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The association between provider encouragement and sodium consumption behaviors

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ABSTRACT

Objective: To explore and describe the associations between provider encouragement and four sodium consumption behaviors.
Methods: We analyzed a 2016 Internet panel survey dataset of 954 socio-demographically diverse adults (age ≥18 years) living in Los Angeles County. Behaviors analyzed were current status of watching one's salt/sodium intake, frequency of adding salt to food, frequency of using a food/Nutrition Facts label to decide what food to purchase, and frequency of changing one's mind about buying a food product due to its sodium content. Multivariable logistic regression analyses examined the relationship between doctor/health professional (provider) encouragement and these sodium-related behaviors, controlling for self-reported health status and sociodemographic characteristics.
Results: Provider encouragement was positively associated with three of the four sodium consumption behaviors examined: currently watching salt/sodium intake (AOR=7.27, 95% CI=3.97–13.34); frequently using a food/Nutrition Facts label (AOR=1.70, 95% CI=1.09–2.64); and frequently changing one's mind about buying a food product due to its sodium content (AOR=2.29, 95% CI=1.45–3.63).
Conclusions: Provider encouragement appears to have a salutary impact on sodium consumption among residents.
Practice implications: Provider encouragement may represent an underutilized strategy for counseling patients about cardiovascular health and about the benefits of reducing sodium consumption.

1. Introduction

Excessive sodium consumption, a well-documented risk factor for hypertension and other cardiovascular diseases [1], represents a growing public health problem in the United States (U.S.). Over the last two decades, there has been a notable increase in sodium consumption among U.S. adults [2]. It is also estimated that over 86% of adult Americans exceed the recommended daily limit for sodium consumption—i.e., 2300 milligrams (mg) of sodium per day [3]. Among youth, similar trends have been observed, those which have appeared to counteract the overall gain in dietary health among young persons during the past 17 years [4]. Research suggests that if Americans can limit their sodium consumption to daily recommended levels, this could yield an annual cost saving of ~$1991 per person treated for hypertension [5].

Since 2010, considerable investments have been made to improve a range of sodium consumption behaviors (e.g., watching one's sodium intake, adhering to a daily sodium limit, using Nutrition Facts labels to guide food selection, etc.) among at-risk groups in the U.S. These efforts have included federal programs such as the Centers for Disease Control and Prevention's *Sodium Reduction in Communities Program* [6], an initiative that encouraged local communities to prototype and to implement practice-based sodium reduction strategies as a way to decrease the sodium content of foods served or sold at various institutional settings. These more upstream strategies have ranged from policy, systems, and environmental change interventions (PSEs) seeking to establish healthier food environments in low-income areas [7–9] to health marketing focused on increasing public awareness and

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knowledge about the cardiovascular health benefits of reducing dietary sodium [10].

Although intuitive as a practical strategy, an area of prevention that has not been fully explored to encourage sodium reduction has been the use of brief lifestyle interventions. Brief lifestyle interventions include advice, encouragement, or communication from a physician ("doctor") or another health professional such as a nurse, a physician assistant, or a pharmacist. When appropriately carried out in the clinical setting, brief lifestyle interventions can have a positive influence on a patient's subsequent lifestyle behaviors. This motivator of change has been demonstrated to be relatively impactful for modifying behaviors such as smoking, problem drinking, and substance abuse [11–15]. For example, in smoking cessation studies, physician advice to quit smoking has been found to significantly increase patients' frequency of quit attempts [14]. Similarly, research suggests that brief physician advice is effective for reducing problem drinking among primary care patients [15]. For obesity, there is evidence that physician advice is linked to increased patient satisfaction with medical care, adherence to treatment, and overall better management of pediatric overweight/obesity [16]. Emerging investigations also suggest that any type of provider encouragement may be enough to nudge patients toward healthier lifestyle behaviors as they relate to the prevention and management of diabetes [17]. Several studies provide evidence that provider encouragement can nudge individuals to adhere to recommended medical treatments. A 2009 meta-analysis of provider encouragement strategies, for example, found that the risk for non-adherence with medical treatment was 19% higher for patients whose physician communicated with them poorly versus those whose physician communicated with them well [18].

