



ROAD TITLE PAGE

RESEARCH GRANT

SERIES

**Road safety and pathological sleepiness:
The role of sleep apnea**

YEAR

SUBJECT

One of the most common concomitants of sleep apnea, daytime sleepiness, may affect driving ability. We used an anonymous self-report questionnaire to examine driving behaviour in three age-matched groups of male subjects. "Controls" (N = 266) were recruited from visitors to the Traffic Authority's stand at Sydney's Royal Easter Show. "Snorers" (N = 341 and "Apneics" (N = 101) were recruited from patients assessed for apnea by overnight sleep study at Royal Prince Alfred Hospital, Hornsby Sleep Disorders Centre and Camperdown Sleep Disorders Centre. Snorers were those who did not have apnea, or had fewer than 10 apneas per hour of sleep. Patients with apnea indices >10 were classified "sleep apneic".

AGENCY

UNIVERSITY OF SYDNEY

A to Z

Helen Bearpark

Fatigue

1990

**ROADS AND TRAFFIC AUTHORITY
ROAD SAFETY BUREAU**

AUGUST 1990



CONSULTANT REPORT ~~CR 3/90~~

**ROAD SAFETY AND PATHOLOGICAL
SLEEPINESS: THE ROLE OF SLEEP APNEA**

Prepared by Helen Bearpark

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REFERENCE

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ABSTRACT

One of the most common concomitants of sleep apnea, daytime sleepiness, may affect driving ability. We used an anonymous self-report questionnaire to examine driving behaviour in three age-matched groups of male subjects. "Controls" (N = 288) were recruited from visitors to the Traffic Authority's stand at Sydney's Royal Easter Show. "Snorers" (N = 34) and "Apneics" (N = 101) were recruited from patients assessed for apnea by overnight sleep study at Royal Prince Alfred Hospital, Hornsby Sleep Disorders Centre and Camperdown Sleep Disorders Centre. Snorers were those who did not have apnea, or had fewer than 10 apneas per hour of sleep. Patients with apnea indices > 10 were classified "apneic".

There was a significant difference ($X^2 = 12.38$, $p = 0.002$) in the number of apneics (19%) who reported having had an accident due to sleepiness, compared with snorers (3%) and controls (8%). Similarly, 57% of the apneic group reported pulling off the road due to sleepiness "sometimes" or "often", whereas only 33% of the control group and 32% of snorers gave this response ($X^2 = 18.01$, $p = 0.0001$).

Falling asleep at traffic lights "sometimes" was reported by only 1% of controls, but by 15% of the snorers and 16% of the apneics. An additional 4% of the apnea group said they fell asleep at traffic lights "often". The difference between the groups was significant ($X^2 = 43.3$, $p < 0.0001$). A large proportion of both patient groups reported falling asleep "sometimes" or "often" WHILE DRIVING (snorers 21% apneics 22%), whereas only 3% of the controls made this response. Surprisingly, there were no differences in the actual accidents reported by the three groups for the two years prior to the survey.

These data suggest the sleepiness associated with sleep apnea does affect driving ability, and indicate that both apneics and snorers should perhaps be considered "high risk" groups.

Recommendations are made for licensing, identification of sleep apnea in professional drivers, increasing public awareness and further research.

INTRODUCTION

Driver fatigue and sleepiness are estimated by Australian road traffic authorities to be major contributing factors in approximately 15% of fatal motor vehicle accidents and in 25% of accidents on main highways. Furthermore, an English study has shown that drivers who fall asleep at the wheel are more likely to have fatal accidents than are people who have epileptic seizures or heart attacks while driving (1).

It has recently been recognized that excessive sleepiness frequently has a pathological basis, the most common cause being sleep apnea. In this disorder repeated collapse of the upper airway occurs during sleep, leading to loud snoring, periods of hypoxia and multiple arousals (frequently as many as 300 - 400 each night) of which the sufferer is generally unaware. Because of the tremendous disruption to their night-time sleep, most people with apnea have daytime sleepiness, which is often uncontrollable, and many also report poor concentration. This disorder is particularly prevalent in middle-aged men, and has been estimated to occur in as many as 10% of men aged between 40 and 60 (2).

When we first proposed investigating the role of sleep apnea in road traffic accidents there were no data available on the subject. However, recent reports from North America indicate the road traffic accident rate of patients with sleep apnea is up to seven times greater than that of non-apneic drivers (3,4), and in May, 1989 an editorial in the British Medical Journal (5) suggested that patients with apnea and daytime sleepiness should be advised to stop driving until treated, and that the licensing authorities should be informed of their condition.

The Sleep Disorders Unit at Royal Prince Alfred Hospital is the largest in Australia, and each month we see approximately 100 patients who have symptoms of sleep apnea. Many of these patients give histories of sleepiness while driving, road traffic accidents and "near misses". The current project was designed to quantify our clinical impressions by comparing driving behaviour, reported accidents and near misses in a group of patients who have documented sleep apnea with a group of age-matched non-apneic controls.

PROCEDURE

Questionnaire

A questionnaire was devised to examine driving behaviour and related variables (e.g. alcohol consumption). The questionnaire was piloted on people attending the Traffic Authority's stand at the Newcastle Agricultural Show, revised, and a final version compiled (Appendix). Subjects were told the questionnaire was about health and road safety. Sleep apnea was not mentioned. The questionnaire was completed anonymously.

Subjects

Control Group (N = 289) As sleep apnea is predominantly a disorder of middle-aged men, we recruited subjects from men over the age of 40 who visited the N.S.W. Traffic Authority's stand at the Royal Easter Show in Sydney.

Patient Groups (APNEICS, N = 101; SNORERS, N = 34) Patients were recruited from men undergoing investigation for sleep apnea at the Sleep Disorders Unit at Royal Prince Alfred Hospital, at the Hornsby Sleep Disorders Centre or at the Camperdown Sleep Disorders Centre, all in Sydney. Patients were excluded if they were not literate in English, if they had any other major medical disorder or if they did not want to participate in the project.

All patients had an overnight sleep study. Patients who had 10 or more apneas per hour of sleep (i.e. apnea index (AI) > 10) were classified "apneics", and those who snored but had fewer than 10 apneas per hour of sleep (AI < 10) were classified "snorers".

RESULTS

Section 1 Demographic variables, driving history, medication and alcohol consumption.

We examined a number of variables that might be expected to affect driving behaviour and accident rate independently of the presence of sleep apnea (e.g. age, driving experience, alcohol consumption etc.), to determine if the groups were equivalent in these respects. The findings are reported in this section.

