# Trends in Prevalences of Behavioral Risk Factors: Recent Hawaiian Experience

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ABSTRACT

Recent time trends were studied for the prevalences of behavioral risk factors in Hawaii during the 5-year period from 1986 through 1990. The presence of linear time trend was analyzed by the multiple logistic regression method on weighted data, adjusting for confounding factors. The risk factors studied were seatbelt nonuse, lack of exercise, obesity, hypertension, smoking, acute drinking, chronic drinking, and driving while intoxicated. Seatbelt nonuse showed a significant decline, from 8.6% to 4.8%, with a mean annual decrease of 0.9 percentage point. Lack of exercise and obesity increased steadily, from 48.0% to 62.4% and from 16.7% to 21.6%, respectively, with respective annual mean increases of 3.3 and 1.4 percentage points. (*Am J Public Health.* 1992;82:1544–1546)

## *Introduction*

The 1979 Surgeon General's report[1] estimates that as many as one half of all deaths in the United States may be due to unhealthy behaviors or life-styles. During the 1980s, major declines occurred in death rates for the leading causes of death (such as heart disease, stroke, and motor vehicle accidents) in the United States[2]; however, with the exception of smoking,[3–5] we have limited knowledge about temporal trends in the prevalences of underlying behavioral risk factors in the general population, despite the close relationships between these factors and many chronic diseases and injuries. In the present study we report on recent time trends for a selected number of behavioral risk factors in Hawaii; these trends are based on information from the Behavioral Risk Factor Surveillance System (BRFSS) for the period 1986 through 1990.

## *Data and Methods*

This study is based on data collected by the Hawaii BRFSS, which is coordinated by the Centers for Disease Control as part of a national surveillance effort.[6,7] Subjects for the survey were randomly chosen from the adult members of households chosen each year on the basis of cluster sampling of telephone numbers of the entire state. Each cluster consisted of 100 telephone numbers, from which 3 were chosen for telephone interviews. One person from each household was interviewed. This study deals with 7140 interviews.

The following eight behavioral risk factors were considered: seatbelt nonuse, lack of exercise, obesity, hypertension, cigarette smoking, acute drinking, chronic drinking, and driving while intoxicated (Table 1). Sociodemographic factors considered were island group, ethnic group, age, sex, years of education, employment status, marital status, and household income. The six ethnic groups were Caucasian, Hawaiian, Chinese, Filipino, Japanese, and others.

The yearly prevalences of the behavioral risk factors were calculated weighting for the numbers of adults and telephones in the household, cluster size, and age-sex-ethnicity distribution of the general population. The statistical method chosen was multiple logistic regression to detect a linear trend, with dichotomous behavioral risk variables as dependent variables (at risk = 1, not at risk = 0) and year as the critical independent variable. A regular multiple regression analysis was performed to estimate changes per year in the prevalences of the risk factors. Other independent variables considered as potential confounders were the sociodemographic factors described above. In these analyses the levels of education and income were treated as ordinal variables, whereas the other sociodemographic factors were treated as categorical variables. The probability level of .01 was used for the significance test of linear trend from regression coefficients because of the large sample in this study. The SUDAAN computer program,[8] which considers sample design and weight, was used to perform the logistic regression analysis on the weighted data.

## *Results*

Table 2 shows the weighted prevalences, unadjusted for sociodemographic factors, of the eight behavioral factors by year and sex. Linear trends are apparent for seatbelt nonuse, lack of exercise, obesity, and chronic drinking.

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Table 3 shows the results of analysis of year effect on the prevalences of the risk factors after fitting other significant sociodemographic factors. There were significant negative linear trends in seatbelt nonuse ($P < .001$) and chronic drinking ($P < .01$). The estimated odds ratios, which compared the prevalence of one year to that of the previous year, were 0.86 and 0.90 for seatbelt nonuse and chronic drinking, respectively. In other words, the prevalence odds decreased by 14% and 10% per year, respectively. On the basis of the regular regression analysis, the changes can be translated into mean annual decreases of 0.9 and 0.8 percentage points in the prevalences of seatbelt nonuse and chronic drinking, respectively.

There were significant positive linear trends for lack of exercise ($P < .001$) and obesity ($P < .001$); the corresponding prevalence odds ratios were 1.15 and 1.10. The estimated mean annual increases in the prevalences were 3.3 and 1.4 percentage points, respectively. No other risk factors showed a significant linear relationship. Separate examinations of the data showed consistent trends between sexes and among ethnic groups.

