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PROJECTING LONG-TERM IMPACT OF MODEST SODIUM REDUCTION IN LOS ANGELES COUNTY

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ABSTRACT

Heart attacks and strokes are the leading causes of death in Los Angeles County (LAC). Dietary sodium reduction policies may reduce the risk for heart disease and stroke. To determine the value of population-level sodium reduction policies in LAC in terms of averted morbidity, mortality, and total medical spending, we modeled a modest sodium consumption reduction scenario of 400 mg/day using the Future Elderly Model-Los Angeles (FEM-LA), a Monte Carlo microsimulation model that projects health and economic outcomes for all LAC residents aged 51 and older. The model projects that, over the period 2006-2051, 3,224-5,353 total deaths (annual average of 70-116 deaths) would be prevented due to reductions in the incidence of heart disease and stroke attributed to dietary salt reduction. Over the same period, this corresponds to a total savings of $2.28-3.56 billion in medical spending (annual average of $49.56-77.37 million).

1 INTRODUCTION

Reducing salt consumption lowers blood pressure and reduces the risk for hypertension, heart disease, and stroke (Appel et al. 2011; Cook et al. 2007; He and MacGregor 2003; Strazzullo et al. 2009). Thus, policies addressing food environment to reduce salt consumption at the population level are important in the United States and Los Angeles County (LAC) in particular, where 48% of adults 45-64 years old and 65% of adults over 65 years old have been diagnosed with hypertension (National Center for Health Statistics 2005), and heart attacks and stroke remain leading causes of death (Office of Health Assessment and Epidemiology 2010). High levels of hypertension, heart disease, and stroke create serious cost implications in terms of medical spending and productivity losses.

To determine the potential value of population-level sodium consumption reduction policies in LAC in terms of averted morbidity, mortality, and total medical spending, we modeled a modest sodium reduction scenario of 400 mg/day (equivalent to salt intake reduction of 1g/day) using the Future Elderly Model-Los Angeles (FEM-LA), a Monte Carlo microsimulation that projects health and economic outcomes for all LAC residents aged 51 and older. We also present results for an alternative, less modest sodium reduction scenario of 1200 mg/day (equivalent to salt intake reduction of 3g/day) as a basis of comparison to the modest sodium reduction scenario outcomes and to establish an upper bound for the value of sodium reduction programs in LAC.

Although clinical trials have shown the benefits of reducing sodium consumption on blood pressure, prospective studies to determine the medical savings achievable in the long term are not feasible due to complexities inherent to study design and prohibitive costs. Simulation models can fill in this role, and indeed previous studies have used simulation to estimate the societal impact of sodium reduction. Palar and Sturm (2009) Palar and Sturm (2009) used a simulation on the Stata platform to determine potential societal savings due to reduction of hypertension attributed to sodium reduction. Bibbins-Domingo et al. (2010) Bibbins-Domingo et al. (2010) used a Coronary Heart Disease (CHD) policy model to evaluate the benefits of population-wide dietary salt reduction of up to 3 gm/day. Dall et al. (2009) Dall et al. (2009) used the Nutrition Impact Model to simulate disease prevalence and medical expenditures under hypothetical 400 mg/day sodium reduction in those with uncontrolled hypertension.

In these previous studies, however, only disease prevalence and medical expenditures related to hypertension and cardiovascular diseases were modeled. Thus, while these models capture the reduction in medical expenditures due to prevented cardiovascular diseases, they do not capture the competing risks that arise from these prevented diseases. For instance, in the case of sodium reduction, an individual might have his heart disease - and death and medical costs due to heart disease – averted; however, he might develop other diseases such as cancer or diabetes in his remaining years of life and incur medical costs due to these other diseases, which potentially can be more costly than medical costs attributed to the heart disease. FEM-LA models the disease prevalence and medical expenditures of three other major diseases other than cardiovascular-related diseases (hypertension, heart disease, and stroke): cancer, diabetes, and lung disease. Thus, the simulation model captures competing risks and the estimates of savings in total medical spending in our results reflect the trade-offs that occur from reducing rates of heart disease and stroke due to the sodium reduction.

In addition, all these previous studies quantified the value of sodium reduction at the national, not local, level. As many policies are developed and implemented at the local level, which might have a significantly different demographics from the US, there is value in quantifying the reduction in mortality and costs of sodium reduction at the local level, such as at the level of Los Angeles County. Quantification of these savings would also help determine the upper bound of sodium reduction program costs for the programs to remain cost-effective in Los Angeles County.

