 28, 2014).

❖ Results

1. Checkup rates by gender, survey year and year of study

The annual checkup rate for the entire six years was 87.1% for men and 93.3% for women.

Figure 1 shows the changes in the male medical checkup attendance rates by student’s year of study over the study’s six survey years. Because of the small numbers of men in the seventh and eighth years of study (Table 1), there were wide variations in rates; those results were deleted. The rate for men in their first year was consistently near 100% over the years studied. However, for other years of study, the rates declined, with 2009 being the highest. By year of study, rates for the men in their second and third years declined, but in their fourth year, the rate rose, although not quite as high as for men in their first year. However, for men in their fifth and sixth years, the rate declined to less than 50%.

Figure 2 shows the same data for the women, although there were no seventh or eighth year women; because there were very few fifth and sixth year women (Table 1), those data were deleted. Compared to the men, the women’s checkup attendance rates were higher overall, but by year of study the rates were similar.

2. Smoking history and annual checkup attendance for men

Table 2 shows the $2 \times 2$ contingency tables of the relationship between smoking history and the number of checkups by survey year and student’s year of study for the men. The total was 17,788 rather than 17,831 because 43 men did not answer the question on smoking. Of those, 4,779 (26.9%) men had smoking history and 13,009 (63.1%) had never smoked.

Undergraduates in 2008 and first-year undergraduates in every survey year could have had only one checkup. For second-year undergraduates and above in 2009, there were data for both their first and second checkups. Some undergraduates had two checkups and some had one. The rest of Table 2 similarly shows the number of men with and without a history of smoking and whether they attended all or some of the medical checkups.

The $2 \times 2$ contingency tables of second-year under-
graduates and above were combined into one by survey year (2009–2013), and chi-square tests were performed (Figure 3). The number of checkups attended was smaller for those with a history of smoking than for those without (All survey years: \( p < 0.001 \)).

3. Smoking history and annual checkup attendance for women

Table 3 shows \( 2 \times 2 \) contingency tables of the relationships between smoking history and number of checkups attended by survey year and student’s year of study for the women. The total number of women was 2,726 because 14 women did not answer the question on smoking. The number with a history of smoking was small (9.9%). The checkup attendance rates declined, with 2009 being the highest.

The \( 2 \times 2 \) contingency tables of second-year undergraduates and above were combined into one by survey year (2009–2013; Figure 4). The numbers of checkups differed significantly between women with a history of smoking and those without in 2011 (\( p < 0.05 \)) and 2012 (\( p < 0.01 \)).