Despite this growing body of evidence that provider encouragement can help improve individuals' health behaviors and outcomes, few studies have examined how this form of brief lifestyle intervention can shape sodium consumption behaviors among at-risk U.S. adults. To address this gap in health promotion practice, the present study used data from a 2016 Internet panel survey of Los Angeles County adult residents to describe the associations between provider encouragement and the following sodium consumption behaviors: (1) currently watching one's salt/sodium intake, (2) frequency of adding salt to food, (3) frequency of using a food/Nutrition Facts label to decide what food to purchase, and (4) frequency of changing one's mind about buying a food product due to its sodium content. Informed by previous studies [19–21], we define 'provider encouragement' as the act of a health care provider (doctor/health professional) offering advice to a patient or communicating a need for them to change a health matter through a clear exchange of information, understanding, and/or trust between the provider and the patient in a clinical setting. We consider 'sodium consumption behaviors' as an array of health behaviors or habits, including individual actions or aspects of self-efficacy, that can meaningfully influence food selection related to sodium consumption.

2. Methods

2.1. Study design and participants

The Los Angeles County Department of Public Health (DPH) contracted a survey firm to conduct a cross-sectional Internet panel survey of Los Angeles County (LAC) adult residents, with a primary focus on describing the sodium consumption behaviors of the participants. The survey was administered between August 4 and August 12, 2016. It recruited participants from an existing panel of subscribers via the survey firm's sampling partner. These subscribers were consumers of globally recognized businesses (e.g., airlines, electronic/retail technology stores, hotel chains, department stores, and pizza/other fast-food outlets) that the sampling partner works with. This Internet panel survey was recently described in another study of LAC residents [17].

Invitations to participate in the survey were sent out to eligible subscribers through a customized email message. To be eligible, participants had to be 18 years of age or older and lived in LAC at the time of the survey. The sampling firm was able to apply a targeted quota sampling approach by asking eligible participants to answer screening sociodemographic questions at the beginning of the online survey. Specifically, participants were enrolled into the survey until saturation was reached for age, sex, race/ethnicity, income, and Service Planning Area. These quota targets, which were used in the survey weighting process, were informed by data from the 2013 American Community Survey [22] and the 2011 Los Angeles County Health Survey [23]. In the final sample and for data analysis purposes, survey weights were applied to reflect a more representative distribution of the participants based on key sociodemographic factors: age, income, sex, race/ethnicity, children in the household, Service Planning Area they lived in, and poverty level. For quality assurance and accuracy of the survey questions, field procedures included programming and testing the survey questionnaire before field administration. Upon finalizing the questionnaire, a soft launch was also carried out to pilot test the survey to ensure smooth dissemination; corrections to programming and the dissemination approach were made during this 'in the field' pilot phase. Previous LAC studies have used similar Internet panel survey methods as the present survey; these methods are described elsewhere [17,24,25].

A total of 2837 panel subscribers clicked on the invitation link to participate, of which 1003 fully completed the survey. The participation rate was ~35% (1003/2837). In the present study, due to the small cell sizes, participants who self-reported as being "American Indian/Alaskan Native" or "other" as a race were dropped from the analyses. Additionally, other sparse data, outliers, and observations with missing information were removed to obtain a final analysis sample of 954 participants. As indicated above, survey weights were applied to ensure that the overall survey sample was representative of the LAC population by Service Planning Area. Survey protocols and materials were reviewed and approved by the DPH Institutional Review Board prior to field implementation.