2 METHODS

2.1 Simulation Model Used: FEM-LA

FEM-LA is an adaptation of the Future Elderly Model (FEM) for Los Angeles County. The future elderly model (FEM) is an economic-demographic Monte Carlo microsimulation developed over the last decade by researchers with funding from the Centers for Medicare and Medicaid Services, the National Institute on Aging, the Department of Labor, and the MacArthur Foundation (Goldman 2012).

The FEM projects health and economic outcomes for all Americans aged 51 and older and uses the Health and Retirement Study (HRS) as a host dataset (Goldman 2012). This data is supplemented with Social Security histories and data on health trends and health care costs from National Health Interview Survey (NHIS), Medicare Current Beneficiary Survey (MCBS), and the Medical Expenditure Panel Survey (MEPS). FEM and FEM-LA are written in Stata and C++.

FEM has been used to study various topics, including disability trends (Chernew et al. 2005), changes in care delivery and medical innovation (Goldman et al. 2005; Lakdawalla et al. 2009), and understanding trends and risk reductions in specific diseases (Bhattacharya et al. 2005) (Goldman et al. 2006b; Goldman et al. 2009) (Lakdawalla et al. 2005) or general population health (Goldman et al. 2006a) (Goldman et al. 2010).

Figure 1 provides a schematic overview of the model. Simulations start in 2004 with an initial population aged 51+ taken from the HRS. The model then predicts outcomes using the estimated transition probabilities. Those who survive remain in the model through the end of that 2-year cycle, at which point the model calculates policy outcomes for the period. The model then moves to the following 2-year period, when a new cohort of 51 and 52 year-olds enters, forming the new age 51+ population stock, which then proceeds through the transition model as before. This process is repeated until the final year of the simulation is reached. The user can specify the end year of the simulation.

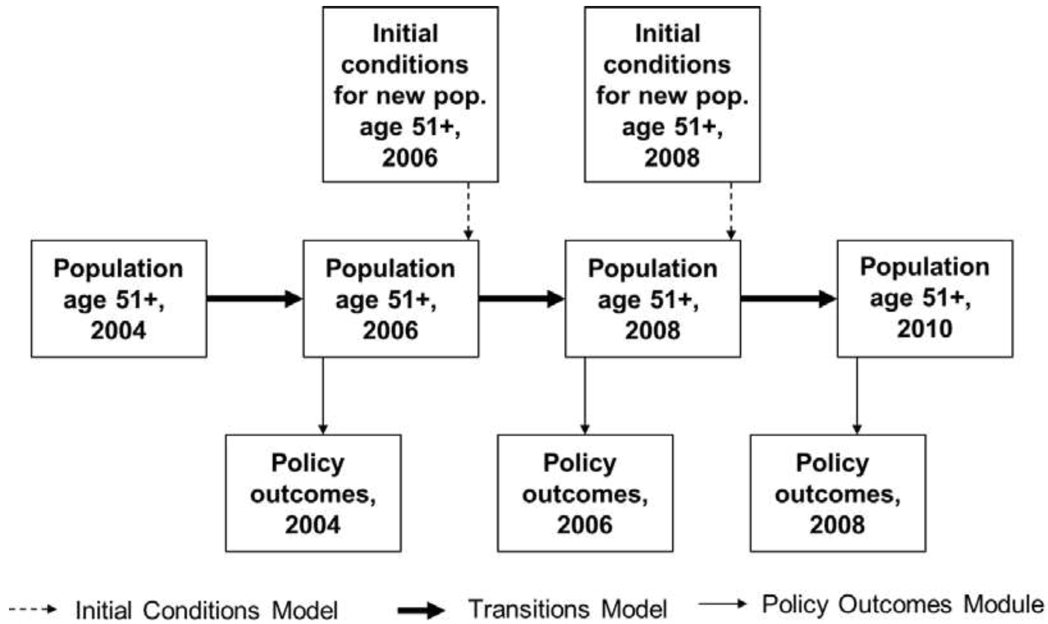

Figure 1: Architecture of FEM.

The FEM model structure has been described in more detail elsewhere (Goldman 2012). We will describe some salient features here. The model has three core components: the initial cohort module, the transition module, and the policy outcome module.

