




Sodium menu labelling: priorities for research and policy

Eleanore Alexander^{1,*} , Lainie Rutkow¹, Kimberly A Gudzone^{2,3}, Joanna E Cohen⁴ and Emma E McGinty¹

¹Department of Health Policy & Management, Johns Hopkins Bloomberg School of Public Health, 624 N. Broadway Baltimore, MD 21205, USA: ²Division of General Internal Medicine, Johns Hopkins School of Medicine, Baltimore, MD, USA: ³Welch Center for Prevention, Epidemiology, and Clinical Research, Johns Hopkins School of Medicine, Baltimore, MD, USA: ⁴Department of Health, Behavior and Society, Johns Hopkins Bloomberg School of Public Health, Baltimore, MD, USA

Submitted 28 January 2020: Final revision received 28 August 2020: Accepted 6 October 2020: First published online 9 October 2020

Abstract

Objective: To understand the different Na menu labelling approaches that have been considered by state and local policymakers in the USA and to summarise the evidence on the relationship between Na menu labelling and Na content of menu items offered by restaurants or purchased by consumers.

Design: Proposed and enacted Na menu labelling laws at the state and local levels were reviewed using legal databases and an online search, and a narrative review of peer-reviewed literature was conducted on the relationship between Na menu labelling and Na content of menu items offered by restaurants or purchased by consumers.

Setting: Local and state jurisdictions in the USA

Participants: Not applicable.

Results: Between 2000 and 2020, thirty-eight laws – eleven at the local level and twenty-seven at the state level – were proposed to require Na labelling of restaurant menu items. By 2020, eight laws were enacted requiring chain restaurants to label the Na content of menu items. Five studies were identified that evaluated the impact of Na menu labelling on Na content of menu items offered by restaurants or purchased by consumers in the USA. The studies had mixed results: two studies showed a statistically significant association between Na menu labelling and reduced Na content of menu items; three showed no effects.

Conclusion: Data suggest that Na menu labelling may reduce Na in restaurant menu items, but further rigorous research evaluating Na menu labelling effects on Na content of menu items, as well as on the Na content in menu items purchased by consumers, is needed.

Keywords:
Sodium
Nutrition
Policy
Menu labelling

High Na intake is associated with high blood pressure and increased risk of stroke and heart disease – the leading cause of death in the USA⁽¹⁾. The US Dietary Guidelines recommend limiting Na intake to 2300 mg daily⁽²⁾; however, average daily Na intake among US adults is currently above 3500 mg⁽³⁾.

More than 25% of Na intake among Americans comes from food purchased at restaurants, and restaurant foods have higher Na density (milligrams of Na per 1000 calories) compared with food obtained from other sources⁽³⁾. While in recent years, some reductions in Na content have been seen in newly introduced menu items, these changes have not been consistent across menu food categories and restaurant service types^(4,5). Additionally, research has found a wide range of Na levels in similar restaurant food items across

restaurants (e.g. vastly different Na content in a medium order of French fries in restaurant A *v.* restaurant B)⁽⁶⁾, which makes it difficult for consumers to estimate Na content without a label.

One policy strategy to assist consumers in understanding the nutrition content of restaurant food is providing nutrient information through menu labelling. Most US federal, state and local laws requiring menu labelling have focused on calories, for example, the federal menu labelling law (as part of the Affordable Care Act (ACA) in 2010) requires chain restaurants to label menu items with calories and provide other nutrition information, including Na, upon request⁽⁷⁾. The federal menu labelling law pre-empted many local and state Na labelling laws requiring Na content labelling on menus in restaurants with twenty

*Corresponding author: Email ealexa12@jhmi.edu

© The Author(s), 2020. Published by Cambridge University Press on behalf of The Nutrition Society



or more locations; therefore, more recently, Na warning labels have emerged as a policy focus. Some states and localities have enacted Na menu labelling laws; yet, we know of no systematic compilation of Na menu labelling laws. While several localities and states have demonstrated interest in Na menu labelling laws, only two real-world studies have been published evaluating US legislation – both studies evaluated laws enacted prior to the ACA that required menu items' Na content to be labelled on the menu^(8,9). Bummer *et al.* found a statistically significant decrease in entrée's Na content comparing 6 to 18 months post-menu labelling implementation in King County, WA, and Auchincloss *et al.* found no significant difference in the Na content of menu items purchased comparing restaurants with Na labelling in Philadelphia, PA, to control restaurants outside of Philadelphia.

While studies have examined the impact of Na menu labelling on the Na content of restaurant foods purchased by consumers, no reviews have synthesised the evidence on Na menu labelling's effects on the Na content of restaurant foods offered to or purchased by consumers. It is important to evaluate the Na content of menu items offered by restaurants and the Na content of menu items purchased by consumers – this allows evaluation of reformulation by restaurants and impacts on consumer behaviour, as has been evaluated in response to calorie labelling⁽¹⁰⁾.