AGE

There was no difference in the ages of the three groups (Table 1).

| | Controls | Snorers | Apneics | p |
|----------------------------|---------------|---------------|---------------|------|
| N | 289 | 34 | 101 | |
| Mean age (yrs) (s.e.m.) | 53.4 (0.6) | 49.8 (1.7) | 52.6 (0.9) | n.s. |

TABLE 1

DRIVING HISTORY

There were no differences between the groups in; the number of years they had held driving licenses; the average number of hours of driving they did each week; how often in each year they took country trips of five hours or more; whether or not their job entailed driving (other than driving to or from work); and if they actually had jobs as drivers. (Table 2).

| | Controls | Snorers | Apnoeics | p |
|---------------------------|-----------------|-----------------|-----------------|-------------|
| License years | 34 yrs (0.5) | 31 yrs (1.5) | 34 yrs (0.5) | <i>n.s.</i> |
| Weekly driving | 20 hrs (1.1) | 24 hrs (3.1) | 22 hrs (1.8) | <i>n.s.</i> |
| Country trips per year | 12 (4) | 8 (6) | 15 (2) | <i>n.s.</i> |
| Job-related driving | 45% | 47% | 45% | <i>n.s.</i> |
| Job "driver" | 8% | 15% | 7% | <i>n.s.</i> |

Table 2

ALCOHOL CONSUMPTION

The frequency with which the three groups reported drinking alcohol was similar, about 3 times a week. However, the patients tend to drink about 3 drinks on each occasion on average compared with about 2 for the control group. This was significant, but not markedly so ($p = 0.03$) (Table 3). There was no significant difference in the total alcohol consumption (frequency x amount) of the three groups.

| | Controls | Snorers | Apnoeics | p |
|-----------|--------------|--------------|--------------|------|
| Frequency | 2.7 (0.2) | 2.7 (0.5) | 2.9 (0.3) | n.s. |
| Amount | 2.4 (0.1) | 3.0 (0.4) | 3.0 (0.2) | 0.03 |

Table 3

MEDICATION

We found a significantly greater use of sleep medication among the patients (Table 4). When multiple comparisons were performed it was seen that more of the snorers than the controls took sedatives ($p = 0.01$), but there was no significant difference between the apnoeics and controls. Twice as many apnoeics as controls reported taking medication for hypertension ($p = 0.0009$), though there was no difference between snorers and controls. However there is no evidence that antihypertensives affect driving ability. There were no significant differences between the groups in their use of medication for heart trouble.

| | Controls | Snorers | Apnoeics | p |
|--------------------|----------|---------|----------|--------|
| Sleeping pills | 3% | 12% | 8% | 0.01 |
| for Blood Pressure | 20% | 26% | 39% | 0.0009 |
| for Heart Trouble | 7% | 16% | 10% | n.s. |

Table 4

SECTION 2

We were of course unable to screen the control subjects for sleep apnea in the sleep laboratory, and to ensure that we had not inadvertently ensnared a population of apneic men at the Easter Show stand, we examined two indices that are usually high in people with apnea (Table 5). One of these is Body Mass Index, a relationship between height and weight that gives an indication of obesity, a common concomitant of sleep apnea. There were highly significant differences between the groups. Apneics were in the obese range (BMI > 30) and were significantly different both from controls ($p < 0.0001$) and snorers ($p < 0.001$). Controls and snorers were in the "overweight" range (i.e. BMI = 25 - 30) and were not significantly different from each other ($p=0.06$).

The other index we used to ensure our control population was not apneic was calculated from scores on a 7-item "mini-sleep questionnaire" (MSQ) (6). The researchers who devised this scale reported mean scores of 2.3 +/- 1.4 for a large sample of non-apneics and 4.2 +/- 2.1 for 480 apneics who had been diagnosed in a sleep laboratory. Our results were virtually identical, indicating that our control group is indeed non-apneic and that our apneic group is similar to other groups of patients with apnea. We found no significant difference between the snorers and apneics on these scores.

BODY MASS INDICES AND SCORES ON THE "MINI-SLEEP QUESTIONNAIRE"

| | Controls | Snorers | Apnoeics | p |
|--------------------------------------|---------------|---------------|---------------|----------|
| Body Mass Index(Wt/Ht ²) | 26 (0.3) | 28 (0.8) | 31 (0.4) | <<0.0001 |
| MSQ Scores | 2.3 (0.04) | 3.8 (0.14) | 4.1 (0.08) | <<0.0001 |

Table 5

Summary of results in Sections 1 and 2

In summary, there were no major differences among the groups in age, driving history, or alcohol consumption that might affect their driving behaviour or accident rate. Sedative use was greater in snorers than controls, but there was no difference in sedative medication between controls and apneics. There were significant differences between the groups on measures of Body Mass Index and MSQ scores, indicating that the control and apneic groups were different as expected. The differentiation was less clear-cut in the snorers, who were not significantly different from the controls on BMI scores, but who were indistinguishable from the apneics on MSQ scores. This suggests they may be an "intermediate" group, somewhere between controls and apneics.

Section 3

In this section we will examine the responses to the questions asked about driving behaviour and road safety.

"Do you think you have ever had a motor vehicle accident due to your sleepiness?"

In response to this question, 19% of the apnea pts, 3% of the snorers and 8% of the controls said they had had at least one such accident. This was significant ($\chi^2 = 12.38$, 2 df, $p = 0.002$) (Figure 1).

When multiple comparisons were carried out, the apnea group was significantly different from the controls ($p=0.002$), but there was no difference between the snorers and controls ($p=0.29$), or the snorers and apneics ($p=0.02$) using the Bonferroni correction for multiple comparisons.