The initial conditions module predicts the economic and health outcomes of new cohorts of 51/52 year-olds. This module takes in data from the Health and Retirement Study (HRS) and trends calculated from other sources. Initial conditions of simulated cohorts are estimated using information about how the mean of the marginal distribution is changing over time and the joint distribution of all variables at a point in time. Correlations between variables are held constant while the mean of the marginal distributions are allowed to change. Health trends in the simulated cohorts are calibrated to meet prevailing health trends in published data or other sources. The estimated outcomes in the initial conditions module are shown in Table 1.

The transition module calculates the probabilities of transiting between various health states and financial outcomes. The module takes as inputs risk factors such as smoking, weight, age and education, along with lagged health and financial states. The transition probabilities are estimated from the longitudinal data in the Health and Retirement Study (HRS) using the maximum likelihood method. The estimated outcomes in the transition module are shown in Table 2.

The policy outcomes module aggregates projections of individual-level outcomes into policy outcomes such as taxes, medical care costs, pension benefits paid, and disability benefits. This component takes account of public and private program rules to the extent allowed by the available outcomes.

Table 1: Estimated outcomes in initial conditions model.

Economic Outcomes	**Health Outcomes**
Employment	Hypertension
Earnings	Heart Disease

Wealth	Self Reported Health
Defined Contribution Pension Wealth	BMI Status
Pension Plan Type	Smoking Status
AIME	Functional Status
Social Security Quarters of Coverage	
Health Insurance	

Table 2: Estimated outcomes in/from transition model.

Economic Outcomes	**Health Outcomes**	**Other Outcomes**
Employment	Death	Income Tax Revenue
Earnings	Heart Disease	Social Security Revenue
Wealth	Stroke	Medicare Revenue
Demographics	Cancer	Medical Expenses
Health Insurance	Hypertension	Medicare Part A Expenses
Disability Insurance Claim	Diabetes	Medicare Part B Expenses
Defined Benefit Claim	Lung Disease	Social Security Outlays
SSI Claim	Nursing Home	
Social Security Claim	BMI Status	
	Smoking Status	
	Functional Status	

To adapt the national FEM to Los Angeles County, the stock population and the incoming cohorts are weighted, and the demographics trends calibrated, to reflect the demographics of Los Angeles County. This process used population projections from the California Department of Finance, mortality records from the Los Angeles County Department of Public Health, and immigration/emigration projections from the University of Southern California's Price School. Thus, the original FEM-LA population of age 51 and older resembles the current demographic characteristics of Los Angeles County, and the characteristics of future new cohorts of age 51-52 are based on long-term LAC demographic trends. The data sources for FEM-LA are listed in Table 3. Costs are estimated annually based on demographics, economic status, current health, risk factors, and functional status using pooled weighted least squares regressions from MEPS and MCBS.

Table 3: Data sources for FEM-LA and their uses in FEM-LA.

Data Source	**Use**
Health and Retirement Study (HRS)	Estimation of the transition model.
Social Security Covered Earnings files	Estimation of individual earnings histories. (Subsample of HRS)
California Department of Finance	Reweighting of national population to Los Angeles County population Birth projections
Los Angeles Department of Public Health Birth and Death Records	Calibration of mortality trends
National Health Interview Survey (NHIS)	Projection of health trends for incoming cohorts.
Medical Expenditure Panel Survey (MEPS)	Estimation of medical costs for non-elderly (<65 y.o.) individuals.
Medicare Current Beneficiary Survey (MCBS)	Estimation of medical costs for elderly (>65 y.o.) individuals.

Expert opinion (Dowell Myers from USC Price School)	Immigration and emigration projections.
Parameters from the literature	Projection of smoking, obesity, and economic trends for incoming cohorts.

2.2 Sodium Reduction Scenario And Parameters

We use the FEM-LA to estimate the value of a modest sodium reduction initiative among the 51-and-older population in LAC by comparing the status quo scenario with scenarios in which dietary salt consumption is reduced by 1 g per day (i.e. a reduction of 400 mg of sodium) throughout the period 2006-2051. This analysis estimated the change in morbidity, mortality, and total medical spending expected from a reduction in population-level sodium intake that is driven by simulated changes in the incidences of heart disease and stroke.