**TABLE 1—Definitions of At-Risk Behavior**

| | Definition |
|---|---|
| Seatbelt nonuse | Respondents report that they "sometimes," "seldom," or "never" use seatbelts. |
| Lack of exercise | Respondents report a sedentary or irregular activity level, exercising for less than 20 minutes at a time three times per week. |
| Obesity | Respondents are 20% or more above the ideal weight of a person with a medium frame, as defined by the 1959 Metropolitan Life height-weight tables.[a] |
| Hypertension | Respondents report that they have been told at some point that their blood pressure is high. |
| Smoking | Respondents are current regular cigarette smokers. |
| Acute drinking | Respondents report having five or more alcoholic drinks on at least one occasion in the past month. |
| Chronic drinking | Respondents report having 60 or more alcoholic drinks in the past month. |
| Drinking and driving | Respondents report having driven after having too much to drink one or more times in the past month. |

[a]Metropolitan Life Insurance Co. New weight standards for men and women. *Statistical Bulletin.* 1959;40:1–4.

## *Discussion*

It is somewhat surprising to observe detectable trends in several behavioral risk factors in a relatively short period of time. Seatbelt nonuse decreased from 8.6% to 4.8% from 1986 to 1990; the adjusted decrease was 3.6 percentage points for the period. The declining tendency in seatbelt nonuse is consistent with observations made in other parts of the country.[9] Hawaii does, however, have the highest rate of automobile seatbelt use in the United States,[10] which may be attrib-

**TABLE 2—Weighted Prevalences of At-Risk Behaviors by Sex and Year**

| | Seatbelt Nonuse | | Lack of Exercise | | Obesity | | Hyperten-sion | | Smoking | | Acute Drinking | | Chronic Drinking | | Driving & Drinking | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | No. | % | No. | % | No. | % | No. | % | No. | % | No. | % | No. | % | No. | % | Total |
| 1986 | | | | | | | | | | | | | | | | | |
| Male | 87 | 9.8 | 318 | 43.6 | 144 | 18.0 | 172 | 23.4 | 191 | 27.4 | 221 | 33.8 | 123 | 16.0 | 43 | 5.3 | 723 |
| Female | 86 | 7.4 | 404 | 52.4 | 139 | 15.4 | 184 | 18.7 | 186 | 20.8 | 61 | 6.5 | 33 | 3.1 | 8 | 1.2 | 834 |
| Total | 173 | 8.6 | 722 | 48.0 | 283 | 16.7 | 356 | 21.1 | 377 | 24.0 | 282 | 20.0 | 156 | 9.5 | 51 | 3.2 | 1557 |
| 1987 | | | | | | | | | | | | | | | | | |
| Male | 100 | 8.5 | 383 | 45.2 | 187 | 21.2 | 205 | 20.8 | 215 | 23.0 | 313 | 35.1 | 157 | 15.0 | 60 | 5.6 | 850 |
| Female | 77 | 5.4 | 557 | 58.8 | 177 | 14.8 | 230 | 21.9 | 215 | 20.9 | 96 | 10.0 | 29 | 2.8 | 23 | 2.0 | 1020 |
| Total | 177 | 6.9 | 940 | 52.1 | 364 | 18.0 | 435 | 21.4 | 430 | 21.9 | 409 | 22.4 | 186 | 8.9 | 83 | 3.8 | 1870 |
| 1988 | | | | | | | | | | | | | | | | | |
| Male | 84 | 9.0 | 408 | 49.0 | 201 | 20.8 | 203 | 22.1 | 231 | 26.2 | 262 | 30.1 | 139 | 16.0 | 60 | 6.1 | 842 |
| Female | 56 | 3.7 | 584 | 59.1 | 204 | 18.0 | 214 | 17.8 | 217 | 20.3 | 100 | 9.5 | 33 | 2.4 | 13 | 1.2 | 1029 |
| Total | 140 | 6.4 | 992 | 54.1 | 405 | 19.4 | 417 | 19.9 | 448 | 23.2 | 362 | 19.6 | 172 | 9.2 | 73 | 3.6 | 1871 |
| 1989 | | | | | | | | | | | | | | | | | |
| Male | 62 | 8.0 | 441 | 51.9 | 193 | 23.4 | 191 | 21.4 | 216 | 24.5 | 245 | 28.3 | 112 | 11.7 | 46 | 5.2 | 887 |
| Female | 39 | 4.4 | 532 | 57.6 | 182 | 18.5 | 236 | 22.5 | 203 | 20.2 | 99 | 9.4 | 34 | 2.8 | 23 | 2.3 | 979 |
| Total | 101 | 6.2 | 973 | 54.8 | 375 | 20.9 | 427 | 22.0 | 419 | 22.3 | 344 | 18.8 | 146 | 7.2 | 69 | 3.7 | 1866 |
| 1990 | | | | | | | | | | | | | | | | | |
| Male | 52 | 7.0 | 505 | 58.0 | 211 | 24.0 | 179 | 19.8 | 217 | 23.7 | 280 | 31.6 | 97 | 11.1 | 58 | 6.5 | 898 |
| Female | 28 | 2.6 | 615 | 66.6 | 180 | 19.2 | 184 | 19.6 | 185 | 18.4 | 71 | 7.2 | 21 | 1.8 | 11 | 1.3 | 974 |
| Total | 80 | 4.8 | 1120 | 62.4 | 391 | 21.6 | 363 | 19.7 | 402 | 21.0 | 351 | 19.3 | 118 | 6.4 | 69 | 3.9 | 1872 |
| Total | 671 | 6.6 | 4747 | 54.3 | 1818 | 19.3 | 1998 | 20.8 | 2076 | 22.5 | 1748 | 20.0 | 778 | 8.2 | 345 | 3.6 | 9036 |