2.2. Measures

2.2.1. Dependent variables

Currently watching salt intake. This was assessed by asking participants two questions. Participants were first asked, "Are you currently watching or reducing your salt intake?" Response options included "yes" or "no." The participants then were asked to indicate if they were currently reducing their salt/sodium intake to prevent or control high blood pressure. To answer "yes" to this question, participants were instructed to check off a box corresponding to this question; leaving the box unchecked was considered a "no" response. Answers to the two questions were combined into a single variable because a factor analysis showed these two questions tapped into the same latent construct. In the descriptive analyses, a "yes" response to either question was coded as 1 and a "no" response was coded as 0. The response values were summed to generate an overall total score that ranged from 0 to 2 and corresponded to the following categories: 'not currently reducing salt/sodium intake" if the summed score was 0, 'partially reducing salt/sodium intake' if the summed score was 1, and 'fully reducing salt/sodium intake' if the summed score was 2. In the multivariable logistic regression analyses (models), the responses were dichotomized as 'currently watching salt/sodium' (coded as 1) if participants answered "yes" to one or both questions and 'not currently watching salt/sodium' (coded as 0) if participants answered "no" to both questions.

Frequency of adding salt to food. Participants were asked, "How often do you add salt to your food?" The initial response options included a 5-point Likert scale ranging from "always" to "never." In all analyses, the scaled responses were dichotomized as 'infrequently' (coded as 1) if they indicated "sometimes", "rarely", or "never" and 'frequently' (coded as 0) if participants indicated "always" or "most of the time."

Frequency of using a Nutrition Facts label. Participants were asked, "When buying food products, how often do you use a food label or

Nutrition Facts label to help you decide what food to purchase?" Response options to this question included a 5-point Likert scale ranging from "always" to "never". For all analyses, this scale was dichotomized as 'frequently' (coded as 1) if participants indicated "always" or "most of the time" and 'infrequently' (coded as 0) if they indicated "sometimes", "rarely", or "never".

Frequency of changing one's mind about buying a food product due to its sodium content. Participants were asked to indicate how often they changed their minds about buying a food product because of the sodium amount displayed on the Nutrition Facts label. Response options for this variable included a 5-point Likert scale ranging from "always" to "never". In all analyses, the scale was dichotomized as 'frequently' (coded as 1) if participants indicated "always" or "most of the time" and 'infrequently' (coded as 0) if they indicated "about half of the time", "less than half of the time", or "never."

2.2.2. Independent variable

Provider encouragement. Participants were asked to indicate if a doctor or another health professional had ever encouraged them to reduce their sodium/salt intake. To answer "yes" to this question, participants were instructed to check off a box corresponding to this question (coded as 1); leaving the box unchecked was considered a "no" response (coded as 0). This variable represents the independent variable or primary regressor of interest in the multivariable logistic regression analyses (models).

2.2.3. Covariates

Sodium knowledge. Participants were asked to respond to two questions. The first question asked participants, "In general, an average adult should consume no more than ____ milligrams of sodium per day?" Participants had the option to fill in a numeric whole number response which was assigned a score of 1 if participants answered 1500–2300 milligrams (mg) of sodium (i.e., correct answer) and a score of 0 if participants answered $<$ 1500 mg or $>$ 2300 mg of sodium or did not answer the question (i.e., incorrect answer). The second question showed participants three Nutrition Facts labels with different sodium nutrition values and then asked them, "Which of these sauces has the least amount of sodium per cup?" The Nutrition Facts label for Sauce B had the lowest sodium content and was therefore considered the correct answer. Responses of "Sauce B" were assigned a score of 1, while Sauce A and Sauce C responses were considered incorrect and assigned a score of 0. Responses to these two questions were later summed and categorized as follows: 'high' for a score of 2 (i.e., coded as 0, where participants answered *both* questions correctly), 'low' for a score of 0 (i.e., coded as 1, where participants did not answer *either* question correctly), or 'medium' for a score of 1 (i.e., coded as 2, where participants answered *one* question correctly).