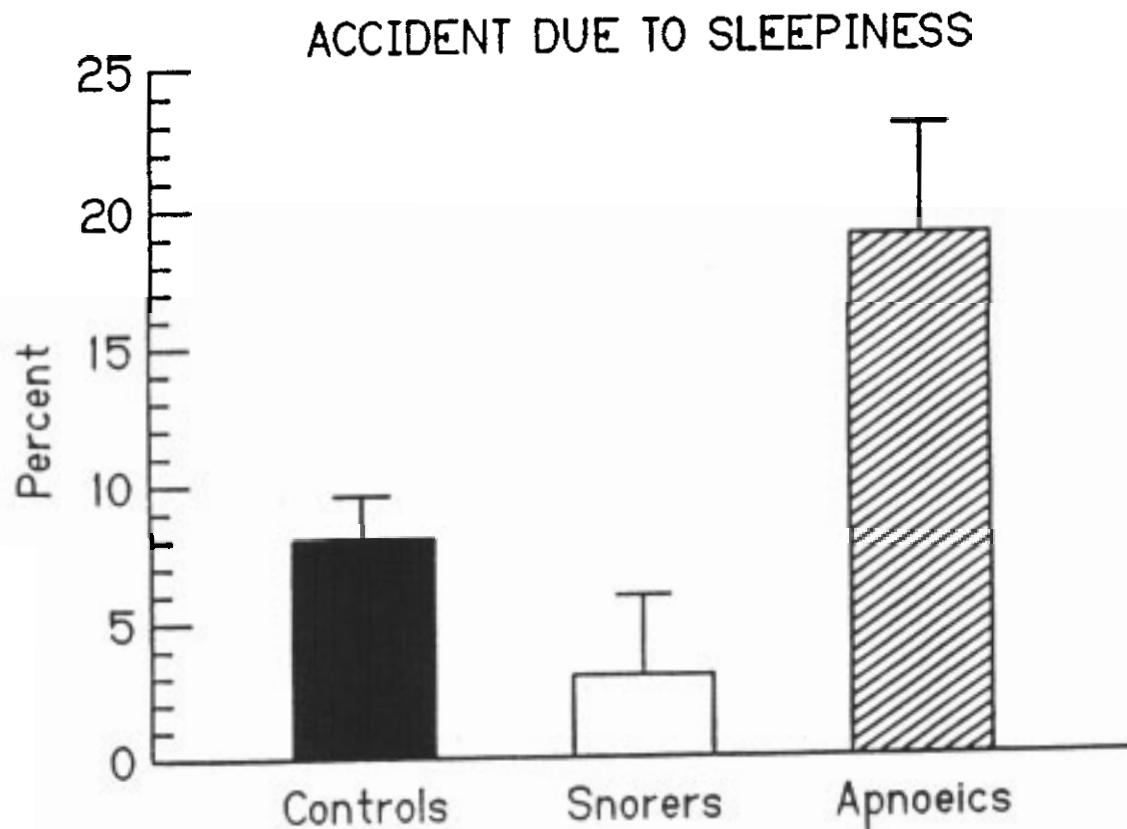


Figure 1

"How often have you been in a situation (while YOU were driving) in which an accident nearly occurred because of your sleepiness?"

As might be expected, near misses due to sleepiness were more common than accidents. Although 42% of apneic patients reported at least one occurrence compared with 30% of controls and 32% of apneics the results were not significant overall ($\chi^2 = 4.9$, 2 df, $p = 0.08$) (Figure 2).

When multiple (i.e. 2 or more) near misses due to sleepiness were reported, there was a trend for these to be less commonly reported by controls (15%) compared with snorers (21%) and apneics (25%). However, this finding did not quite achieve significance ($\chi^2 = 5.6$, 2 df, $p = 0.06$).

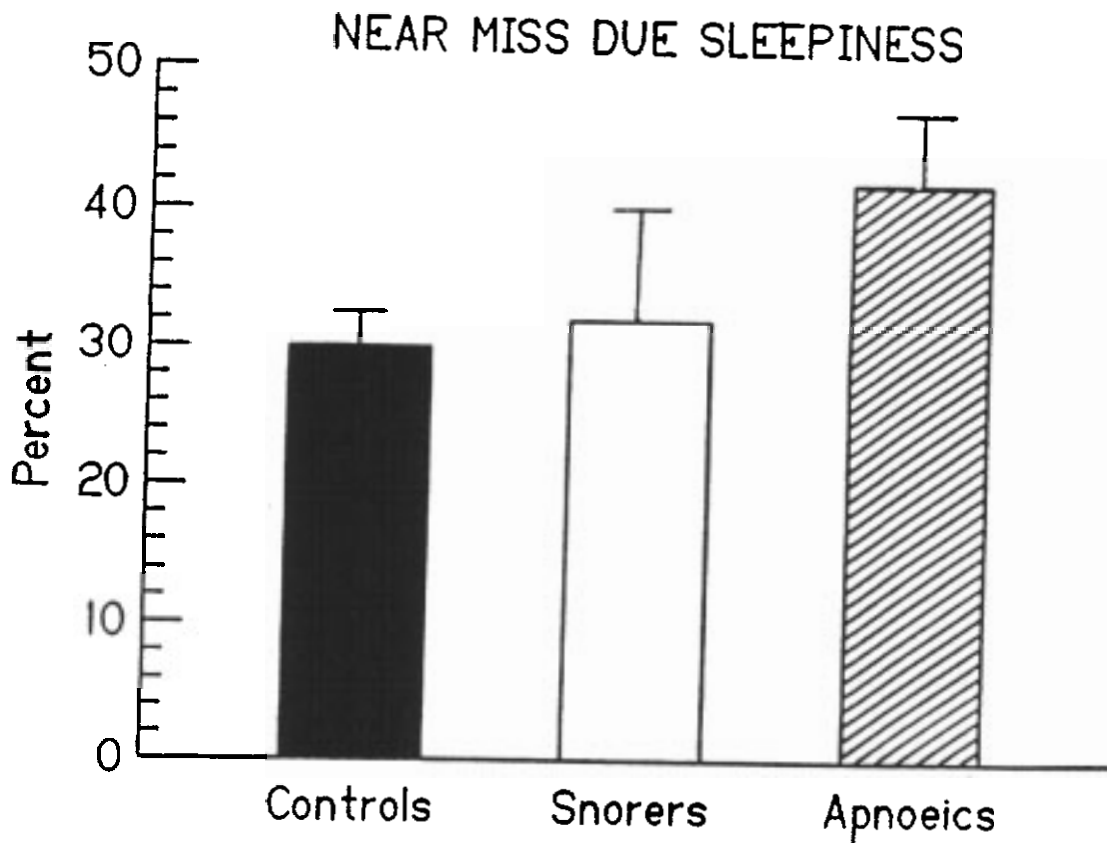


Figure 2

Do you ever have to pull off the road whilst driving due to sleepiness?

Pulling over due to sleepiness was much more commonly reported by apnoeics than by those in the other 2 groups. 57% of apnoeics said they did this sometimes or often compared with 32% of snorers and 33% of controls ($\chi^2 = 18.02$, 2 df, $p = 0.0001$) (Figure 3).

Multiple comparisons confirmed that more of the apnoeic group pulled over due to sleepiness than controls ($p = 0.00002$) or snorers ($p = 0.01$), whereas there was no difference between the controls and snorers on this variable ($p = 0.9$).