**Discussion**

For the six years of the study overall, the rate at which men at this university attended the school’s annual medical checkups was 87.1% and for women the rate was 93.3%. These rates are close to those of other Japanese universities. This study showed that each
| Year of study | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | Total |
|---------------|------|------|------|------|------|------|-------|
|               | N    | Y    | N    | Y    | N    | Y    | N     | Y    |
| 1st year      |      |      |      |      |      |      |       |      |
| Checkups      | 699  | 141  | 784  | 132  | 1x   | 785  | 103   | 1x   |
| Smoking history | 2x   | 2x   | 1x   | 2x   | 2x   | 706  | 40    | 1x   |
| N             | 486  | 140  | 601  | 201  | 2x   | 605  | 117   | 2x   |
| Y             | 382  | 117  | 439  | 222  | 3x   | 496  | 223   | 3x   |
| 2nd year      |      |      |      |      |      |      |       |      |
| Checkups      | 485  | 185  | 548  | 195  | 2x   | 601  | 201   | 2x   |
| Smoking history | 1x   | 2x   | 1x   | 1x   | 1x   | 7    | 4     | 1x   |
| N             | 382  | 185  | 439  | 222  | 3x   | 496  | 223   | 3x   |
| Y             | 382  | 185  | 439  | 222  | 3x   | 496  | 223   | 3x   |
| 3rd year      |      |      |      |      |      |      |       |      |
| Checkups      | 401  | 255  | 382  | 248  | 3x   | 439  | 242   | 3x   |
| Smoking history | 1x   | 44   | 1x   | 1x   | 44   | 1x   | 1x    | 44   |
| N             | 398  | 235  | 496  | 223  | 3x   | 472  | 165   | 3x   |
| Y             | 398  | 235  | 496  | 223  | 3x   | 472  | 165   | 3x   |
| 4th year      |      |      |      |      |      |      |       |      |
| Checkups      | 391  | 332  | 363  | 273  | 3x   | 382  | 248   | 3x   |
| Smoking history | 1x   | 37   | 1x   | 1x   | 37   | 1x   | 1x    | 37   |
| N             | 398  | 235  | 496  | 223  | 3x   | 472  | 165   | 3x   |
| Y             | 398  | 235  | 496  | 223  | 3x   | 472  | 165   | 3x   |
| 5th year      |      |      |      |      |      |      |       |      |
| Checkups      | 26   | 33   | 20   | 25   | 3x   | 20   | 13    | 4x   |
| Smoking history | 1x   | 6    | 1x   | 1x   | 6    | 1x   | 1x    | 6    |
| N             | 14   | 15   | 21   | 18   | 5x   | 21   | 15    | 12   |
| Y             | 14   | 15   | 21   | 18   | 5x   | 21   | 15    | 12   |
| 6th year      |      |      |      |      |      |      |       |      |
| Checkups      | 1x   | 8    | 4    | 8    | 3x   | 7    | 2     | 4x   |
| Smoking history | 1x   | 1    | 3    | 1x   | 1    | 3    | 1x    | 1    |
| N             | 14   | 15   | 21   | 18   | 5x   | 21   | 15    | 12   |
| Y             | 14   | 15   | 21   | 18   | 5x   | 21   | 15    | 12   |
| 7th year      |      |      |      |      |      |      |       |      |
| Checkups      | 1x   | 3    | 0    | 3    | 3x   | 0    | 1     | 4x   |
| Smoking history | 1x   | 0    | 2    | 1-2x | 0    | 2    | 1-3x  | 0    |
| N             | 14   | 15   | 21   | 18   | 5x   | 21   | 15    | 12   |
| Y             | 14   | 15   | 21   | 18   | 5x   | 21   | 15    | 12   |
| 8th year      |      |      |      |      |      |      |       |      |
| Checkups      | 1x   | 0    | 0    | 0    | 3x   | 0    | 1     | 4x   |
| Smoking history | 1x   | 0    | 2    | 1-2x | 0    | 2    | 1-3x  | 0    |
| N             | 14   | 15   | 21   | 18   | 5x   | 21   | 15    | 12   |
| Y             | 14   | 15   | 21   | 18   | 5x   | 21   | 15    | 12   |
| Subtotal      | 2,004| 957  | 2,191| 1,012| 2,265| 910  | 2,290 | 714  |
| Total         |      |      |      |      |      |      |       |      |
| Checkups      | 2,961|      | 3,203|      | 3,175|      | 3,004 |      |
| Smoking history |      |      |      |      |      |      | 2,874 |      |
| N             | 2,961|      | 3,203|      | 3,175|      | 3,004 |      |
| Y             |      |      |      |      |      |      | 2,874 |      |
| Participants in the annual checkups | 2,961 |      | 3,203 |      | 3,175 |      | 3,004 |      |
| Checkup rate  | 87.5%|      | 92.1%|      | 89.6%|      | 86.9% |      |
| No answer to the question on smoking | 6    |      | 1    |      | 8    |      | 9    |      |

Table 2: Relationships between smoking history and annual checkup attendance by survey year and student’s year of study (Men)
### Table 3  Relationships between smoking history and annual checkup attendance by student’s survey year and year of study (Momen)

| Year of study | Checkups N | Y | Checkups N | Y | Checkups N | Y | Checkups N | Y | Checkups N | Y | Checkups N | Y | Checkups N | Y | Checkups N | Y | Checkups N | Y | Total |
|---------------|------------|---|------------|---|------------|---|------------|---|------------|---|------------|---|------------|---|------------|---|------------|---|-------|
| 1st year      | 1x 105     | 13| 1x 131     | 7 | 1x 125     | 1 | 1x 1x      | 4 | 1x 109     | 4 | 1x 104     | 0 | 700        | 27|            |    |          |    |       |
| 2nd           | 1x 107     | 8 | 1x 2x      | 93| 15 2x 117 | 11| 2x 11    | 96| 4 2x 98   | 3 | 2x 104    | 2 | 615        | 43|            |    |          |    |       |
| 3rd           | 1x 90      | 15| 1x 2x      | 97| 10 3x 82 | 17| 3x 107   | 10| 3x 84    | 8 | 3x 91    | 10 | 551        | 70|            |    |          |    |       |
| 4th           | 1x 105     | 13| 1x 2x      | 88| 13 3x 90 | 13| 4x 75   | 19| 4x 100   | 12| 4x 80    | 12 | 538        | 82|            |    |          |    |       |
| 5th           | 1x 2       | 0 | 1x 2x      | 1 | 2 3x 0   | 0 | 4x 1    | 1 | 5x 1     | 1 | 5x 4     | 1 | 9         | 4 |            |    |          |    |       |
| 6th           | 1x 0       | 0 | 1x 2x      | 0 | 0 3x 0   | 0 | 4x 0    | 0 | 5x 0     | 0 | 6x 0     | 0 | 0         | 0 |            |    |          |    |       |
| Subtotal      | 409        | 49| 423        | 50| 422       | 44| 398      | 42| 426       | 33| 402       | 28 | 2,480     | 246|           |    |          |    |       |
| Total         | 458        |   | 473        |   | 466       |   | 440      |   | 459       |   | 430       |   | 2,726     |   |            |    |          |    |       |
| Participants in the annual checkups | 458 | | 475 | | 468 | | 440 | | 469 | | 430 | | 2,740 | |
| Checkup rate | 94.8%      |   | 96.2%      |   | 94.4%     |   | 90.0%    |   | 92.9%     |   | 91.7%     |   | 93.3%     |   |            |    |          |    |       |