We use Bibbins-Domingo's projected estimates of annual reductions in incidence of CHD and stroke (Bibbins-Domingo et al. 2010)(Bibbins-Domingo et al. 2010) due to a dietary salt reduction of 1 g per day as input into the simulation to simulate the effect of the sodium reduction on long-term health and economic outcomes. Bibbins-Domingo provides two estimates (low estimates and high estimates) for the reduction in incidence of heart disease and stroke due to the dietary salt reduction. The low estimates are derived from a meta-analysis on sodium reduction and the high estimates are derived from clinical trials data and are provided in Table 4. Separate estimates are used for blacks and non-blacks in the simulation.

We first run a baseline scenario reflecting current health and demographic trends in LAC. We then run two scenarios corresponding to dietary salt reduction of 1g/day, one with the low estimates of annual reduction of incident heart disease and stroke applied to establish the lower bound of long-term impact of the sodium reduction in the 51 years old and older population in Los Angeles County, and one with the high estimates applied to establish the upper bound.

We then compare the results of the low and high estimate scenarios corresponding to dietary salt reduction of 1g/day with the baseline scenario results to establish a range of the impact of the dietary salt reduction in Los Angeles County.

All simulations are run for 100 iterations. From previous experiments with the simulation, this is the number of iterations for which the simulation results are relatively stable (i.e. running additional iterations do not change the results significantly) while still keeping the run duration of the simulation reasonable.

Table 4: Bibbins-Domingo estimated reduction in heart disease and stroke incidence due to a daily 1g dietary salt reduction.

	Annual % change in incident heart disease		**Annual % change in incident stroke**	
	Low estimate	High estimate	Low estimate	High estimate
Non-black	-2.1	-3.4	-1.7	-2.7
Black	-3.4	-5.6	-2.6	-4.3

2.3 Sensitivity Analysis

The scenario above assumes a perfect (100%) uptake of the sodium reduction initiatives in the population; that is, that every LAC resident age 51+ in the simulation reduce their sodium intake. This gives an upper bound of the value of potentially achievable sodium reduction initiatives in LAC. However, it is useful to have projections of more realistic scenarios with regards to uptake of sodium reduction initiatives. As there is uncertainty in the eventual uptake of sodium reduction policies in the simulation, here, we repeat the scenario explained in section 2.2 above for two different levels of uptake: low uptake (50% of the population in the simulation changed their behavior and reduced their sodium intake by 1 g), and moderate uptake (75% of the population in the simulation reduced their sodium intake by 1g).

2.4 Alternative Sodium Reduction Scenario

To form a basis of comparison to the results of the modest sodium reduction initiative, we also use the FEM-LA to estimate the value of a not-so-modest sodium reduction initiative among the 51-and-older population in LAC by comparing the status quo scenario with scenarios in which dietary salt consumption is reduced by 3 g per day (i.e. a reduction of 1200 mg of sodium) throughout the period 2006-2051. As before, we use Bibbins-Domingo's projected estimates of annual reductions in incidence of CHD and stroke (Bibbins-Domingo et al. 2010) due to a dietary salt reduction of 3 g per day as simulation input.

Table 5: Bibbins-Domingo estimated reduction in heart disease and stroke incidence due to a daily 3g dietary salt reduction.

	Annual % change in incident heart disease		**Annual % change in incident stroke**	
	Low estimate	High estimate	Low estimate	High estimate
Non-black	-4.3	-7.0	-2.2	-3.4
Black	-4.7	-8.3	-4.2	-6.7

3 RESULTS

3.1 Main Simulation

Detailed results by year of simulation are shown in appendices A and B (appendix A showing the health outcomes, and appendix B showing the economic outcomes). Table 6 below shows a summary of the results.

Table 6: Number of cases of heart disease, stroke, and deaths averted due to a reduction of 1g/day in dietary salt intake, and the corresponding savings in total medical spending.

	Averted cases of heart disease	**Averted cases of stroke**	**Averted deaths**	**Savings in total medical spending**
Annual average	1,381-2,242	575-931	70-116	$49.56-77.37 million
Cumulative (2006-2051)	63,515-103,134	26,467-42,808	3,224-5,353	$2.28-3.56 billion

The model projects that, over the period 2006-2051, a total of 63,515-103,134 incident cases of heart disease could be averted among the 51 years old and older population in Los Angeles County due to a decrease in incidence of heart disease of 2.1%-3.4%; this corresponds to an average of 1,381-2,242 new cases of heart disease averted per year. A total of 26,467-42,808 incident cases of stroke are averted in these simulations, corresponding to an annual decrease in incidence of stroke of 1.8%-2.8%; this corresponds to an average of 575-931 cases of new stroke averted per year.