SOMETIMES/OFTEN PULL OVER

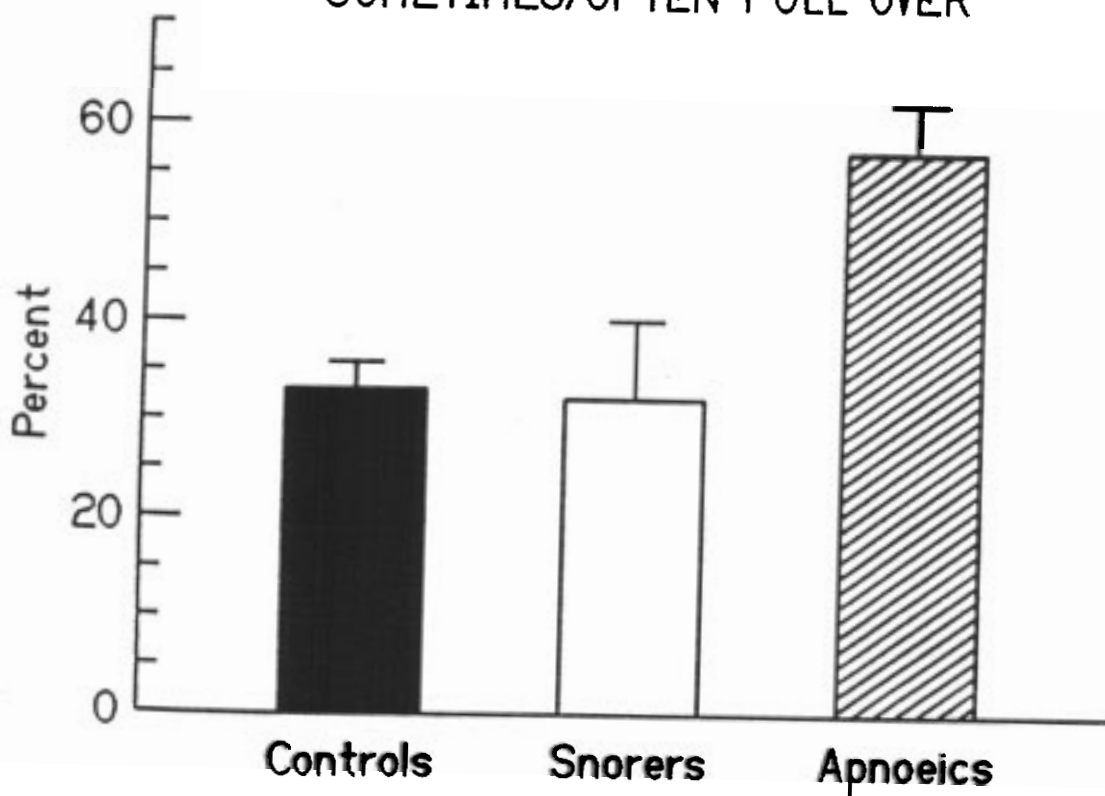


Figure 3

"Have you ever fallen asleep while waiting at traffic lights?"

20% of the apneic group and 15% of the snorers reported falling asleep sometimes or often at lights, compared with only 1% of the control group ($\chi^2 = 43.43$, 2 df, $p = 0.0001$). (Figure 3).

In fact the only people who reported falling asleep "often" at lights were in the apneic group (4%).

SOMETIMES/OFTEN SLEEP AT LIGHTS

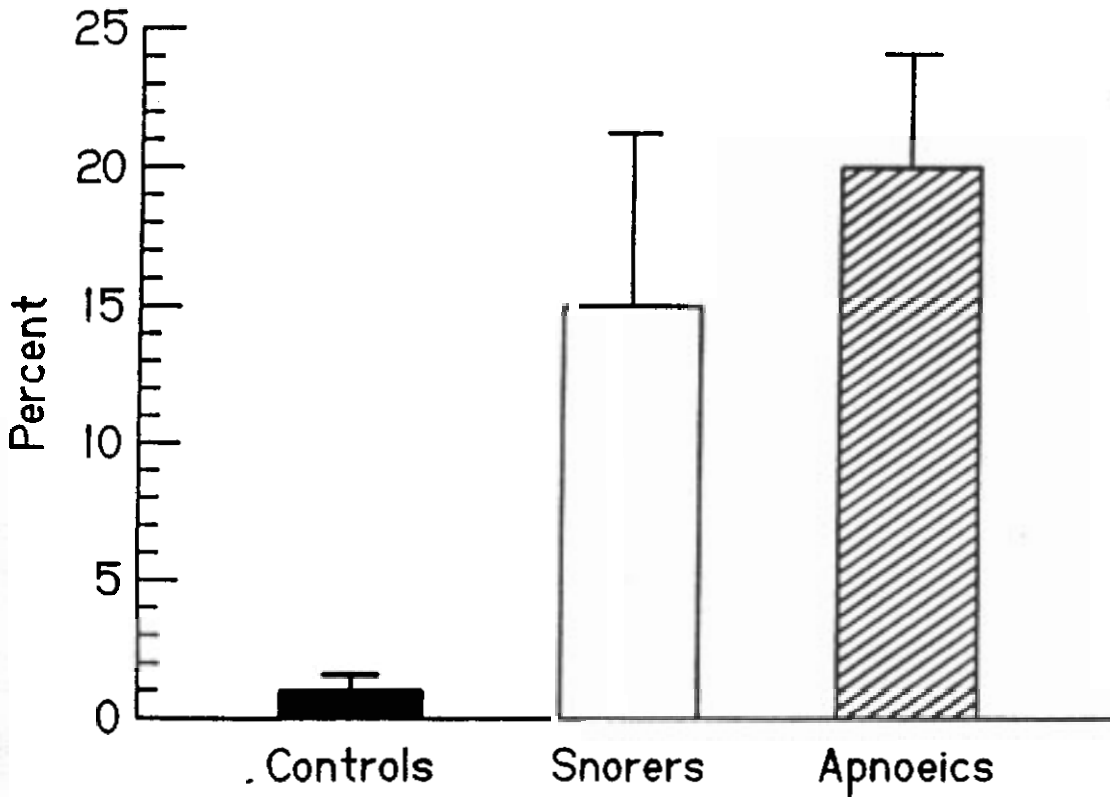


Figure 4

"Have you ever fallen asleep while driving?"