No answer to the question on smoking | 0 | 2 | 2 | 0 | 10 | 0 | 14 |
year of school had its pattern. First-year undergraduates had just started school and acted on the recommendation to attend a checkup. Second- and third-year undergraduates used their own discretion in deciding whether to go, resulting in lower attendance rates. Fourth-year undergraduates were motivated to go for their checkup because they are asked for the checkup results when they apply for jobs. In Japan, the number of undergraduates who need to spend more than four years getting their degree is small. That was the case in this study as well. The checkup attendance rate for this group was extremely low, suggesting underlying issues such as...
mistake of major choice, human relations at the university, etc.

In this study, 26.9% of men and 9.9% of women had smoking history. Compared to undergraduates with no history of smoking, those with a history of smoking attended fewer of the annual medical checkups. The difference was more remarkable among men. Undergraduates might not disclose their complete smoking history at medical checkups. Minors in particular may be more apt not to disclose such history. Considering this reporting bias, there may be an under-reporting of smoking history among undergraduates and this bias might affect the statistically significant differences found in our analysis. However, when we analyzed the data from undergraduates who were not minors (those in their third to eighth years), the results were similar, showing that undergraduates with self-reported smoking history had fewer medical checkups (men: p < 0.00001 in all survey years, women: p < 0.05 in 2011 and 2012). Therefore, any reporting bias is likely to have a small impact on the findings.

Elderly smokers were less likely to participate in general medical checkup or cancer screening12,13 and this study of young people had similar results. Reasons for smoking have suggested many variables such as socio-economic status or family history of smoking 15-17. Our data for analysis did not contain other potential confounders. However, it is difficult for the universities to intervene in them.

Honjo et al.18 reported that more smokers were able to quit smoking when they received regular check-ups than when they did not. The medical checkup site at the university provides undergraduates with the opportunity to learn more about not only smoking cessation programs but also other diseases. Having regular medical checkups is a first step in taking interest in one’s health. In addition, it might be possible for universities to improve undergraduates’ attendance of the medical checkup.

Because the undergraduate population is of an age group that is relatively healthy and generally experiences low rates of disease and robust physical health, it may be difficult for undergraduates to recognize the importance of attending regular medical checkups, smoking cessation, and other health-fostering behaviors. Most of the population in this age group perceive their health as good or excellent and do not consider the possibility of a decline in health in the future. In addition, although smokers are far more likely to develop lung cancer than non-smokers are, not all smokers experience lung cancer. Such uncertainty about perceived risk might lead to individual differences in health investment19. If undergraduates spend time in proximity to healthy middle-aged smokers, they might further underestimate future loss of health due to smoking and have a lesser likelihood of investing resources in healthy behaviors. We must educate this population regarding the importance of investing time and energy in a healthy lifestyle and preventive medical care in order to maintain health and well-being.

Historically, information regarding the annual medical checkup has been communicated via the school’s internet bulletin board, posters, or individual emails. As for other ways to increase checkup attendance, Japanese undergraduates show a strong preference for forming groups to coordinate their activities20,21. As a result, they frequently engage in activities based on friendships made, for example, in school club activities or classes. It could be important to ask club advisors and undergraduate representatives or teaching faculty to pass on the information. Before they graduate and have to begin deciding on their own whether to have regular medical checkups, guidance is important to encourage habit formation.

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