In the same period, a total of 3,224-5,353 deaths were averted among the 51 years old and older population in Los Angeles County due to the reductions in incidence of heart disease and stroke attributed to a reduction of 1g/day in dietary salt intake, with an average of 70-116 deaths averted annually. Over the same period, this corresponds to a total savings of $2.28-3.56 billion dollar in total medical spending (average of $49.56-77.37 million dollar in savings annually).

A modest reduction in salt intake in the ages 51 and older population results in reduction in mortality and substantial savings in total medical spending in Los Angeles County. Thus, annual programmatic spending for sodium reduction initiatives below the projected savings in total medical spending of $49.56-77.37 million may be a cost-beneficial investment for the County.

3.2 Sensitivity Analysis

The results for a 1g/day reduction of dietary salt intake reduction with a 50% and 75% population uptake are shown in Appendix C. The estimated number of averted disease cases, deaths, and savings in medical spending are roughly proportional to the fraction of the population who change their sodium intake. Even if only 50% of the population age 51+ reduce their sodium intake, the average annual savings in medical spending is still relatively substantial at $23.73-38.10 million.

3.3 Alternative Sodium Reduction Scenario

The results for a 3g/day reduction of dietary salt intake reduction are shown in Appendix D. Annually, an average of 2,882-4,778 cases of heart disease, 783-1226 cases of stroke, and 134-219 deaths are estimated to be averted. This corresponds to average annual savings in total medical spending of $82-136 million, about 70% more than the average annual savings in total medical spending corresponding to the 1g/day reduction of dietary salt intake scenario.

4 DISCUSSION

Even though the simulation used in this study, the FEM-LA, only includes LA residents ages 51 and older, the simulation still captures the bulk of averted morbidity and mortality in LAC as a whole, since heart disease and stroke generally occur in the older population.

The scenario of daily 400 mg sodium intake reduction reflects a modest reduction that is realistic and achievable in the population through a concerted effort of sodium reduction initiatives. For instance, since 2010, LAC has participated in the CDC Sodium Reduction in Communities Program and has developed a framework that focuses on increasing demand for lower- and low-sodium foods. One of the implementations is to increase the availability of low and lower sodium foods by implementing nutrition standards in government distributive meal programs, government departments with cafeterias, snack shops, and vending machines. The vending machine intervention alone reduces the average sodium level in a snack package sold in the vending machines by 168 mg (Source: internal LACDPH estimate). For a government employee who purchases one or two snack packages from the vending machine a day and a meal from the cafeteria, a daily sodium reduction of 400 mg is achievable (assuming no substitution effects whereby the employee increases his sodium intake elsewhere). If the value of such a modest sodium reduction is substantial, LAC should consider expanding the program to the general LAC population and reinforcing existing population-level sodium reduction programs. This may entail mandating a reduction of average sodium level in food sold in vending machines and restaurants county-wide. That said, to reduce the possible substitution effect, such programs are ideally implemented systems-wide, instituting sodium reduction in all processed and prepared food which form the bulk of sodium intake in Americans' diets, although this might not be achievable in reality.

Our results are consistent to previous studies (Bibbins-Domingo et al. 2010; Dall et al. 2009; Palar and Sturm 2009)(Bibbins-Domingo et al. 2010; Palar and Sturm 2009; Dall et al. 2009) in that modest sodium reduction can yield substantial decrease in mortality and medical spending. We extended previous studies by using a model that takes into account competing risks due to other diseases incurred in additional life years saved due to prevented cardiovascular events, and by projecting estimates for the local level, where many policy decisions are made and implemented. For Los Angeles County, with a 10-million population and sizeable public health budget, accurately quantifying population-wide policy impact at the County level is important to appropriately allocate its budget for the optimal benefit of the population.

One limitation of this study is that parameter estimates for sodium reduction taken from Bibbins-Domingo (Bibbins-Domingo et al. 2010) were calculated for a sample of US adults 35-84 years old, whereas our simulation model only includes adults ages 51 and older. Since salt sensitivity likely increases with age, the annual reductions of incident CHD and stroke reported in their study are likely lower than the actual reductions of incident CHD and stroke in our older population. Therefore, our simulations may underestimate the reduction in morbidity, mortality, and medical spending from prevented cardiovascular events.