There was a highly significant difference in the responses of the groups to this question ($\chi^2 = 37.9$, 2 df, $p < 0.0001$). 22% of the apneic group and 21% of the snorers reported that they had fallen asleep while driving "sometimes" or "often", whereas only 3% of the control group reported this (Figure 4).

In fact none of the controls reported falling asleep "often" while driving, but 2% of the apneics and 3% of the snorers did.

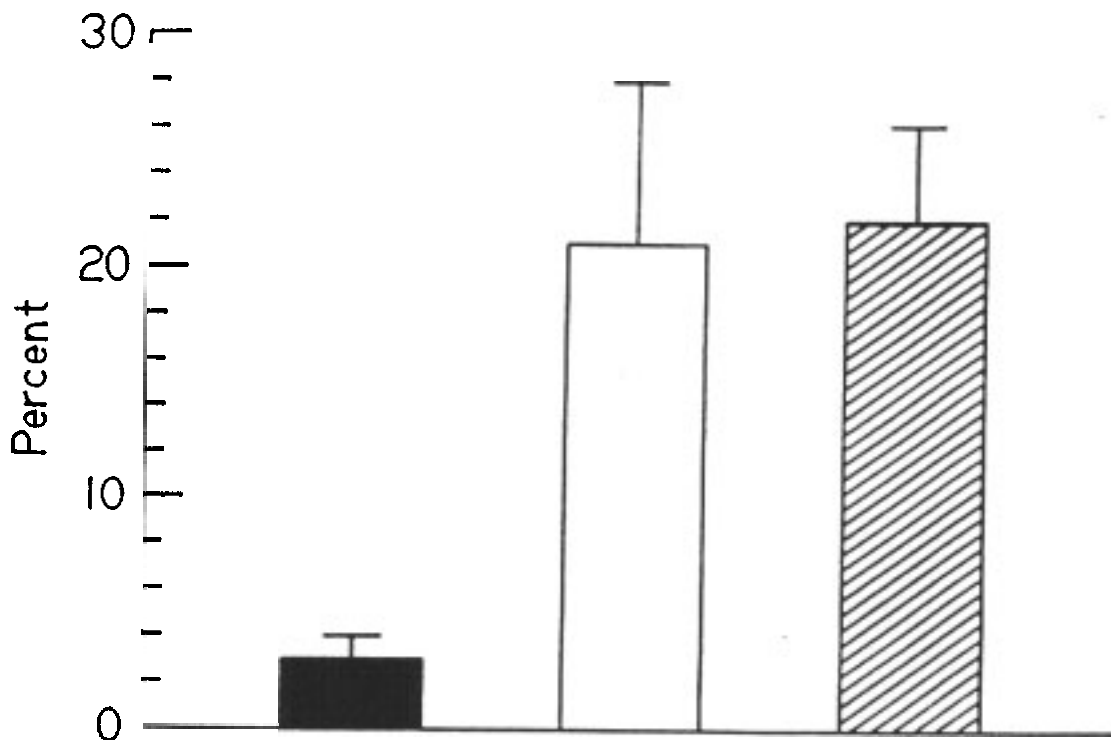


Figure 5

"During the last 2 years, WHEN YOU WERE DRIVING, how many MAJOR*, MODERATE* or MINOR* accidents have you had?"

(* These terms were defined, see Appendix)

Given the other findings in this study and those recently reported overseas, it is somewhat surprising that there was no difference at all in the accidents reported by the three groups over the past two years in any category (Figure 5). This may be a function of the fact that we are relying here on self-report data whereas previous overseas studies have examined police accident records.

ACCIDENTS IN LAST 2 YEARS

| | Controls | Snorers | Apnoeics |
|----------|----------|---------|----------|
| Total | 0.4 | 0.3 | 0.3 |
| Major | 0.1 | 0.1 | 0.1 |
| Moderate | 0.08 | 0.0 | 0.05 |
| Minor | 0.2 | 0.2 | 0.2 |

Figure 6

Summary of results from Section 3

The significant findings relating to driving behaviour in the three groups studied were:

Relative to controls APNEICS were:

- Almost twice as likely to report pulling off the road sometimes or often due to sleepiness

- * 2.5 times more likely to report having had a motor vehicle accident due to sleepiness

- * 7 times more likely to report falling asleep sometimes or often while driving

- * 20 times more likely to report falling asleep sometimes or often at traffic lights

Relative to controls SNORERS were:

- * 7 times more likely to report falling asleep sometimes or often while driving

- 15 times more likely to report falling asleep sometimes or often at traffic lights

DISCUSSION

These results show quite clearly that there are major differences in driving behaviour between men suffering from sleep apnea and an age-matched control group who have similar driving histories, drive for similar periods each week and have a comparable alcohol intake.

In particular patients with apnea are much more likely to have had at least one motor vehicle accident that they attributed to sleepiness, and to be exhibiting behaviour associated with extreme sleepiness WHILE DRIVING e.g. actually falling asleep at the wheel, falling asleep at traffic lights and pulling off the road because of sleepiness.

Those in the snoring group were also much more prone to report falling asleep while driving and falling asleep at traffic lights than controls. However, they did not report any more sleep-related accidents than the controls, and their reported frequency of pulling off the road because of sleepiness was similar to controls. It should be remembered that the number in the snoring group was much smaller than in the other two groups, which may have some bearing on these results. However it does appear that the snorers represent an "intermediate" group, both physiologically and in terms of their driving behaviour, and one might speculate that the first effects of disrupted sleep on driving behaviour are falling asleep at traffic lights and while driving, and as the sleep apnea becomes more pronounced it is associated with pulling off the road because of sleepiness and sleep-related accidents.

The degree of sleepiness experienced both by the snorers and the apneics we studied would appear to put such individuals into a group of road users at high risk for sleep-related accidents. However, when we asked the respondents how many accidents they had had in the previous two years the rate was no higher for the patient groups than for the controls. There a number of possible explanations for this:

* One is that there are no differences between the groups, and that despite reporting falling asleep at the wheel and at traffic lights much more frequently than controls, people with apnea and heavy snoring do not have any more accidents. This seems unlikely, particularly in view of the findings of other groups who have examined actual accident records and have found the incidence of accidents to be much higher in apneics (3, 4).

* Another possibility is that because accidents are rare events the small time frame we specified - 2 years - and the relatively small sample sizes were insufficient to show any differences. Although the overseas studies cited had small sample sizes they sampled longer time periods.

* Perhaps even more importantly, this study relies on self-reported data whereas in the Canadian and American studies the researchers collected their accident data from police records.