To understand policies being considered to address Na content of restaurant food, we reviewed proposed and enacted Na menu labelling laws at the local and state levels. We also reviewed and summarised the available evidence on the relationship between Na menu labelling and Na content of menu items offered by restaurants or purchased by consumers and conclude by identifying areas for future research and policy.

Methods

Local and state sodium labelling laws

We identified local- and state-level proposed and enacted Na menu labelling laws (i.e. legislation and regulation). While bills that would have required Na menu labelling have been introduced unsuccessfully at the federal level, for this review, we focused on policy activity at the state and local levels. Given this potential for local and state action, we sought to better understand the types of Na menu labelling laws that these jurisdictions are introducing and enacting.

Proposed and enacted state-level Na menu labelling laws were identified between the years 2000 and 2020 (search updated on 27 April 2020) using the LexisNexis State Capital, Nexis Uni and UConn Rudd Center Legislative databases with a combination of the keywords 'menu', 'sodium', 'salt' and 'restaurant' and verified using state governmental websites. We selected this time frame to ensure inclusion of the earliest Na menu labelling laws, which appeared in the early 2000s. We included both

proposed and enacted laws to identify the types of policies that jurisdictions are considering in this area. Because bills are often introduced multiple times before they become law, proposed bills provide a window into policies that may become law in the future.

As there is no central repository of proposed and enacted local Na menu labelling laws, we searched Google using the terms 'menu', 'label', 'policy', 'sodium' and 'restaurant' and identified additional publicly available compilations of Na menu labelling laws collected through 2012 from the Centers for Science in the Public Interest⁽¹¹⁾, the National Conference of State Legislatures⁽¹²⁾ and the Centers for Disease Control and Prevention's Public Health Law Program⁽¹³⁾. Findings were validated through local jurisdictions' websites.

All identified local- and state-proposed and enacted laws were reviewed for inclusion by EA, and thirty-six proposed and enacted laws were included in the final data set. Laws were included if they addressed required Na menu labelling in the restaurant setting. Laws were excluded if: (1) they did not require Na menu labelling (e.g. Na information must be available upon request) or (2) they sought to prevent a jurisdiction from engaging in Na menu labelling. For each law, the following data were abstracted: year introduced; jurisdiction; current status and primary focus. Laws were reviewed and summarised to describe the status: successfully enacted compared with not enacted; focus area: Na menu labelling within broader menu labelling or Na menu warning label; and level of government proposed: state or local.

Evaluations of sodium menu labelling

A narrative review, which comprehensively synthesises previously published literature using a narrative format⁽¹⁴⁾, was conducted to evaluate the impact of Na menu labelling on two outcomes: Na content of menu items offered by restaurants or purchased by consumers in real-world settings in the USA. Evaluations conducted outside of the USA and online were excluded from the review. We created a search strategy to identify articles indexed in PubMed (Appendix A). The search occurred on 27 March 2019 and was updated on 27 April 2020. Twenty articles were retrieved from this search. Then, reference lists from menu labelling review articles^(10,15–20) were examined for additional articles to include. Following this search, articles were reviewed for inclusion by EA.

The review was guided by the Population, Intervention, Comparison, Outcome, Time (PICOT) framework (Appendix A). The PICOT framework helps to find the best evidence by defining key components of the research question (who, what, compared with whom, etc.), which identify study inclusion criteria⁽²¹⁾. Two studies not set in the USA were excluded from the analysis. A flow diagram describing the literature search and filtering results is included in Appendix Fig. 1.

Results

Sodium menu labelling laws

Since 2000, thirty-eight laws – eleven at the local level and twenty-seven at the state level – have been proposed to require Na labelling of restaurant menu items (Table 1). Na menu labelling laws require Na content labelled (in milligrams) or a warning label. More laws were enacted at the local level than the state level – by 2020, seven local laws were enacted to require chain restaurants to label the Na content of menu items (San Francisco City and County, CA (2008)⁽²²⁾; San Mateo County, CA (2008)⁽²³⁾; Santa Clara County, CA (2008)⁽²⁴⁾; King County, WA (2008)⁽²⁵⁾; Philadelphia, PA Code § 6-102 (2008)⁽²⁶⁾; New York, NY (2015)⁽²⁷⁾; Philadelphia, PA (2018)⁽²⁸⁾, compared with one state law (California 2008)⁽²⁹⁾ (Table 1). Thirty of the thirty-eight proposed and enacted local and state laws required Na labelling within a broader menu labelling law that also requires calorie labelling (Table 1).

