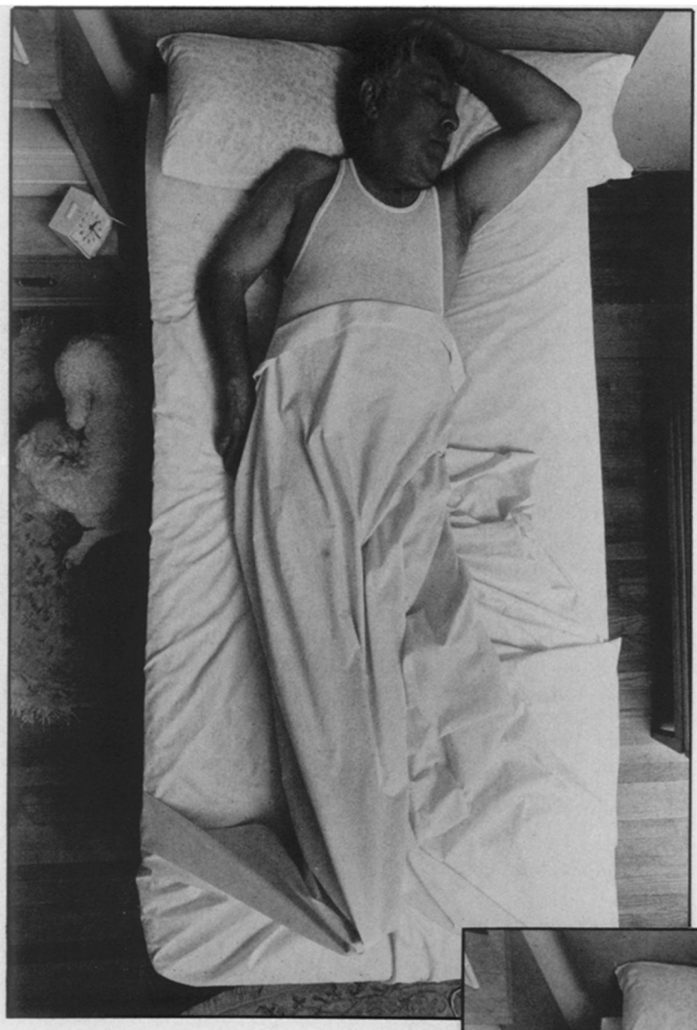
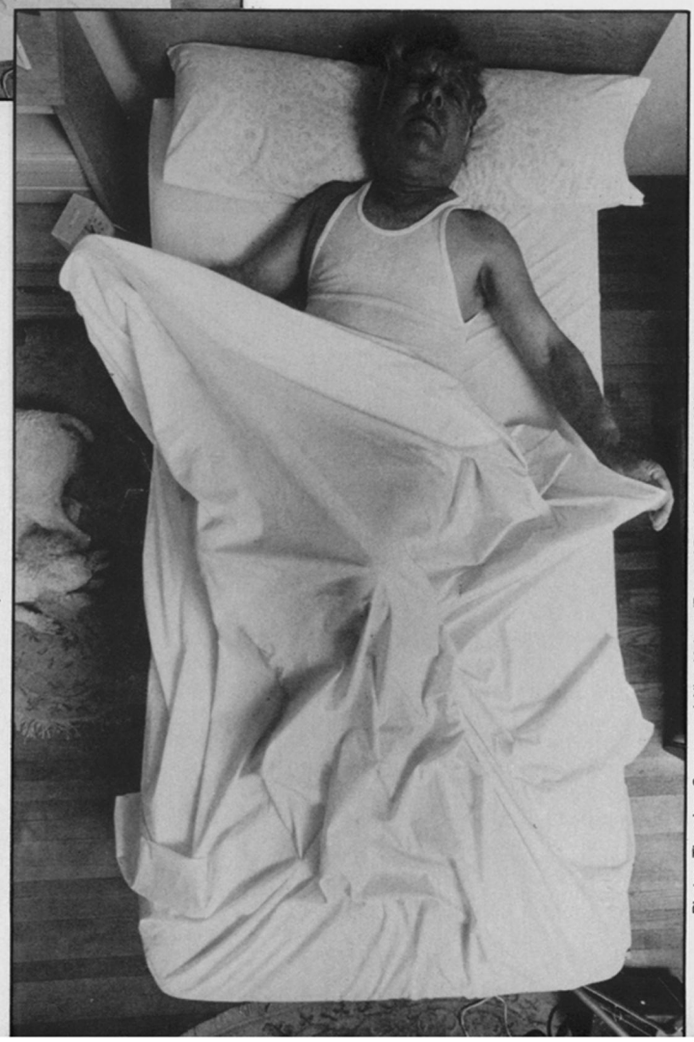


Time-lapse photographic studies of body position in sleep, such as the one shown here, are capable of distinguishing a poor night's sleep from a good one. Increased incidence of disturbed sleep patterns has been observed in older persons.