We had felt that using an anonymous questionnaire might induce respondents to be truthful about their accident record, but it may be that people are still reluctant to reveal the number of accidents they have had, particularly when they are aware that road safety authorities are involved in the research project.

* Another possible reason for under-reporting of accidents by apnea patients is that they simply may not remember all the accidents they have had. A common concomitant of sleep apnea is memory impairment and it may be that these patients do not remember their accidents as well as a control group who are not impaired. One way to test this would be to access actual crash reports through the records of police or insurance companies.

* Sleep apnea is a chronic condition, and although its natural history is still not known we believe that it probably develops over the course of many years. During the development of the disorder people with apnea may learn strategies - such as pulling off the road or falling asleep at traffic lights - which prevent them having accidents.

* It is also possible that when apnea patients do have accidents they are fatal. Parson (1) has shown that when drivers fall asleep at the wheel the outcome is more likely to be fatal than if they had a heart attack or fit, when presumably they have more warning. The American National Transportation Safety Board is currently conducting a survey of truck accidents in which the driver is killed, and is asking relatives routinely about features of obstructive sleep apnea, as this disorder is common in long distance truck drivers (7, 8).

RECOMMENDATIONS

There are a number of recommendations we wish to make in light of the above findings:

Licensing

The issue of licensing drivers who have sleep apnea needs to be addressed. One possibility may be to have sleep apnea listed on the license application form in the same way as epilepsy and diabetes.

Identification of apnea in professional drivers

There is a need to screen drivers, and particularly long-distance transport drivers, for evidence of sleep apnea. Various aspects of the life-style of men in this occupation put them at high risk of developing apnea (e.g. obesity, sedentary occupation, consumption of alcohol). Moreover the type of driving they do is often boring and requires vigilance over prolonged periods, which is exactly the kind of task that causes people with apnea to fall asleep.

Increasing public awareness

As sleep apnea has been estimated to affect up to 10% of middle-aged men, it is necessary to increase public awareness of the disorder. This is particularly important in professional drivers and the assistance of transport workers' associations, trade unions and motorists' organisations such as the NRMA should be sought in this regard.

It is also necessary to increase the awareness of the medical profession, particularly GPs, to this common, but often unrecognised, condition and its hazards.

As a first step in finding out what the public know about apnea and where their information came from, we carried out a pilot study at the Royal Easter Show, and are currently analysing the data.

FUTURE RESEARCH

Accident records

In terms of actual accidents reported our findings do not concur with those of similar studies done overseas, in that the reported accident rate was the same in the apneic group as in the controls. However, in the overseas studies actual accident records were examined, whereas we relied on self-report data. Furthermore, there are no data available on the characteristics of the accidents in which patients with apnea are involved. We would imagine, for example, that single-car accidents might be more common in this group.

To clarify these issues, it is essential that driving records of patients with apnea be examined, and we would suggest comparing accident records, "points" scores and insurance claims in patients with apnea with those of controls. There is also an urgent need to determine how many drivers involved in fatal accidents may have been suffering from undetected sleep apnea.

Performance testing

In order to formulate better guidelines to determine which patients with apnea are a safety risk, we need to test daytime vigilance and visuo-motor co-ordination. There is a major problem with determining the degree of daytime impairment in patients with nocturnal sleep disturbance in that there is frequently a marked discrepancy between reported daytime sleepiness and degree of sleep apnea. For example, a patient with a laboratory finding of 20 apneic episodes per hour of sleep may exhibit very little daytime sleepiness whereas one with 5 or 6 apneas per hour of sleep (who would be classified "snorer") may be extremely sleepy during the day.

There are currently no efficient, practical ways of measuring daytime sleepiness available. However we know of at least one group overseas (Findley et al, reference 3) that is developing a PC-based driving simulator for use in this work. It is also possible that the methods currently used to examine the effect of alcohol on performance could be adapted for work in this area.

Treatment effect

Another reason for the necessity to develop accurate daytime measures of performance is to test the efficacy of treatment for sleep apnea in terms of driving ability. The most common form of treatment for sleep apnea worldwide, continuous positive airways pressure (CPAP), was pioneered in our unit. In general, the effects of this treatment on daytime sleepiness appear to be dramatic but there are no data available about the effect of treatment on driving performance. However from the large amount of

knowledge we have accumulated about post-treatment effects we know that some patients have residual physiological impairment that is apparently irreversible. It is therefore likely that daytime performance deficits continue in some people even after treatment, and it is important that we identify these people and the level of their impairment.

Interactive effect of alcohol, medication, shift work with apnea.

We know that alcohol, even in small amounts, makes apnea much worse. We are concerned that alcohol levels currently considered "safe" may cause performance deficits when consumed by people with apnea.

Similarly we know there is an interactive effect between apnea and some medications. In patients with untreated sleep apnea significant performance decrements may result from what are normally therapeutic doses of commonly prescribed medications.

It is also well-documented that sleep deprivation increases the severity of sleep apnea. This is of particular concern in shift-workers who are also drivers, e.g. long-haul truck drivers, where performance decrements can easily lead to fatalities.

It is essential that the above areas be examined so that recommendations can be made regarding the effects of each of these agents on driving performance and, more generally, industrial safety, in people with sleep apnea.

Other causes of pathological sleepiness

This report has dealt with only one possible cause of pathological sleepiness, sleep apnea. However, there are other common sleep disorders such as nocturnal myoclonus and chronic insomnia that give rise to complaints of excessive daytime sleepiness. To our knowledge their effect on driving performance has never been investigated. In this study, 8% of the control group reported at least one accident due to sleepiness and 30% said they had almost had an accident because of sleepiness, suggesting that there are other causes of daytime sleepiness in this non-apneic population, some of which are probably due to other sleep pathology. Further investigation in this area is obviously warranted.

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APPENDIX

Traffic Authority of N.S.W.

University of Sydney

**Health and Road Safety
Questionnaire**

Please help

Royal Prince Alfred Hospital

Federal Office of Road Safety

HEALTH AND ROAD SAFETY

| | | | | | |
|-----------------|---|---|---|---|---|
| Office use only | | | | | |
| 1 | 2 | 3 | 4 | 5 | 6 |

THANKYOU FOR ANSWERING THESE QUESTIONS.

YOUR ANSWERS WILL HELP US TO REDUCE ROAD ACCIDENTS.

YOU WILL NOT BE ASKED TO PUT YOUR NAME ON THIS QUESTIONNAIRE.