As is common in projections from simulation models, our estimates are limited by uncertainty in the input parameters. Also, we did not account for possible effects of lower blood pressure due to salt reductions on diabetes outcomes. Additionally, our simulation model did not include the possible improvements in diseases not present in our model, such as kidney disease, which may be ameliorated by sodium reduction. Accounting for these possible effects would have increased averted morbidity, mortality, and savings in medical spending.

Crucially, there has been some recent evidence (O'Donnell et al. 2011; Yaktine et al. 2013), that high levels of sodium consumption might not be as harmful as previously thought and that low levels of sodium consumption might have adverse health effects, contradicting previous evidence. While these recent evidence are still controversial in the public health space, if this new evidence were validated by further study, they could materially change the results of our analysis and policy recommendations regarding sodium reduction initiatives. For our future work, we will investigate the long-term effects of reductions in sodium consumption in the population in light of these more recent evidence to determine the potentially adverse public health impact of population-level sodium reduction policies, if the recent findings were eventually validated by future research.

5 CONCLUSION

Our analysis suggest that modest and achievable reductions in dietary sodium intake, even if only half of the older population in LAC change their behavior, would achieve substantial reduction in morbidity, mortality, and medical spending in the older LAC population. The results of this study support the expansion and reinforcement of current sodium reduction initiatives in Los Angeles County.

ACKNOWLEDGMENTS

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A result of this analysis was previously briefly mentioned in the Center for Disease Control and Prevention’s September 2014 webinar on the topic of prevention of heart diseases and strokes, in Dr. Patricia L. Cummings’ segment on “Partnerships to Improve Cardiovascular Health through Sodium Reduction in Los Angeles County, California” (Centers for Disease Control and Prevention 2014)(Centers for Disease Control and Prevention 2014).

A HEALTH OUTCOMES OF THE FEM-LA SIMULATION COMPARING THE STATUS QUO SCENARIO VS THE LOW ESTIMATES AND THE HIGH ESTIMATES OF THE EFFECT OF THE 1G/DAY SALT REDUCTION SCENARIO

	Population (millions)			Individuals with heart disease			Individuals with strokes			Deaths		
Period	Status Quo	Low Estimate	High Estimate	Status Quo	Low Estimate	High Estimate	Status Quo	Low Estimate	High Estimate	Status Quo	Low Estimate	High Estimate
2006-07	2.341425	2.341425	2.341425	525316	523716	522771	188619	187900	187505	104488	104488	104488
2008-09	2.452503	2.452553	2.452586	566977	563783	561736	202737	201432	200688	103260	103210	103177
2010-11	2.591441	2.591581	2.591659	616334	611846	608984	222556	220764	219756	104327	104238	104193
2012-13	2.736364	2.736622	2.736757	675485	669718	666098	248219	245829	244495	110254	110136	110080
2014-15	2.872951	2.87333	2.87354	733138	726253	721999	274502	271607	269899	114926	114805	114729
2016-17	3.000394	3.000931	3.001261	790447	782490	777531	301739	298393	296329	121985	121827	121708
2018-19	3.111799	3.112462	3.112968	848125	838907	833468	328898	325124	322754	126191	126065	125888
2020-21	3.23652	3.237344	3.237908	910452	900482	894439	359297	354977	352275	132033	131872	131814
2022-23	3.366495	3.367533	3.368278	972876	962159	955327	388811	384049	381129	139700	139485	139304
2024-25	3.472359	3.473638	3.47448	1032759	1021312	1014086	419302	414118	410863	145791	145551	145454
2026-27	3.573534	3.575051	3.575975	1092339	1080474	1072809	449333	443817	440406	151451	151212	151131
2028-29	3.663208	3.664898	3.665935	1151588	1139069	1131010	479487	473625	470132	159342	159169	159055
2030-31	3.753264	3.755224	3.756465	1209383	1196290	1188162	509277	503214	499409	165150	164881	164676
2032-33	3.859715	3.86186	3.863263	1268574	1254835	1246344	539541	533317	529430	169388	169203	169040
2034-35	3.960055	3.962383	3.963782	1326452	1312460	1303803	569322	562955	558837	178238	178054	178058
2036-37	4.055323	4.057818	4.059397	1380585	1366391	1357426	597063	590252	585985	184358	184190	184009
2038-39	4.142115	4.144788	4.146561	1433737	1418985	1409827	624327	617273	612713	192398	192220	192025
2040-41	4.22166	4.224339	4.226135	1483421	1468268	1458787	651229	643618	638938	198939	198934	198910
2042-43	4.307109	4.309775	4.311641	1530782	1514906	1505177	677458	669506	664797	204094	204107	204037
2044-45	4.383299	4.386154	4.388108	1577554	1560932	1550964	702325	694180	689265	209191	209001	208914
2046-47	4.44369	4.44659	4.448589	1617674	1600872	1590721	726802	718501	713449	216608	216563	216517
2048-49	4.483646	4.486675	4.488734	1654177	1637121	1626717	749782	741123	735902	225636	225506	225447
2050-51	4.507745	4.510968	4.513091	1684355	1667199	1656623	767765	758959	753560	228969	228775	228711