Perceived health impact of salt/sodium consumption. Participants were asked, "What impact, if any, do you think consuming salt has on your health?" Response options to this question included a 5-point Likert scale ranging from "extremely harmful" to "not at all harmful," which were dichotomized as 'harmful' (coded as 0) if participants indicated "extremely harmful" or "very harmful" and 'not harmful' (coded as 1) if they indicated "somewhat harmful", "not very harmful", or "not at all harmful."

Self-reported health status. Participants were asked, "In general, how would you rate your health?" Response options to this question included a 5-point Likert scale ranging from "excellent" to "poor," which were dichotomized as 'in good health' (coded as 0) if participants indicated "excellent" or "very good" and 'not in good health' (coded as 1) if they indicated "good", "fair", or "poor."

Weight loss behaviors. Participants were asked to indicate if they are currently trying to maintain, lose, gain, or do nothing about their weight which was then dichotomized as 'trying to lose weight' (coded as 0) if participants indicated they were trying to lose weight and 'not trying to lose weight' (coded as 1) for all other responses.

Self-reported physical activity levels. This was assessed by asking participants, "In general, how physically active are you?" Response options to this question included a 5-point Likert scale ranging from "extremely active" to "not active at all," which were dichotomized as 'active' (coded as 0) if participants indicated "extremely active" or "very active" and 'not active' (coded as 1) if they indicated "somewhat active", "not very active", or "not active at all."

Sociodemographic characteristics. Several sociodemographic characteristics were inputted as covariates in the multivariable logistic regression analyses. These included: sex (1=male, 0=female); age (0=18–44, 1=45–64, 2=65 years or older); race/ethnicity (0=White, 1 =Black; 2=Hispanic; 3=Asian/Native Hawaiian or Other Pacific Islander; educational status (0=high school or less, 1=some college, 2=college, 3=postgraduate); employment status (0=full-time, 1=part-time, 2=unemployed/student/homemaker, 3=retired); and marital status (0=married/in a domestic partnership, 1 =not married/in a domestic partnership).

2.3. Statistical analyses

Descriptive statistics were generated on all dependent variables, independent variable/regressor, and covariates to inform the final variable selection for the multivariable logistic regression analyses (models). This process included examining the frequency, percentage, central tendency, and dispersion measures of each variable. Correlation tests were carried out to assess if variables were highly correlated with one another (i.e., $r>0.50$) and if they required mitigation for potential multicollinearity. When necessary, factor analyses were also performed to inform if highly correlated variables captured the same latent constructs and should be collapsed into a single variable. Weighted percentages for variables used in the multivariable logistic regression analyses were tabulated by the full sample and by provider encouragement. Pearson chi-squared tests were conducted to assess for group differences in provider encouragement by sociodemographic characteristics, health attributes, and sodium consumption behaviors. The multivariable logistic regression models were constructed to examine the associations between provider encouragement and the four sodium consumption behaviors of interest, controlling for covariates and other relevant factors. For all analyses, a p-value <0.05 was considered statistically significant. SAS software version 9.4 (SAS Institute, Inc., Cary, North Carolina, USA) and Stata 14.1 (StataCorp LP, College Station, Texas, USA), were used to clean and analyze the Internet panel survey data, respectively.

3. Results

Results of the descriptive analyses are presented in Table 1**.** In the full sample, over half of the participants were female (51.4%), between the ages of 18–44 (53.8%), and married/in a domestic partnership (54.3%). Many participants were Hispanic/Latino (38.4%), had a high school education or less (35.6%), and employed full-time (48.5%). Overall, participant knowledge about sodium was low (59.9%), which is consistent with the finding that a majority of them did not perceive salt/sodium consumption as being harmful to their health (62.1%). More than half reported being not in good health (58.1%), trying to lose weight (55.6%), and being physically inactive (80.5%). Provider encouragement – the variable that differentiates between patients who did or did not talk with or receive advice from a doctor or health professional about reducing their sodium/salt intake — differed by participants' age, perceived health impact of salt/sodium consumption, self-reported health status, effort to lose weight, their salt/sodium intake behaviors, frequency of reading food/Nutrition Facts labels, and frequency of changing one's mind about buying a food product to its high salt/sodium content ($p<0.05$).