The Aging of Sleep



Photos: Theodore Spagna and Allan Hobson/Dept. of Psychiatry, Harvard Medical School

For an unknown number of the elderly, sleep is anything but graceful. It may grow dangerously erratic — causing illness, perhaps even death.

BY JOEL GREENBERG

According to Wilse Webb's "Save Your Ass Theory," sleep is "an evolutionary, adaptive relationship between the environment of the organism and the organism" — i.e., people and certain animals sleep when and as long as they do because at some point in their development that schedule meant the difference between life and death. "All those humanoids who stayed in caves when it was most dangerous and least effective to be out hunting — at night — survived," says Webb, a psychologist at the University of Florida. Similarly, sheep, cattle and goats sleep only two to four hours a day because those who lingered behind the rest of the group faced the prospect of becoming some other animal's dinner.

Whether or not it is indeed a by-product of the survival instinct, there is growing indication that sleep may be a crucial mechanism in survival's antithesis — death. Particularly among the elderly, the

impact of sleep patterns upon illness and death processes may be profound. And although the study of sleep in older persons is just in its infancy, researchers believe there are already indications pointing to such a sleep-illness-death link. "Sleep by its nature is a period of severe risk for the organism," says William C. Dement, director of the sleep research center at Stanford University. Dement feels there may even exist a "sudden adult death syndrome" that could be the primary instrument of death in some cases among the elderly.

Such informal, provocative hypotheses kept most participants awake at a recent gathering of 23 sleep researchers at the National Institute on Aging (NIA) in Bethesda, Md. (However, Webb did note that nine persons nodded off at various times during the first day of the two-day workshop.) Though the meeting was primarily a brainstorming session designed to lay the groundwork for future studies on sleep and aging, the discussion was based on an expanding, if still preliminary, body of research results.

"So many people in thei' middle and late years have sleep problems," says NIA Director Robert N. Butler. "Through the study of sleep and sleep pathology there may be some clues about organic brain damage as well as fundamental central nervous system information in the elderly." A comprehensive review of research thus far — compiled for the workshop from published and unpublished studies throughout the world — points to a number of correlations between sleep patterns and aging.

Some of the most striking data come from an American Cancer Society (ACS) six-year follow up of more than one million Americans in the 1960s. Although primarily designed to pinpoint certain antecedents of cancer, the study also yielded a number of previously unrecognized characteristics of sleep. It showed, for instance, that the elderly (older than 65) are more prone to short sleep (four to five hours or less a night) or to long sleep (nine to 10 hours or more) than the rest of the population. And throughout the large population sample this held true regardless of other disease or illnesses that were present, according to Daniel F. Kripke of the Veterans Administration Hospital in San Diego.

But what particularly stunned Kripke and others analyzing the data was an 80 percent increase in mortality among those who slept for extremely long nightly periods over death rates for average and short-length sleepers. Moreover, although only four percent of all those in the sample who died slept longer or shorter than average, about 75 percent of the over-65 deaths correlated with long or short sleep. And even those who slept just one hour more or less than the average of seven to 7.9 hours nightly were more likely to die, according to Kripke.