1. What is the postcode at your home address? . . .

| | | | | | |
|---|---|---|----|--|--|
| | | | | | |
| 7 | 8 | 9 | 10 | | |

2. What is your occupation? (or if you are retired, what **was** your occupation?) _____

11 12

3. If you are working now, do you do shiftwork?
(Please tick)

| | | |
|---|--------------------------|----|
| Yes..... | <input type="checkbox"/> | 13 |
| No..... | <input type="checkbox"/> | 14 |
| Retired or not currently working. | <input type="checkbox"/> | 15 |

4. How old are you?

| | |
|----|----|
| | |
| 16 | 17 |

5. How old were you when you first got a driver's licence?

| | |
|----|----|
| | |
| 18 | 19 |

6. What class of licence do you have at present? (If you have more than one type, **please tick each one you have.**)

| | | |
|--|--------------------------|----|
| Class 1 (cars and light trucks). | <input type="checkbox"/> | 20 |
| Class 2 (hire cars and country taxis) | <input type="checkbox"/> | 21 |
| Class 3 (large rigid trucks). | <input type="checkbox"/> | 22 |
| Class 4 (public passenger buses). | <input type="checkbox"/> | 23 |
| Class 5 (articulated trucks). | <input type="checkbox"/> | 24 |
| Taxi driver (transport districts). | <input type="checkbox"/> | 25 |
| Motorcycle rider. | <input type="checkbox"/> | 26 |

DRIVING QUESTIONS

IN THIS SECTION WE ARE ONLY INTERESTED IN THOSE TIMES WHEN YOU ARE, OR WERE, THE DRIVER OF THE VEHICLE.

7. What is the average number of hours you spend driving?
 on weekdays (each day) hrs per day
27 28
- on weekends (each day) hrs per day
29 30
8. Not counting driving to and from work, do you drive as part of your job? (Please tick)
- | | | |
|---|--------------------------|----|
| Yes..... | <input type="checkbox"/> | 31 |
| No..... | <input type="checkbox"/> | 32 |
| Retired or not currently working. | <input type="checkbox"/> | 33 |
9. Approximately how many times each year do you drive on country trips of 5 hours or more? trips per year
34 35 36
10. Do you ever have to pull off the road whilst driving due to sleepiness? (Please tick)
- | | | |
|--------------------|--------------------------|----|
| Never..... | <input type="checkbox"/> | 37 |
| Rarely. | <input type="checkbox"/> | 38 |
| Sometimes. | <input type="checkbox"/> | 39 |
| Often. | <input type="checkbox"/> | 40 |
11. Have you ever fallen asleep while waiting at traffic lights? (Please tick)
- | | | |
|--------------------|--------------------------|----|
| Never..... | <input type="checkbox"/> | 41 |
| Rarely..... | <input type="checkbox"/> | 42 |
| Sometimes. | <input type="checkbox"/> | 43 |
| Often. | <input type="checkbox"/> | 44 |
12. Have you ever fallen asleep while driving? (Please tick)
- | | | |
|--------------------|--------------------------|----|
| Never..... | <input type="checkbox"/> | 45 |
| Rarely..... | <input type="checkbox"/> | 46 |
| Sometimes. | <input type="checkbox"/> | 47 |
| Often. | <input type="checkbox"/> | 48 |

13 Do you think you have ever had a motor vehicle accident due to your sleepiness? (Please tick)

| | | |
|--------------------------------|--------------------------|----|
| Never | <input type="checkbox"/> | 49 |
| Once | <input type="checkbox"/> | 50 |
| Two to four times | <input type="checkbox"/> | 51 |
| More than four times | <input type="checkbox"/> | 52 |

13a. If more than four times, how often?

About times
53 54

14. How often have you been in a situation (while you were driving) in which an accident nearly occurred because of your sleepiness?

| | | |
|--------------------------------|--------------------------|----|
| Never | <input type="checkbox"/> | 55 |
| Once | <input type="checkbox"/> | 56 |
| Two to four times | <input type="checkbox"/> | 57 |
| More than four times | <input type="checkbox"/> | 58 |

14a. If more than four times, how often?

About times
59 60

15. During the last 2 years, when you were driving, how many major, moderate or minor accidents have you had? (Please write in the number in each category)

Major (damage to vehicle and/or people, police called)

61 62

Moderate (damage to vehicle and/or people, police not called)

63 64

Minor (scrape, bump or no damage, police not called)

65 66

No Accident (Please tick)

67

15a. How many of these accidents do you think were mainly your fault?

68 69

HEALTH QUESTIONS

THE NEXT GROUP OF QUESTIONS ARE ABOUT YOUR HEALTH

16. Are you regularly taking any of the following medicines?
- | | | | |
|--------------------------------|----------|--------------------------|----|
| Sedatives or sleeping tablets? | Yes..... | <input type="checkbox"/> | 70 |
| | No..... | <input type="checkbox"/> | 71 |
| Medicine for blood pressure? | Yes..... | <input type="checkbox"/> | 72 |
| | No..... | <input type="checkbox"/> | 73 |
| Medicine for heart trouble? | Yes..... | <input type="checkbox"/> | 74 |
| | No..... | <input type="checkbox"/> | 75 |
| Medicine for Narcolepsy? | Yes..... | <input type="checkbox"/> | 76 |
| | No..... | <input type="checkbox"/> | 77 |

Other (Please write here) _____ 78

| |
|--|
| Office use only <input type="checkbox"/> 2 |
|--|

17. How tall are you?..... ft ins
3 4 5
- or cms
6 7 8

18. How much do you weigh?..... st lbs
9 10 11 12
- or kilos
13 14 15

19. Do you fall asleep during the day, particularly when you are not busy?
- | | | |
|--------------------|--------------------------|----|
| Never..... | <input type="checkbox"/> | 16 |
| Hardly ever.... | <input type="checkbox"/> | 17 |
| Occasionally. . . | <input type="checkbox"/> | 18 |
| Quite often. . . . | <input type="checkbox"/> | 19 |
| Often..... | <input type="checkbox"/> | 20 |
| Very often. . . . | <input type="checkbox"/> | 21 |
| Always. | <input type="checkbox"/> | 22 |

20. Do you suffer from morning fatigue?
(on awakening)

| | | |
|---------------------|--------------------------|----|
| Never. | <input type="checkbox"/> | 23 |
| Hardly ever. . . . | <input type="checkbox"/> | 24 |
| Occasionally. . . | <input type="checkbox"/> | 25 |
| Quite often. . . . | <input type="checkbox"/> | 26 |
| Often. | <input type="checkbox"/> | 27 |
| Very often. | <input type="checkbox"/> | 28 |
| Always. | <input type="checkbox"/> | 29 |

