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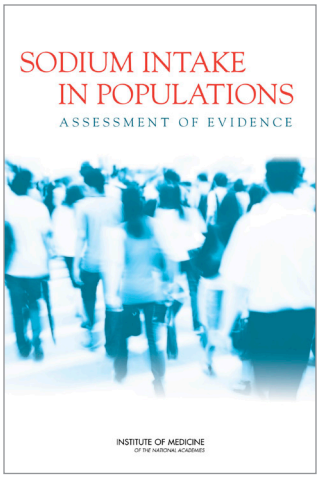
Sodium Intake in Populations
Assessment of Evidence



Despite public health efforts over the past several decades to encourage people in the United States to consume less sodium, adults still consume an average of 3,400 mg/day, well above the current federal guideline of less than 2,300 mg daily. Evidence has shown that reducing sodium intake reduces blood pressure and the risk for cardiovascular disease (CVD) and stroke. Some recent research, however, suggests that sodium intakes that are low may also increase health risks—particularly in certain groups.

Against the backdrop of questions about whether sodium reduction in the population increases risk of adverse health outcomes, the Centers for Disease Control and Prevention (CDC) asked the Institute of Medicine (IOM) to examine the designs, methodologies, and conclusions in this latest body of research on dietary sodium intake and health outcomes in the general U.S. population and among individuals with hypertension; pre-hypertension; those 51 years of age and older; African Americans; and those with diabetes, chronic kidney disease, and congestive heart failure. The committee also was asked to comment on the implications of this new evidence for population-based strategies to gradually reduce sodium intake and to identify gaps in data and research and suggest ways to address them.

The CDC asked the IOM to examine the designs, methodologies, and conclusions in the latest body of research on dietary sodium intake and health outcomes.

The committee presents its findings and recommendations in *Sodium Intake in Populations: Assessment of Evidence*.

Direct Focus on Health Outcomes

Concerns about the health risks of dietary sodium are based primarily on a substantial body of research that links excessive sodium intake to high blood

pressure, a widely accepted biological predictor of risk for CVD and stroke. Based on this research, the Department of Health and Human Services and the Department of Agriculture developed the *2010 Dietary Guidelines for Americans,* which include a goal of reducing dietary sodium intake to less than 2,300 milligrams per day for the general population, and further reducing intake to 1,500 mg/day among certain large population subgroups who may be at higher risk:

- African Americans
- people 51 years of age and older
- people who have hypertension, diabetes, or chronic kidney disease

But a number of recent studies have looked at the direct effects of sodium on health outcomes, not just blood pressure as an indicator of risk. These studies on direct health outcomes were the primary focus of the IOM committee. Specifically, the committee was asked to review and assess the study designs, methodological approaches, and conclusions about studies on sodium intake linked to direct health outcomes in the population generally, as well as for the subgroups listed above.

The committee finds that the new studies are not consistent in their methodological approaches to measuring sodium intake and that they have many limitations related to the quality of those measures and the quantity of available evidence assessing sodium intake and health outcomes. The range of limitations included over- or under-reporting intake levels and incomplete collection of urine samples—which are a way of determining sodium intake based on excretion. Among other problems, variability in the way the data were collected limited the committee's ability to make comparisons across studies. Because of the number and variety of limitations in all of the studies the committee reviewed, it assessed each study based on its own merits.

Despite such limitations however, the committee concludes that the evidence supports a positive relationship between higher levels of sodium intake and risk of CVD. This is consistent with existing evidence on blood pressure as a surrogate indicator of CVD and stroke risk for the general population. The committee also concludes that studies on health outcomes are inconsistent in quality and insufficient in quantity to determine that sodium intakes below 2,300 mg/day either increase or decrease the risk of heart disease, stroke, or all-cause mortality in the general U.S. population.

For population subgroups, some studies indicate that low sodium intake may lead to greater risk of adverse health effects in patients who have a diagnosis of moderate or severe congestive heart failure and are receiving certain aggressive therapeutic treatments. The committee found no evidence for benefit and some evidence suggesting risk of adverse health outcomes associated with sodium intake levels in ranges approximately 1,500 to 2,300 mg/day among those with diabetes, kidney disease, or CVD. Further, the evidence on both the benefit and harm is not strong enough to indicate that these subgroups should be treated differently than the general U.S. population. Thus, the evidence on direct health outcomes does not support recommendations to lower sodium intake within these subgroups to or even below 1,500 mg/day.

Implications for population-based strategies

With regard to implications for population-based efforts, the committee finds that:

- The available evidence on associations between sodium intake and direct health outcomes is consistent with population-based efforts to lower excessive dietary sodium intakes.
- The evidence on health outcomes is not consistent with efforts that encourage lowering of dietary sodium in the general population to 1,500 mg/day.

The committee's report provides additional insight concerning the nation's efforts to stem the health effects of high dietary sodium intake, based on newer types of studies focused directly on health outcomes.

- There is no evidence on health outcomes to support treating population subgroups differently from the general U.S. population.

Charting a research agenda

The committee identifies a number of data and methodological gaps in the studies it reviewed—especially among population subgroups—which can guide future research. For example, there is a need for standardized methodological approaches to measure sodium intake, as current methods make comparisons across studies difficult. Methods also are needed that account for confounding factors in dietary studies, including the influence of total daily caloric intake on observational associations between sodium and health outcomes.

The committee concludes that more randomized controlled trials will be needed, as these represent the highest quality study design for determining the effect of sodium on health outcomes. Clinical trials might focus on examining the effects of a range of sodium levels on risk of cardiovascular events, stroke, and mortality among patients in controlled environments. This may be more feasible among individuals as part of natural experiments, such as those in other countries where policies affecting sodium consumption are in effect. Such trials may be especially important among higher-risk subgroups, including African Americans and adults 51 years of age and older, because less rigorous observational studies in these populations may be more prone to errors and provide less robust results.

The committee also identifies a need for studies to collect and re-analyze data from existing clinical trials that were designed to evaluate sodium and health, as well as data during extended follow-up periods after the completion of a clinical trial to identify health outcomes.

Conclusion

The committee's report provides additional insight concerning the nation's efforts to stem the health effects of high dietary sodium intake, based on newer types of studies focused directly on health outcomes. The new studies support current efforts to reduce excessive sodium intake in order to lower risk of heart disease and stroke. However, the evidence on health outcomes is not consistent with efforts that encourage lowerng of dietary sodium in the general population to 1,500 mg/day. Further research may shed more light on the association between lower—1,500 to 2,300 mg—levels of sodium and health outcomes.

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