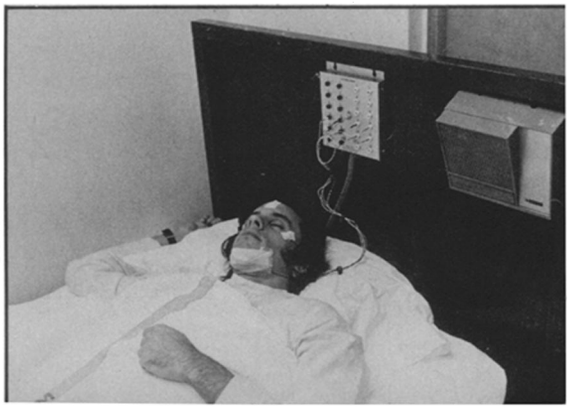
Even though the results contain no data on specific causes of death, the strong correlations between death and "pathological sleep" — especially over such a large sample — warrant further examination, the scientists agree. "No question, there's a powerful relationship between how long you report you sleep and mortality," says Allan Rechtschaffen of the University of Chicago department of psychiatry. "The question now is 'why.' We have to look at how illness affects sleep, how sleep affects illness and how sleep affects recovery from illness." And despite some long-held popular beliefs about bed rest, "We still don't have any evidence that sleep helps recovery from illness," Rechtschaffen says.

Evidence that does exist from the ACS and other studies on sleep and aging, includes:

- Persons who use sleeping pills often were 50 percent more likely to die within the six-year period of the ACS study. "This does not prove that sleeping pills increase your chances of death," Kripke says. "But it certainly raises the question. We do not know the long-term effects of these drugs," he cautions.
- Persons over 65 average 13 prescriptions a year; the institutionalized elderly are on 6.1 drugs at any one time, according to NIA Director Butler.
- The fear of death among the elderly seems related to sleep problems, Butler says. Forty-five percent deny death or are extremely anxious about it, but at the same time "there is a great desire to die in one's sleep" rather than while awake, he says.
- Complaints of sleep problems appear to increase with age.
- Heart disease, stroke, cancer and suicide increases have all been correlated with patterns of extremely long or short nightly sleep.
- The incidence of waking from sleep during the night increases sharply with age. This is a prominent characteristic among the elderly, even in the "healthy, active, working" women studied by Webb at the University of Florida. While most reported little difficulty in falling asleep initially, 44 percent of the women described their nightly sleep as "light." A study by Harold Zepelin, a psychologist at Oakland University in Rochester, Minn., indicates that older people are more susceptible to awakening during the first two-thirds of the night than at other times. Other studies suggest that stage 4 or "slow wave" sleep declines with age in males.
- Increased numbers of bathroom expeditions to urinate seem to contribute to the high incidence of awakenings, Zepelin says. (This report prompted John Lacey of the Fels Research Institute in Yellow Springs, Ohio, to comment: "I'm surprised you didn't mention the 'P value.'")
- While elderly females show comparatively little of the stage 4 slow wave decrease seen in males, they do exhibit erratic sleep patterns in the REM (rapid eye movement) and third (high electroencephalograph voltage and slow, delta waves) stages.
- Brain blood flow, particularly in the brain stem and midbrain, appears to increase in pressure in volume during sleep, primarily in the REM stage. Other data suggest that blood flow decreases in stage 2, a relatively low EEG voltage stage, characterized by intermittent, short sequences of waves.
- A "striking drop" in the levels of brain neurotransmitters norepinephrin and epinephrin was found during REM and stages 3 and 4 in a study of "healthy old men" by Patricia Prinz of the University of Washington in Seattle. "This is the opposite of what I expected," says Prinz, who also reported "wide swings in heart beat and respiration during REM."
- Snoring also seems to be more widespread among the aged, especially in women. Preliminary data indicate that heavy snoring may be a predictor of hypertension and heart disease, and that sleeping pills may contribute to converting snores to more serious problems of sleep apnea (temporary cessation of breathing). "Snoring in the elderly is not just a laughing matter," says Elliot A. Philipson of the University of Toronto.

Of all the potential causes of death directly related to sleep, apnea appears the most likely suspect. Also implicated as a cause of sudden infant death (SN: 4/15/78, p. 234), apnea is seen with growing frequency among those older than 65. "Sleep apnea clearly gets worse with age and clearly can be a cause of death by the time a man [or woman] reaches 65," says Elliot Weitzman, director of the Sleep-Wake Disorders Unit at Montefiore Hospital and Medical Center in New York City. "We've had people referred to us [diagnosed] as

EEG of brain waves reflects sleep quality.



Stanford Univ. Medical Center

presenile dementia that turned out to have severe sleep apnea."