21. Do you snore during sleep?

| | | |
|---------------------|--------------------------|----|
| Never. | <input type="checkbox"/> | 30 |
| Hardly ever. . . . | <input type="checkbox"/> | 31 |
| Occasionally. . . | <input type="checkbox"/> | 32 |
| Quite often. . . . | <input type="checkbox"/> | 33 |
| Often. | <input type="checkbox"/> | 34 |
| Very often. | <input type="checkbox"/> | 35 |
| Always. | <input type="checkbox"/> | 36 |

22. Do you frequently wake up during sleep?

| | | |
|---------------------|--------------------------|----|
| Never. | <input type="checkbox"/> | 37 |
| Hardly ever. . . . | <input type="checkbox"/> | 38 |
| Occasionally. . . | <input type="checkbox"/> | 39 |
| Quite often. . . . | <input type="checkbox"/> | 40 |
| Often. | <input type="checkbox"/> | 41 |
| Very often. | <input type="checkbox"/> | 42 |
| Always. | <input type="checkbox"/> | 43 |

23. Do you suffer from headaches on awakening?

| | | |
|---------------------|--------------------------|----|
| Never. | <input type="checkbox"/> | 44 |
| Hardly ever. . . . | <input type="checkbox"/> | 45 |
| Occasionally. . . | <input type="checkbox"/> | 46 |
| Quite often. . . . | <input type="checkbox"/> | 47 |
| Often. | <input type="checkbox"/> | 48 |
| Very often. | <input type="checkbox"/> | 49 |
| Always. | <input type="checkbox"/> | 50 |

24. Do you suffer from chronic unexplained fatigue?

| | | |
|---------------------|--------------------------|----|
| Never. | <input type="checkbox"/> | 51 |
| Hardly ever. . . . | <input type="checkbox"/> | 52 |
| Occasionally. . . | <input type="checkbox"/> | 53 |
| Quite often. . . . | <input type="checkbox"/> | 54 |
| Often. | <input type="checkbox"/> | 55 |
| Very often. | <input type="checkbox"/> | 56 |
| Always. | <input type="checkbox"/> | 57 |

25. Do you suffer from restless sleep?

| | | |
|-----------------------|--------------------------|----|
| Never. | <input type="checkbox"/> | 58 |
| Hardly ever. | <input type="checkbox"/> | 59 |
| Occasionally. | <input type="checkbox"/> | 60 |
| Quite often. | <input type="checkbox"/> | 61 |
| Often. | <input type="checkbox"/> | 62 |
| Very often. | <input type="checkbox"/> | 63 |
| Always. | <input type="checkbox"/> | 64 |

ALCOHOL QUESTIONS

THE NEXT FEW QUESTIONS ARE ABOUT ALCOHOL CONSUMPTION

26. How often do you usually drink alcohol?

(Please tick **one** answer)

| | | |
|--|--------------------------|----|
| Every day or nearly every day. | <input type="checkbox"/> | 65 |
| 3 to 4 days each week. | <input type="checkbox"/> | 66 |
| 1 to 2 days each week. | <input type="checkbox"/> | 67 |
| 2 to 3 days a month. | <input type="checkbox"/> | 68 |
| About 1 day a month. | <input type="checkbox"/> | 69 |
| Never or hardly ever. | <input type="checkbox"/> | 70 |

27. What kind of alcohol do you drink?

(Please tick only the **one** you **mostly** drink)

| | | |
|-------------------------------|--------------------------|----|
| Beer. | <input type="checkbox"/> | 71 |
| Low alcohol beer. | <input type="checkbox"/> | 72 |
| Wine. | <input type="checkbox"/> | 73 |
| Spirits (whisky etc). | <input type="checkbox"/> | 74 |

Other (please write it here) _____

75

| | | |
|-----------------|--------------------------|---|
| Office use only | <input type="checkbox"/> | 1 |
|-----------------|--------------------------|---|

28. On the days that you drink alcohol, how many drinks do you usually have? (Please tick **one** answer)

| | | |
|--------------------------|--------------------------|---|
| One to two. | <input type="checkbox"/> | 2 |
| Three to four. | <input type="checkbox"/> | 3 |
| Five to six. | <input type="checkbox"/> | 4 |
| Seven to eight. | <input type="checkbox"/> | 5 |
| More than eight. | <input type="checkbox"/> | 6 |

COT DEATH QUESTIONS

THE FOLLOWING QUESTIONS WILL HELP US INVESTIGATE THE CAUSES OF SUDDEN INFANT DEATH SYNDROME (COT DEATH).

29. How many **children** have you ever had? (Please include children from all marriages and relationships but **do not** include adopted children or step children.)

| | |
|---|---|
| | |
| 7 | 8 |

IF YOU HAVE HAD NO CHILDREN, FINISH HERE.

30. Did any of your children die between the ages of one week and two years? (Please tick)

| | | |
|----------|--------------------------|----|
| Yes..... | <input type="checkbox"/> | 9 |
| No..... | <input type="checkbox"/> | 10 |

30a. How many of these deaths were called 'cot death'?

| | |
|----|----|
| | |
| 11 | 12 |

31. Were any of your children found almost dead without obvious cause and later revived?

| | | |
|----------|--------------------------|----|
| Yes..... | <input type="checkbox"/> | 13 |
| No..... | <input type="checkbox"/> | 14 |

31a. If yes, how many of your children did this happen to?

| | |
|----|----|
| | |
| 15 | 16 |

32. How many **grandchildren** have you ever had?

| | |
|----|----|
| | |
| 17 | 18 |

IF YOU HAVE HAD NO GRANDCHILDREN, FINISH HERE.

33. Did any of your grandchildren die between the ages of one week and two years? (Please tick)

| | | |
|----------|--------------------------|----|
| Yes..... | <input type="checkbox"/> | 19 |
| No..... | <input type="checkbox"/> | 20 |

33a. How many of these deaths were called 'cot death'?

| | |
|----|----|
| | |
| 21 | 22 |

34. Have any of your grandchildren been found almost dead without obvious cause and later revived?

| | | |
|----------|--------------------------|----|
| Yes..... | <input type="checkbox"/> | 23 |
| No..... | <input type="checkbox"/> | 24 |

34a. If yes, how many of your grandchildren did this happen to?

| | |
|----|----|
| | |
| 25 | 26 |

THANKYOU FOR FILLING IN THIS QUESTIONNAIRE. WE GREATLY APPRECIATE YOUR HELP WITH THIS PROJECT.