Table 2 presents the results of the multivariable logistic regression analyses (models). Provider encouragement was significantly associated

Table 1
Sociodemographic characteristics, health attributes, and sodium consumption behaviors among Los Angeles County residents by provider encouragement: Results from a 2016 Internet panel survey of Los Angeles County residents (n = 954).

	Full Sample	Provider encouragement[b]		
	Weighted %[a]	Yes Weighted %[a]	No Weighted %[a]	*P-value*
Sociodemographic characteristics				
Sex				*0.4609*
Female	51.4	54.1	50.3	
Male	48.6	45.9	49.7	
Age				*0.0000*
18–44	53.8	35.3	60.8	
45–64	31.1	37.4	28.7	
65 years or older	15.1	27.4	10.5	
Race/Ethnicity				*0.1622*
White	33.9	35.5	33.4	
Black	11.1	11.0	11.1	
Hispanic	38.4	42.7	36.8	
ANHOPI	16.5	10.8	18.7	
Educational status				*0.2518*
High school education or less	35.6	35.1	35.8	
Some college	33.9	39.3	31.9	
College	18.5	16.1	19.4	
Postgraduate	12.1	9.5	13.0	
Employment status				*0.0615*
Full-time	48.5	44.4	50.0	
Part-time	14.5	12.5	15.3	
Unemployed/student/homemaker	22.0	20.9	22.4	
Retired	15.0	22.2	12.3	
Marital status				*0.6863*
Married/in a domestic partnership	54.3	55.9	53.8	
Not married/not in a domestic partnership	45.7	44.2	46.2	
Health attributes				
Sodium knowledge				*0.3183*
Low	59.9	60.7	59.6	
Medium	35.0	32.1	36.0	
High	5.2	7.2	4.4	
Perceived health impact of salt/sodium consumption				*0.0000*
Not harmful	62.1	43.7	69.0	
Harmful	37.9	56.3	31.0	
Self-reported health status				*0.0001*
In good health	41.9	28.3	47.0	
Not in good health	58.1	71.7	53.0	
Weight loss behaviors				*0.0002*
Trying to lose weight	55.6	69.0	50.6	
Not trying to lose weight	44.4	31.0	49.4	
Self-reported physical activity level				*0.3207*
Not very active	80.5	83.1	79.4	
Active	20.0	16.9	20.6	
Sodium consumption behaviors				
Currently watching salt/sodium intake				*0.0000*
Yes	61.3	89.1	50.8	
No	38.7	10.9	49.2	
Frequency of adding salt to food				*0.7002*
Infrequently	83.5	84.5	83.1	
Frequently	16.5	15.5	16.9	
Frequency of reading food/Nutrition Facts labels				*0.0073*

(*continued on next page*)

Table 1 (*continued*)

	Full Sample	Provider encouragement[b]		
		Yes	No	
	Weighted %[a]	Weighted %[a]	Weighted %[a]	*P-value*
Infrequently	59.2	49.4	62.9	
Frequently	40.8	50.6	37.1	
Frequency of changing one's mind in buying a food product due to its high salt/sodium content				0.0000
Infrequently	65.1	49.3	71.0	
Frequently	34.9	50.7	29.0	

ANHOPI = Asian/Native Hawaiian or Other Pacific Islander.

[a] Percentages may not add up to 100% due to rounding.