TABLE 3—Result of Regression Analyses of Prevalences of Behavioral Risk Factors

| | Logistic Partial Coefficient ($\hat{\beta}$) | Standard Error ($s_{\hat{\beta}}$) | Odds Ratio (OR) per Year ($e^{\hat{\beta}}$) | Confidence Interval of OR | Multiple Regression Coefficient |
|---|---|---|---|---|---|
| Seatbelt nonuse | −.149* | .040 | 0.86 | 0.78, 0.96 | −.009* |
| Lack of exercise | .140* | .020 | 1.15 | 1.09, 1.21 | .033* |
| Obesity | .094* | .026 | 1.10 | 1.03, 1.17 | .014* |
| Hypertension | −.004 | .029 | 1.00 | 0.92, 1.07 | −.000 |
| Smoking | −.030 | .023 | 0.97 | 0.91, 1.03 | −.005 |
| Acute drinking | −.042 | .026 | 0.96 | 0.90, 1.03 | −.005 |
| Chronic drinking | −.110** | .035 | 0.90 | 0.82, 0.98 | −.008** |
| Drinking and driving | .025 | .053 | 1.03 | 0.89, 1.18 | .001 |

*$P < .001$; **$P < .01$.

utable partially to the state's primary law. Under the law, a violator is cited for the seatbelt-law violation alone. The prevalences of chronic drinking diminished from 9.5% to 6.4%, with an adjusted decrease of 3.2 percentage points. However, this apparent trend must be interpreted with caution. There was a change in the questionnaire dealing with drinking habits in 1989. In previous years questions were asked about the numbers of drinks of beer, wine, and liquor separately, whereas the question dealt with all drinks beginning in 1989. Therefore, the observed trend may simply be an artifact resulting from the change.

The noteworthy finding of this study is that the prevalences of lack of exercise and obesity underwent steady increases during the study period. The fact that these two factors changed in the same direction provides logical consistency, although the cause-effect relationship cannot be tested in this study. The prevalence of sedentary lifestyles represented by lack of exercise increased from 48.0% to 62.4% from 1986 to 1990, with an adjusted increase of 13.2 percentage points. Data from other states are of great interest for comparative purposes. Obesity increased from 16.7% to 21.6% for the period, with an adjusted increase of 5.4 percentage points. We do not know whether a national trend exists with respect to overweight, but an increasing trend was also noted in Florida in the period from 1985 through 1988.[10] However, these observations are contrary to the long-term trend observed earlier.[11] The causal relationship between lack of exercise and obesity needs further investigation. In this connection it is of interest that Tucker and Bagwell[12] found a strong positive association between hours of television viewing and obesity in adult females.

Theoretically, we might attribute the observed trends to a possible sampling bias associated with year. However, it is difficult to visualize a bias as systematic as the one observed. The response rates were between 72% and 86% except in 1990, when the rate was 58%. No specific trend was observed in the nonresponse rates. □

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