Local laws

In 2003, the first local Na menu labelling bill was proposed in the District of Columbia as part of a broader menu labelling bill requiring nutrition information (specifically, calories, grams of saturated fat, grams of *trans*-fat, grams of carbohydrates and milligrams of Na) labelling for food and drinks. The bill was not successful, and similar bills in the District of Columbia were unsuccessfully introduced in subsequent years.

The first enacted local Na labelling laws, which required Na menu labelling within a broader menu labelling law, were introduced in 2008 in two cities and four counties: San Francisco City and County, CA (2008)⁽²²⁾, San Mateo County, CA (2008)⁽²³⁾, Santa Clara County, CA (2008)⁽²⁴⁾, Philadelphia, PA (2008)⁽²⁶⁾ and King County, WA (2008)⁽²⁵⁾ (Table 1). In 2015, the New York City Board of Health adopted regulations to require chain restaurants to include a warning label on the menu next to items containing at least 2300 mg of Na and post a warning statement on the menu^(27,30) (Table 1). Most recently, in 2018, the Philadelphia mayor signed a law requiring chain restaurants to include a warning label on the menu next to items containing >2300 mg of Na and post a warning statement on the menu that defines the warning label^(28,31) (Fig. 1).

State laws

Between 2003 and 2008, bills requiring Na menu labelling were proposed in California, Kentucky and New York as a component of a broader menu labelling law (Table 1). In 2007, California passed a Na menu labelling law within a

broader menu labelling law⁽³²⁾, but the law was vetoed by the Governor. The only state-level Na menu labelling law to be enacted was signed by the California Governor in 2008⁽²⁹⁾. The law required labelling of items' Na content and other nutrients (calories, carbohydrates and saturated fat) on menus, menu inserts, brochures or table tents.

In 2010, the federal menu labelling law was passed as part of the ACA⁽³³⁾, which requires calorie labelling at restaurants with twenty or more locations and preempted many local and state menu labelling laws that required labelling of nutrient data within covered establishments under the law (i.e. laws applying to chains with twenty or more locations are preempted; laws applying to chains with nineteen or fewer locations can still be enforced). At least one court has determined that a graphical Na warning label is not preempted by the federal menu labelling law because it is a warning rather than a nutrient content label (Fig. 1)⁽³⁴⁾. Following the ACA, some states, including New York and New Jersey, then began introducing stand-alone bills focused on Na menu labelling specifically. None of these bills has been passed into law.

Summary of sodium menu labelling research evidence

Five studies met inclusion criteria (Table 2)^(8,9,35–37). Two studies evaluated local laws in Philadelphia (2008)⁽²⁶⁾ and King County, WA (2008)⁽²⁵⁾ requiring Na menu labelling^(8,9), and three studies assessed Na menu labelling interventions unrelated to state or local law^(35–37). Four of the five studies assessed the effects of Na menu labelling on the Na content of menu items ordered/purchased by consumers^(9,35–37), and one study assessed the Na content of menu items offered by restaurants⁽⁸⁾. Articles were published between 1986 and 2014.

Evaluations of local sodium menu labelling laws on restaurant offerings

One study evaluated the impact of King County's, WA, Na labelling law on Na content of menu items offered by restaurants⁽⁸⁾. Bruemmer *et al.* examined mean entrée's Na content in menu items offered by twenty-six fast-food and eleven full-service restaurants in King County, WA, at six and 18 months post-implementation of Na menu labelling (pre-implementation entrée's Na content was not measured). The authors found a statistically significant decrease of 108 mg of Na per entrée from 6 to 18 months post-implementation⁽⁸⁾.

Evaluations of local sodium menu labelling laws on consumer purchases

One study evaluated the impact of Philadelphia's, PA, Na menu labelling law on Na content of items purchased by consumers⁽⁹⁾. Auchincloss *et al.* compared the Na content of menu items purchased in two full-service restaurants that