[b] Participants were asked to indicate if a doctor or another health professional had ever encouraged them to reduce their salt/sodium intake. Participants had the option to check off the box to this question (which was classified a 'yes' response) or not check off the box (which was classified as a "no" response).

with three of the four sodium consumption behaviors examined. Participants who received encouragement from a provider to reduce sodium consumption had significantly higher odds of watching their salt/sodium intake (adjusted odds ratio [AOR]=7.27, 95% Confidence Interval [CI]=3.97–13.34) than participants who did not receive such encouragement. Similarly, participants who received encouragement from a provider versus those who did not report using a food/Nutrition Facts label more frequently (AOR=1.70, 95% CI=1.09–2.64) and were more likely to change their mind about buying a food product when the sodium content was high (AOR=2.29, 95% CI=1.45–3.63). Across the four logistic regression models, participants who did not perceive salt/sodium consumption as harmful to health (as compared to those who did) had significantly lower odds of currently watching their sodium/salt intake (AOR=0.28, 95% CI=0.18–0.44), infrequently adding salt to their food (AOR=0.39, 95% CI=0.23–0.66), frequently using a food/Nutrition Facts label (AOR=0.66, 95% CI=0.45–0.96), and frequently changing their food purchasing decisions when a food item has a high sodium content (AOR=0.39, 95% CI=0.26–0.59).

Other results from the multivariable logistic regression models suggest differences by race/ethnicity, education, and employment status. For example, the models showed that Asian/Native Hawaiian or Other Pacific Islander participants had higher odds of currently watching their salt/sodium intake when compared to White participants (AOR=1.81, 95% CI=1.02–3.21); Black participants had lower odds of frequently using a food/Nutrition Facts label when compared to White participants (AOR=0.53, 95% CI=0.29–0.97). Educational attainment was significantly associated with frequency of using a food/Nutrition Facts label—i.e., participants with more education had higher odds of frequently using a food/Nutrition Facts label than participants with a high school education or less (some college AOR=1.76, 95% CI=1.02–3.03; college AOR=1.90, 95% CI=1.07–3.38; postgraduate AOR=2.29, 95% CI=1.21–4.35). Lastly, participants who were employed part-time or who reported being unemployed/student/homemaker had higher odds of frequently adding salt to food as compared to participants who were employed full-time (part-time AOR=0.44, 95% CI=0.22–0.86; unemployed/student/homemaker AOR=0.43, 95% CI=0.23–0.79).

4. Discussion and conclusion

4.1. Discussion

The present study sought to explore and describe the potential associations between patient-reported provider encouragement and four key sodium consumption behaviors. Multiple studies on provider encouragement have shown positive outcomes for promoting lifestyle modifications in the clinical setting [11–15]. As a brief intervention strategy, this approach may be underutilized in clinical settings and could serve as an important tool for healthcare providers to persuade patients to reduce their excess sodium consumption. Several notable study results lend support to this conclusion.

First, results from the present study suggest that encouragement from a doctor or another healthcare professional could meaningfully motivate a patient to decrease sodium intake and practice other sodium-reducing dietary behaviors. This cascade of actions could translate to nudging individuals to watch their sodium consumption, use food/Nutrition Facts labels, and change their food purchasing decisions due to a product's high sodium content. These potentially favorable patient inducements are in line with prior research on lifestyle behavior change – i.e., several studies have found that brief interventions and other related provider-patient interactions can be efficacious for persuading patients to quit smoking or to reduce their alcohol use [14,15]. Other studies have demonstrated a similar impact on obesity prevention and other lifestyle changes. This includes physician advice for weight control [26,27], physical activity promotion [28], and improving behaviors related to diabetes prevention and management [17,29].

Table 2
Adjusted logistic regression models describing the associations between provider encouragement and each of the four sodium consumption behaviors, after controlling for covariates: Results from a 2016 Internet panel survey of Los Angeles County residents (n = 954).