Philipson, who is conducting a variety of metabolic and biological investigations of sleep in the elderly, says that "breathing during sleep may be serving very different functions than when a person is awake ... the control systems — metabolic and behavioral — may be quite different." Arousal from sleep, a frequent occurrence among the elderly, "can have a profound influence on breathing," Philipson says. "We know that the elderly person has less oxygen pressure and therefore is vulnerable to hypoxemia [deficient blood oxygenation] during sleep." If a person's arousal response is impaired — as studies suggest it may be in the aged — "then they are less apt to wake up" during a threat to respiration, he says. "This can cause severe hypoxia, which could aggravate other medical conditions and maybe [result in] death during sleep," Philipson suggests.

Such risks may well be compounded by the wide use of prescription drugs among the elderly, says Dement. "The situation of prescribing drugs to the elderly is abominable," he says. "Hypnotics unquestionably depress respiration — this could be one of the most important points. [Doctors] assume that most of these people will take these drugs for the rest of their lives ... the drugs may actually shorten that life." More than 12 million prescriptions a year are written for Flurazepam, a sleeping agent with the brand name of Dalmane. "We have to know whether that drug shortens or prolongs life," says Kripke.

There are other sleep disturbances — insomnia, excessive daytime sleepiness or narcolepsy, seizures, teeth grinding and circadian rhythm fluctuations — that appear more frequently with age. But Webb cautions there is a critical difference between abnormalities and natural changes — not necessarily unhealthy — that simply result from old age. "We don't want to overtreat 'benign insomnia,' " he says, "if it's not affecting the rest of the person's waking life. A person may need some counseling to help cope with it, but that may be all."

Webb views the sleep changes among the aged as "a running down of a process. The change in sleep is akin to not being able to run the 100-yard dash as well as you could before," he says. He terms college-age persons — a group that makes up much of the sleep study volunteer population — "sleep athletes." As people get older, he suggests, "the sleep process becomes a little less athletic than it used to be."

The peak of healthy, deep sleep seems to occur in early adolescence, when "sleep has all the beauty we like to ascribe to it — depth [and] big, slow waves," says Dement. When the youngster awakens, he or she is "totally awake ... bounding around for 16 hours." From that point on, the sleep structure gradually erodes. "We see a deterioration even from 12 to 16 years old," says Ismet Karacen of the V.A. Hospital in Houston.

Still, the conglomeration of study results points to an increase in pathological problems in the elderly beyond the by-products of natural aging. "A perfectly normal pulmonary system can show itself to be dysfunctional in sleep," Webb says. "It is conceivable," he says, that some aspects of sleep might constitute a cause of death, particularly among older persons. "Some people sleep considerably more or less [after 65] than they did at an earlier age," he says. The psychologist, though, says he is not overly concerned about persons who sleep one or even two hours more or less than the 7-and-a-half-hour mean sleep time. It's those who sleep more than 10 and one-half hours or less than 4 and one-half hours that he terms "pathological — probably due to a biochemical alteration or CNS disorder."

One external factor that might transform a merely eccentric sleeper into a pathological one is a highly structured sleeping schedule such as those employed in many nursing homes — where five percent of all the elderly reside, but 25 percent die. "Many nursing homes operate on strange schedules, primarily for the convenience of scheduling work shifts," Zepelin says. "The patients may get up at 4 or 5 a.m., have breakfast at 6, lunch at 10 and supper at 4 or 5 p.m." Add to that the wide use of hypnotic drugs and the lack of activity programs, and the nursing home resident may actually be a somewhat higher risk for sleep-related problems than if he or she were living elsewhere, he says. Weitzman reports that nightmarish intersections of all these negative aspects of nursing homes have resulted in a syndrome "where a patient is eating, falls asleep and asphyxiates when the food clogs the trachea .... I know this has happened," he says.

In its preliminary recommendations, the workshop group calls for studies of "bizarre sleep-wake schedules in nursing homes" as part of a wide range of behavioral, biological, metabolic and epidemiological studies on sleep and aging. "During sleep we may have some of the most dangerous threats to the organism and the brain," says Rechtschaffen. "Poor sleep among the aged may be a sign of the brain's growing failure to react to these challenges."

Dement speculates that one eventually might be able to predict death — and try to prevent it — through sophisticated measurements of cerebral blood flow, cardiac function, metabolism and other interconnected mechanisms during sleep as well as wakefulness. "[Sleep's] mechanisms are crucially situated in the brain stem," he says.

"Sleep and waking behavior change with age — we have to find out the cause and effect." Dement says. "We know that disturbed sleep can produce a hell on earth." □