Fig. 1 Philadelphia Na warning label

**Table 1** Local- and state-level proposed laws related to restaurant menu labelling for Na content

Year introduced	Jurisdiction	Status*	Citation	Primary focus
Local-level proposed laws				
2003	District of Columbia	Public Hearing	B. 15-0387	Requires Na labelling within a broader menu labelling bill.
2005	District of Columbia	Notice of Intent to Act	B. 16-0495	Requires Na labelling within a broader menu labelling bill.
2007	District of Columbia	Notice of Intent to Act	B. 17-0139:	Requires Na labelling within a broader menu labelling bill.
2008	San Francisco City and County, CA	Signed into law by San Francisco Mayor	Ordinance No. 40-08	Requires Na labelling and reporting within a broader menu labelling and reporting bill.
2008	King County, WA	Adopted	Board of Health Reg. 08-02-2	Requires Na labelling within a broader menu labelling bill.
2008	San Mateo County, CA	Passed by San Mateo County Board of Supervisors	Bill 19-07	Requires Na labelling within a broader menu labelling bill.
2008	Santa Clara County, CA	Passed by Santa Clara County Board of Supervisors	Ordinance No. NS-300-793	Requires Na labelling within a broader menu labelling bill.
2008	Philadelphia, PA	Passed by Philadelphia City Council	Code § 6-102:	Requires Na labelling within a broader menu labelling bill.
2009	District of Columbia	Notice of Intent to Act	B. 18-0405	Requires Na labelling within a broader menu labelling bill.
2015	New York City, NY	Adopted by the New York City Board of Health	NYC Health Code Article 81	Requires restaurants to include a warning label on the menu next to the items containing more than 2300 mg of Na and post a warning statement.
2018	Philadelphia, PA	Signed into law by Mayor	Philadelphia Health Code § 6-308:	Requires restaurants to post a warning label next to the menu items with at least 2300 mg of Na and a warning statement.
State-level proposed laws				
2003	NY	Referred to Committee	A.B. 5520; S.B. 4555	Requires Na labelling within a broader menu labelling bill.
2004	CA	Died in Committee	S.B. 1171	Requires Na labelling within a broader menu labelling bill.
2005	NY	Referred to Committee	A.B. 5664; S.B. 4551	Requires Na labelling within a broader menu labelling bill.
2006	NY	Referred to Committee	A.B. 729	Requires Na labelling within a broader menu labelling bill.
2007	NY	Referred to Committee	S.B. 3831; A.B. 1192	Requires Na labelling within a broader menu labelling bill.
2007	CA	Vetoed by Governor	S.B. 120	Requires Na labelling within a broader menu labelling bill.
2007	CA	Died in Committee	A.B. 2572	Requires Na labelling within a broader menu labelling bill.
2007	NY	Referred to Committee	S.B. 3780; S.B. 3787	Requires Na labelling within a broader menu labelling bill.
2008	KY	Referred to Committee	S.B. 211	Requires Na labelling within a broader menu labelling bill.
2008	NY	Referred to Committee	A.B. 9831	Requires Na labelling within a broader menu labelling bill.
2008	CA	Signed by Governor	S.B. 1420	Requires Na labelling within a broader menu labelling bill.
2009	DE	Referred to Committee	SB-81	Requires Na labelling within a broader menu labelling bill.
2009	FL	Died in Committee on Health Regulation	S. 2590	Requires Na labelling within a broader menu labelling bill.
2009	MD	Unfavorable Report by Health and Government Operations; Withdrawn	H.B. 601	Requires Na labelling within a broader menu labelling bill.
2009	OK	Second Reading; referred to Committee	S.B. 1135	Requires Na labelling within a broader menu labelling bill.
2009	PA	Referred to Committee	H.B. 1608	Requires Na labelling within a broader menu labelling bill.
2009	TX	Referred to Committee	H.B. 1522	Requires Na labelling within a broader menu labelling bill.

Table 1 *Continued*

Year introduced	Jurisdiction	Status*	Citation	Primary focus
2009	NY	Referred to Committee	S.B. 2824	Requires Na labelling within a broader menu labelling bill.
2009	VT	Referred to Committee	H.120	Requires Na labelling within a broader menu labelling bill.
2010	NY	Referred to Committee	S.B. 6458	Requires Na labelling within a broader menu labelling bill.
2011	NY	Held in Committee	A.B. 1018	Requires Na labelling within a broader menu labelling bill.
2015	NY	Referred to Committee	A.B. 8266	Requires chain restaurants to place a warning label on the menus next to food items that contain >2300 mg of Na.
2017	NJ	Referred to Committee	A.B. 4843; S.B. 3109	Requires Na labelling for foods and beverages for sale at chain restaurants; requires a warning label on menus next to food items that contain more than 2300 mg of Na.
2017	NY	Referred to Committee	A.B. 4534	Requires chain restaurants to place a warning label on menus next to food items that contain more than 2300 mg of Na.
2018	NJ	Referred to Committee	A.B. 1373; S.B. 828	Requires Na labelling for foods and beverages for sale at chain restaurants; requires a warning label on menus next to food items that contain more than 2300 mg of Na.
2019	NY	Referred to Codes	A.B. 3871; S.B. 4930	Requires chain restaurants to place a warning label on menus next to food items that contain more than 2300 mg of Na.
2020	NJ	Referred to Committee	A.B. 1721	Requires chain restaurants to place a warning label on menus next to food items that contain more than 2300 mg of Na.

Note: 'Adopted' is used for law made within a government's executive branch and 'passed' is used for law made within a government's legislative branch.