	Dependent variables			
	Behavior 1: Currently watches salt/sodium intake Adjusted Odds Ratio (95% CI)	Behavior 2: Infrequently adds salt to food Adjusted Odds Ratio (95% CI)	Behavior 3: Frequently uses food/Nutrition Facts label Adjusted Odds Ratio (95% CI)	Behavior 4: Frequently changes purchasing behaviors[a] Adjusted Odds Ratio (95% CI)
Primary Regressor (Independent Variable): Provider Encouragement				
Doctor/healthcare provider has ever encouraged reducing sodium/salt intake *(ref=no, has not encouraged)*				
Yes, has encouraged	7.27 (3.97–13.34)***	0.82 (0.49–1.40)	1.70 (1.09–2.64)*	2.29 (1.45–3.63)***
COVARIATES				
Sociodemographics				
Sex *(ref=female)*				
Male	0.72 (0.46–1.12)	1.54 (0.95–2.51)	0.68 (0.46–1.01)	0.70 (0.42–1.16)
Age *(ref=18–44 years)*				
45–64 years	0.87 (0.52–1.46)	1.06 (0.58–1.93)	0.74 (0.48–1.15)	0.58 (0.36–0.93)*
65 years or older	1.99 (0.88–4.49)	2.30 (0.84–6.34)	0.80 (0.33–1.93)	0.90 (0.41–1.98)
Race/Ethnicity *(ref=White)*				
Black	1.57 (0.65–3.75)	0.89 (0.40–1.97)	0.53 (0.29–0.97)*	0.70 (0.37–1.34)
Hispanic	0.84 (0.49–1.43)	0.88 (0.47–1.66)	0.68 (0.40–1.14)	1.64 (0.96–2.80)
ANHOPI	1.81 (1.02–3.21)*	1.58 (0.73–3.46)	1.10 (0.61–1.98)	1.24 (0.70–2.20)
Educational status *(ref=high school or less)*				
Some college	1.57 (0.88–2.77)	0.98 (0.54–1.75)	1.76 (1.02–3.03)*	1.61 (0.87–2.95)
College	1.25 (0.68–2.29)	1.06 (0.54–2.08)	1.90 (1.07–3.38)*	1.24 (0.65–2.37)
Postgraduate	0.96 (0.48–1.92)	1.32 (0.55–3.18)	2.29 (1.21–4.35)*	1.29 (0.63–2.63)
Employment status *(ref=full time)*				
Part-time	1.21 (0.62–2.35)	0.44 (0.22–0.86)*	0.88 (0.48–1.63)	0.67 (0.35–1.30)
Unemployed/student/homemaker	0.70 (0.40–1.24)	0.43 (0.23–0.79)**	0.60 (0.35–1.03)	0.59 (0.32–1.07)
Retired	1.52 (0.69–3.36)	0.46 (0.19–1.11)	1.38 (0.66–2.90)	1.00 (0.48–2.06)
Marital status *(ref=married/in a domestic partnership)*				
Not married/not in a domestic partnership	1.00 (0.66–1.53)	1.54 (0.95–2.47)	1.30 (0.88–1.90)	0.77 (0.51–1.18)
Health attributes				
Sodium knowledge *(ref= High)*				
Low	0.77 (0.34–1.75)	1.54 (0.95–2.47)	0.30 (0.14–0.65)**	1.86 (0.84–4.10)
Medium	1.04 (0.46–2.39)	0.52 (0.19–1.44)	0.37 (0.17–0.83)*	1.48 (0.66–3.32)
Perceived health impact of salt/sodium consumption *(ref=harmful)*				
Not harmful	0.28 (0.18–0.44)***	0.39 (0.23–0.66)***	0.66 (0.45–0.96)*	0.39 (0.26–0.59)***
Self-reported health status *(ref=in good health)*				
Not in good health	0.96 (0.61–1.51)	1.70 (1.01–2.86)*	1.07 (0.71–1.60)	1.10 (0.70–1.71)
Weight loss behaviors *(ref=trying to lose weight)*				
Not trying to lose weight	1.24 (0.81–1.91)	1.12 (0.70–1.80)	0.76 (0.53–1.14)	1.17 (0.76–1.81)
Self-reported physical activity level *(ref=active)*				
Not very active	0.79 (0.48–1.31)	1.03 (0.57–1.87)	0.35 (0.23–0.55)***	0.58 (0.36–0.94)*

*p < 0.05 **p < 0.001 ***p < 0.0001

[a] Corresponds to frequently changing one's mind about buying a food product due to its sodium content.