B ECONOMIC OUTCOMES OF THE FEM-LA SIMULATION COMPARING THE STATUS QUO SCENARIO VS THE LOW ESTIMATES OF THE EFFECT OF 1G/DAY SALT REDUCTION SCENARIO AND THE HIGH ESTIMATES OF THE EFFECT OF THE 1G/DAY SALT REDUCTION SCENARIO

	Total medical spending ($)		
year	Status Quo	Low Estimate	High Estimate
2006-07	30,577,900,000	30,556,000,000	30,543,500,000
2008-09	35,304,700,000	35,269,000,000	35,246,700,000
2010-11	36,652,700,000	36,610,100,000	36,583,500,000
2012-13	39,275,700,000	39,222,200,000	39,190,900,000
2014-15	41,649,500,000	41,591,400,000	41,556,500,000
2016-17	44,457,000,000	44,390,800,000	44,350,400,000
2018-19	48,105,000,000	48,031,600,000	47,986,300,000
2020-21	53,609,800,000	53,531,200,000	53,483,500,000
2022-23	59,827,800,000	59,738,800,000	59,680,900,000
2024-25	66,433,200,000	66,336,600,000	66,276,500,000
2026-27	73,587,100,000	73,484,600,000	73,422,800,000
2028-29	81,308,900,000	81,198,300,000	81,132,900,000
2030-31	89,386,900,000	89,275,800,000	89,205,700,000
2032-33	98,425,100,000	98,313,300,000	98,249,300,000
2034-35	108,135,000,000	108,030,000,000	107,959,000,000
2036-37	118,240,000,000	118,130,000,000	118,055,000,000
2038-39	128,934,000,000	128,818,000,000	128,740,000,000
2040-41	140,004,000,000	139,872,000,000	139,806,000,000
2042-43	151,523,000,000	151,377,000,000	151,310,000,000
2044-45	163,342,000,000	163,170,000,000	163,107,000,000
2046-47	175,482,000,000	175,345,000,000	175,284,000,000
2048-49	187,707,000,000	187,557,000,000	187,482,000,000
2050-51	199,851,000,000	199,691,000,000	199,608,000,000

C NUMBER OF CASES OF HEART DISEASE, STROKE, AND DEATHS AVERTED DUE TO A REDUCTION OF 1G/DAY IN DIETARY SALT INTAKE, AND THE CORRESPONDING SAVINGS IN TOTAL MEDICAL SPENDING, WITH LOW AND MODERATE UPTAKE OF THE SODIUM REDUCTION INITIATIVES

	Averted cases of heart disease	Averted cases of stroke	Averted deaths	Savings in total medical spending
Low uptake of sodium reduction initiatives in the population (50% uptake)				
Annual average	681-1,106	285-461	35-61	$23.73-38.10 million
Cumulative (2006-51)	31,321-50,897	13,128-21,213	1,632-2,789	$1.09-1.75 billion
Moderate uptake of sodium reduction initiatives (75% uptake)				
Annual average	1,036-1,676	289-467	48-81	$31.38-48.81 million
Cumulative (2006-51)	47,642-77,110	13,292-21,465	2,209-3,714	$1.44-2.25 billion

D NUMBER OF CASES OF HEART DISEASE, STROKE, AND DEATHS AVERTED DUE TO A REDUCTION OF 1G/DAY IN DIETARY SALT INTAKE, AND THE CORRESPONDING SAVINGS IN TOTAL MEDICAL SPENDING.

	Averted cases of heart disease	Averted cases of stroke	Averted deaths	Savings in total medical spending
Annual average	2,882-4,778	783-1226	134-219	$82.01-135.84 million
Cumulative (2006-2051)	132,594-219,792	36,002-56,419	6,182-10,080	$3.77-6.24 billion

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