*The Affordable Care Act (ACA) preempted many local and state menu labelling laws (e.g. laws applying to chains with twenty or more locations are preempted; laws applying to chains with nineteen or fewer locations can still be enforced).

required Na labelling in Philadelphia, PA, to five control restaurants outside of Philadelphia not requiring Na labelling in August 2011 and found no significant difference in the Na content of menu items purchased in the labelling *v.* comparison groups⁽⁹⁾. However, the investigators found that among the subgroup of customers purchasing food at Philadelphia restaurants with Na labelling who reported that nutrition information affected their order (26% of customers), 370 mg of less Na was purchased relative to everyone else.

Voluntary sodium menu labelling interventions unrelated to state or local law

Three studies assessed the impact of voluntary Na labelling interventions on Na content of menu items purchased in settings including restaurants and cafeterias. All of the studies had an observational design. The earliest study, published in 1986, was set in a California corporate cafeteria that displayed cards labelling and comparing the Na content, as well as other nutrients, of two items⁽³⁶⁾.

The cards stated 'HEP [health enhancement program] suggests you compare the difference' and displayed the milligrams of Na for each item and a pie chart of maximum recommended Na intake⁽³⁶⁾. This study by Schmitz and Fielding found that consumers purchased food with an average of 413 mg of less Na per person comparing 6 months following labelling to 6 d pre-labelling⁽³⁶⁾. Ge *et al.* evaluated Na labelling interventions, in addition to other nutrient labelling interventions, at a full-service restaurant at Purdue University in Indiana⁽³⁵⁾. The researchers found no change in entrée's Na content purchased in response to Na labelling with Na and other nutrients, comparing purchases the week of the labelling intervention to baseline⁽³⁵⁾. Pulos and Leng did not find a significant difference in the Na content of entrées sold comparing 30 d pre-labelling to 30 d post-labelling in six full-service restaurants in Pierce County, Washington⁽³⁷⁾. These restaurants voluntarily labelled their menus with SmartMenu labelling, which includes labelling menu items' Na (mg) content, as well as labelling items' other nutrients.



Table 2 Studies of the impact of Na menu labelling on Na content of menu items offered by restaurants or purchased by consumers

Author, year	Study design	Setting	Sample size		Intervention description	Study period	Na outcome	Summary of results
			Intervention	Control				
Evaluations of local menu labelling laws on restaurant offerings								
Bruemmer, 2012	Observational study, single-group post-only	Full-service and fast-food restaurants subject to menu labelling regulations in King County, WA	Thirty-seven restaurants and 1771 entrées	N/A	King County, WA, menu labelling, requiring chain restaurants to display calorie, saturated fat, carbohydrate and Na content information on menus or at the point of ordering	May to July 2009 (6 months post-implementation) and May to July 2010 (18 months post-implementation)	Na content of entrées offered.	Across all fast-food and full-service restaurants, menu labelling was associated with a statistically significant decrease in entrée's Na content at 6- and 18-month post-implementation.
Evaluations of local menu labelling laws on consumer purchases								
Auchincloss, 2013	Observational study, post-only, with comparison group	Full-service restaurants in PA, DE, MD, NJ	Two restaurants and 327 purchases	Five restaurants and 321 purchases	Philadelphia menu labelling, requiring restaurant chains to post calorie information on menu boards and to list calories, Na, saturated fat, <i>trans</i> -fats and carbohydrates for each item on all printed menus.	August 2011	Na content of menu items purchased.	There was no statistically significant difference in the Na content of foods purchased in Philadelphia, where menu labelling was required, relative to foods purchased in comparison states.
Evaluations of voluntary Na menu labelling interventions implemented by restaurants on consumer purchases								
Ge, Behnke & Almanza, 2014	Observational study, single-group pre/post	Full-service restaurant at Purdue University, Indiana.	567 lunch entrée purchases.	N/A	Three menu labelling options: 1) Calorie Information; 2) A Healthy Symbol: calorie information + green leaf icon was posted next to menu items that met healthy criteria; 3) A Nutrient List: the nutritional content (calories, nutritional content of fat, calories derived from fat (%), saturated fat, cholesterol, Na, fibre) was listed	January to February 2013	Na content of entrées sold.	There were no statistically significant changes in Na of entrées sold between baseline and each labelling period in 2013.