Second, as it relates to provider encouragement, the perception of sodium consumption as being harmful to health appeared to have a favorable influence on a patient's sodium consumption behaviors. Intuitively, this not only makes real-world sense, but previous studies suggest similar patterns in which internal beliefs about eating more healthfully, including decreasing sodium intake, may lead to stronger motivation and action to reduce daily dietary sodium [24,30,31].

Finally, most of the survey participants had low sodium knowledge, self-reported having poor health, were trying to lose weight, and indicated being physically inactive. These sobering health attributes and statistics are, unfortunately, not too surprising, as previous research has described similar results for these sociodemographic and health-related predictors of sodium consumption [24,32]. Collectively, they speak to a need for increased provider education about potential harm from excessive sodium intake and better tailoring of sodium reduction strategies by population attributes so that the unique needs of these target/at-risk groups are met.

The present Internet panel survey has several limitations. First, as this was a cross-sectional survey, causal relationships between the different variables could not be determined. Second, selection bias was a concern, as participants were largely self-selected with incentives or through their motivations. Participants also likely had better access to the internet than the general LAC population. For example, most, if not all of them, probably had continuous and easy access to a smartphone or computer. However, the effects of this selection bias were mitigated by the use of survey quotas and weights to help enroll a study sample that resembles the LAC population distribution. Third, the responses to the survey questions were largely self-reported, suggesting the answers given in the survey may have been over-or under-exaggerated due to participant errors, recall bias, or social desirability bias. These biases were mitigated in part by combining two questions into one variable whenever feasible to create an index/composite variable. Guided by the Domain Sampling Theory, this approach helps minimize random error by averaging out these responses [33]. Lastly, there was a lack of granularity to the questions used to collect the data on some of the sodium and other health behaviors assessed, making comparisons to results from similar studies challenging. Some of the questions were internally developed by DPH/survey firm, but pretesting was performed to help mitigate this issue.

4.2. Conclusion

Despite its limitations, the present study offers key insights into the potential utility of expanding provider advice or provider encouragement as a practical strategy for further educating and motivating patients to reduce their sodium consumption. As it stands, there is much room for improvement in this area, as heart disease and stroke continue to have significant economic ramifications in the U.S. [34]. This is unfortunate, as these health conditions are largely preventable through blood pressure control and other risk factor modifications [35]. Adapting provider advice or provider encouragement in the clinical setting could increase the frequency and quality of contact points where healthcare providers can meaningfully discuss and convince patients to take pragmatic, but highly effective, non-pharmaceutical steps toward improving their cardiovascular health. For instance, having providers increase their patient's sodium knowledge could be an avenue to improving cardiovascular disease outcomes at the population-level. Further research and practice exploration of how this brief intervention could be used strategically and in a complementary manner to augment the goals of upstream sodium reduction PSEs that are already underway is warranted.

4.3. Practical implications

Given that the study results align with and corroborate prior studies on this intervention, provider encouragement may represent an underutilized strategy for counseling patients about cardiovascular health and about the benefits of reducing sodium consumption. If the associated benefits of encouragement provided by a healthcare provider could be scaled appropriately and delivered often in the primary care setting, this valuable non-pharmaceutical intervention could be highly effective and meaningful as part of routine clinical practice for blood pressure control and cardiovascular health promotion. There is a lot of potential in applying this approach to help Americans reduce their risks of cardiovascular morbidity and mortality.

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CRediT authorship contribution statement

B.R. and T.K. conceptualized the initial survey design. B.R. was responsible for data collection. S.L. was responsible for conceptualizing the analyses and drafting the original draft of the article. B.R. supervised the project's analysis and writing. T.K. provided iterative feedback and helped to review and edit the article for intellectual content. All authors contributed to the interpretation and presentation of the data and helped to finalize the article for publication. All authors have read and agreed to the published version of the article.

Declaration of Competing Interest

The authors declare no competing interests.

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