Sodium menu labelling

Table 2 Continued

Author, year	Study design	Setting	Sample size		Intervention description	Study period	Na outcome	Summary of results
			Intervention	Control				
Schmitz & Fielding, 1986	Observational study, single-group pre/post	Corporate cafeteria in California	832 trays	N/A	Comparison cards stating 'HEP [health enhancement program] suggests you compare the difference' for two items, in milligrams. Na and a pie chart of maximum recommended intake.	March (6 d); October (6 d). Year of data collection not included in the publication.	Na content of food purchased.	Statistically significantly less Na (413 mg) per person was purchased 6 months post-labelling compared to 6 d pre-labelling.
Pulos and Leng, 2010	Observational study, single-group pre/post	Full-service restaurants in Pierce County, WA	Six local restaurants; about 16 000 entrées purchased*	N/A	SmartMenu labelling includes labelling food menu items with calories, fat (g), Na (mg) and carbohydrates (g)	Fall of 2008, Winter of 2009	Mean Na per entrée sold.	There were no statistically significant changes in mean entrée's Na content purchased pre-/post-menu labelling.

*Exact number(s) not published.

Discussion

Sodium menu labelling laws

Na menu labelling policy has been implemented at the local and state levels, with seven local laws and one state law enacted of thirty-eight proposed. Thirty of the local and state Na menu labelling policies included labelling within a broader menu labelling law that included calorie labelling, and some recently proposed policies have focused on Na menu warning labels that highlight items with high Na content.

While evidence on the impact of Na menu labelling is limited⁽³⁸⁾, the policy implications from calorie menu labelling evaluations may help to inform policymakers' decisions about Na menu labelling policy. Reviews of the effects of calorie menu labelling conclude that overall, there is limited evidence supporting a significant association between menu item's calorie labelling and reductions in the calories of menu items ordered/purchased^(15,16,18–20), although coffee shops, full-service restaurants and cafeterias have been identified as settings in which calorie menu labelling has been associated with reduced calories purchased^(10,17). Given the lack of consistent evidence suggesting that calorie menu labelling reduces calories purchased, policymakers may want to take a different approach to Na menu labelling, such as the Na warning menu labels currently implemented in New York, NY, and Philadelphia, PA. The Na menu warning labels highlight menu items to avoid, rather than simply informing consumers of a nutrient count that requires interpretation. Additionally, while this review focused on the USA, future research is needed to review the international landscape of Na menu labelling policies. Learnings may be informative for policymakers in the USA.

Providing Na information puts the onus on the consumer to make a lower Na choice; yet, 30 % of US adults are not interested in changing their salt intake⁽³⁹⁾. Therefore, it is important to consider policy options that reduce the Na content of restaurant items. For example, in 2010, New York State proposed a prohibition on the use of salt in food preparations by restaurants⁽⁴⁰⁾. Lessons from the *trans*-fat policy ban may also prove instructive. Before the FDA banned *trans*-fats in foods in 2016 (with implementation in 2018), *trans*-fat was banned in New York City effective in 2008 (New York Health Code Section 81.08 [2006]). Evaluation of the New York City regulation found a significant *trans*-fat reduction of 2.4 g per fast-food purchase following implementation, compared with before the regulation⁽⁴¹⁾. This suggests that laws requiring restaurants to reduce Na content of menu items may be an effective strategy for reducing the amount of Na consumed by customers. However, unintended consequences may be associated with reduced Na consumption, if consumers or restaurants replace Na with other unhealthy nutrients such as fat and sugar; therefore, changes in nutrients of menu items offered should be monitored to identify unhealthy changes.



Voluntary reductions in Na content of menu items is an opportunity for the food industry. The US FDA has released guidance for voluntary Na reduction to encourage restaurants and manufacturers to reduce Na in foods⁽⁴²⁾. Several examples highlight successful Na reduction at the community level^(43,44). Additionally, several restaurants have committed to voluntarily reduce Na in menu items as part of the National Salt and Sugar Reduction Initiative, a programme convened by the New York City Health Department⁽⁴⁵⁾. An evaluation of the National Salt Reduction Initiative found modest progress by packaged food companies⁽⁴⁶⁾, although progress among restaurants is not well understood. Restaurants can also introduce new menu items with reduced Na, remove items with high Na, reformulate existing menu items to reduce Na or reduce portion sizes, but voluntary initiatives cannot be enforced and may be difficult to evaluate.

Sodium menu labelling research evidence

It is important to understand the impact of Na menu labelling on changes in both the Na content of menu items purchased by consumers and the Na content of menu items offered by restaurants. The shift from Na numeric labelling laws to Na warning laws in recent years highlights the impact of preemption on local and state policy. At the local level, the New York, NY (2015)⁽²⁷⁾ and Philadelphia, PA (2018)⁽²⁸⁾ laws requiring Na warning labels have not been evaluated, and Na warning labels have also been proposed in New York State and New Jersey. Future research is needed to understand the impact of these laws on the Na content of available and purchased restaurant menu items, as this evidence could inform policymakers about the effectiveness of such policy.

Research has shown that adding calorie and Na information may lead consumers to order items with more or less Na, depending on taste preferences⁽⁴⁷⁾. Na menu labelling may change consumer behaviour, encouraging consumers to use the Na menu label⁽⁴⁸⁾ and increase purchases of menu items with reduced Na, which may contribute to reduced Na intake. Further, Na menu labelling may encourage restaurants to reduce Na content in menu items. Of the five studies evaluating Na menu labelling, only one assesses the Na content of menu items offered as an outcome⁽⁸⁾. This study found a significant decrease in entrée's Na content comparing 6- and 18-month post-menu labelling implementation. Additional studies are needed to understand whether Na menu labelling has an effect on the Na content of menu items offered. Additionally, qualitative research that evaluates the barriers restaurants face in reducing Na in menu items (e.g. lack of lower Na ingredients from suppliers and limited research and development(R&D) budgets for Na reduction) may inform researchers, public health practitioners and other stakeholders of resources that could support restaurants' efforts to reduce Na content of menu items.

Considering Na menu labelling impact on consumer purchases, currently only four US-based real-world studies have been published evaluating the effects of Na menu labelling on Na content of menu items purchased by consumers in food service settings and the results are mixed^(9,35-37). Online experiments have been conducted to evaluate consumer response to Na menu labelling^(38,47,49), with significant results in some interventions – for example, compared with control, traffic light and red stop sign warning labels significantly reduced Na content of menu items ordered. Qualitative research focused on consumers is needed to explore how they view and understand Na menu labelling and consumers' perceptions of whether and how Na menu labelling does or does not influence their purchasing decisions.

Evaluation of trends in the Na content of restaurant menu items has found that calorie-adjusted Na content in new restaurant menu items declined from 2012 to 2016, but reductions are inconsistent across menu categories and Na content of menu items remains high⁽⁵⁾. Given that average daily Na intake among US adults is over 1000 mg more than recommended, additional reductions in Na intake may be needed to reach clinical significance. Further, the accuracy of Na labelling may be an issue; research evaluating the accuracy of nutrient labelling in university food service settings found significant differences in the Na content, among other nutrients, of sampled items⁽⁵⁰⁾.

Additional studies with strong designs are needed to evaluate Na menu labelling. All of the studies evaluated in this analysis had an observational design. Three used single-group, pre-/post-study designs, measuring outcomes before and after a Na menu labelling intervention in the setting(s) that implemented the intervention⁽³⁵⁻³⁷⁾. One study measured post-Na menu labelling outcomes in an intervention *v.* a comparison group but did not measure pre-intervention baseline outcomes and so was unable to assess differences in the changes in Na content of menu items in the intervention group relative to the comparison group⁽⁹⁾. Finally, one study used a single-group, post-test-only design, where outcomes were measured at two time points after Na menu labelling was implemented⁽⁸⁾. While a randomised controlled trial design is not feasible to evaluate laws, as laws cannot be applied to randomised groups, evaluations using rigorous quasi-experimental approaches, such as difference-in-differences or synthetic control analyses, to evaluate changes in the Na content of menu items offered or purchased before and after Na menu labelling laws/interventions, relative to a control group, are needed. Further, a systematic review of the literature is needed to evaluate the existing evidence on Na menu labelling, including critical review of the study methodology.

Limitations

Given there is no central repository of local laws, it is possible that not all local laws were identified through the

search. Studies evaluating Na menu labelling have also been conducted in international settings and may provide useful insights for US policy. For example, Vanderlee and Hammond compared Na consumed between participants at a hospital cafeteria in Canada with a Hospital Check programme that labelled nutrients including Na at the point of purchase, with a control hospital that provided limited nutrition information for a selection of items⁽⁵¹⁾. Participants at the hospital with the Hospital Check programme reported consuming fewer 314 mg of Na than participants at the control cafeteria. The goal of this paper is to understand the different Na menu labelling approaches that have been considered by policymakers, rather than to understand the current legal environment. Identifying whether the laws were enacted is beyond the scope of this paper. It is possible that some of the laws identified were subsequently nullified due to preemption. The functional properties of Na in food science (e.g. texture, structure and food safety) were not discussed as they are outside the scope of this article.

Conclusion

Na -focused local and state menu labelling laws have been increasingly proposed and enacted since 2003. Understanding the impact of Na menu labelling is important to inform policymakers about whether this approach is effective. The current evidence evaluating Na menu labelling in the USA shows mixed results, with reductions in Na content of menu items offered by restaurants or purchased by consumers seen in some settings. More research is needed to evaluate the impact of Na menu labelling on Na content of menu items and purchasing behaviour. Policymakers should also consider laws that limit the Na content of restaurant foods.

Acknowledgements

Acknowledgements: N/A. *Financial support:* This research received no specific grant from any funding agency, commercial or not-for-profit sectors. *Conflicts of interest:* None. *Authorship:* All authors contributed to the design of the study. E.A. led the review of laws, the narrative review of evidence and manuscript writing. E.E.M., L.R., K.G. and J.E.C. contributed revisions to the manuscript and approved the final manuscript for submission. *Ethics of human subject participation:* This study was deemed Exempt by the Johns Hopkins Bloomberg School of Public Health Institutional Review Board.

Supplementary material

For supplementary material accompanying this paper visit <https://doi.org/10.1017/S1368980020003961>

References

1. CDC (2018) Salt 2018. <https://www.cdc.gov/salt/index.htm> (accessed October 2018).
2. US Department of Health and Human Services & US Department of Agriculture (2015) *2015–2020 Dietary Guidelines for Americans*, 8th ed. Washington, DC: US Dept of Health and Human Services.
3. Quader ZS, Zhao L, Gillespie C *et al.* (2017) Sodium intake among persons aged ≥ 2 years - United States, 2013–2014. *MMWR Morbidity Mortal Wkly Rep* **66**, 324–238.
4. Wu HW & Sturm R (2014) Changes in the energy and sodium content of main entrées in US chain restaurants from 2010 to 2011. *J Academy Nutr Dietetics* **114**, 209–219.
5. Wolfson JA, Moran AJ, Jarlenski MP *et al.* (2018) Trends in sodium content of menu items in large chain restaurants in the U.S. *Am J Prev Med* **54**, 28–36.
6. Urban LE, Roberts SB, Fierstein JL *et al.* (2014) Temporal trends in fast-food restaurant energy, sodium, saturated fat, and trans fat content, United States, 1996–2013. *Prev Chronic Dis* **11**, E229.
7. Food and Drug Administration (2014) Food Labeling; Nutrition Labeling of Standard Menu Items in Restaurants and Similar Retail Food Establishments 2014. <https://www.federalregister.gov/d/2014-27833> (accessed March 2019).
8. Bruemmer B, Krieger J, Saelens BE *et al.* (2012) Energy, saturated fat, and sodium were lower in entrée at chain restaurants at 18 months compared with 6 months following the implementation of mandatory menu labeling regulation in King County, Washington. *J Acad Nutr Dietetics* **112**, 1169–1176.
9. Auchincloss AH, Mallya GG, Leonberg BL *et al.* (2013) Customer responses to mandatory menu labeling at full-service restaurants. *Am J Prev Med* **45**, 710–719.
10. Bleich SN, Economos CD, Spiker ML *et al.* (2017) A systematic review of calorie labeling and modified calorie labeling interventions: impact on consumer and restaurant behavior. *Obesity* **25**, 2018–2044.
11. Center for Science in the Public Interest (2014) State and Local Menu Labeling Policies 2014. <https://cspinet.org/resource/state-and-menu-labeling-policies> (accessed March 2019).
12. National Conference of State Legislatures (2019) State Laws Related to Dietary Sodium 2019. <http://www.ncsl.org/research/health/analysis-of-state-laws-related-to-dietary-sodium.aspx> (accessed March 2019).
13. Ramanathan T (2012) Nutrition Labeling of Sodium: Summary of Related Laws and Policies Public Health Law Program, CDC's Office for State, Tribal, Local and Territorial Support: CDC; 2012. <https://www.cdc.gov/phlp/publications/topic/sodium/docs/other.pdf> (accessed March 2019).
14. Green BN, Johnson CD & Adams A (2006) Writing narrative literature reviews for peer-reviewed journals: secrets of the trade. *J Chiropr Med* **5**, 101–117.
15. Long MW, Tobias DK, Craddock AL *et al.* (2015) Systematic review and meta-analysis of the impact of restaurant menu calorie labeling. *Am J Public Health* **105**, e11–e24.
16. Sinclair SE, Cooper M & Mansfield ED (2014) The influence of menu labeling on calories selected or consumed: a systematic review and meta-analysis. *J Acad Nutr Dietetics* **114**, 1375–1388. e15.
17. VanEpps EM, Roberto CA, Park S *et al.* (2016) Restaurant menu labeling policy: review of evidence and controversies. *Curr Obes Rep* **5**, 72–80.
18. Swartz JJ, Braxton D & Viera AJ (2011) Calorie menu labeling on quick-service restaurant menus: an updated systematic review of the literature. *Int J Behav Nutr Phys Activity* **8**, 135.



19. Cantu-Jungles T, McCormack L, Slaven J *et al.* (2017) A meta-analysis to determine the impact of restaurant menu labeling on calories and nutrients (ordered or consumed) in US adults. *Nutrients* **9**, 1088.
20. Kiszko KM, Martinez OD, Abrams C *et al.* (2014) The influence of calorie labeling on food orders and consumption: a review of the literature. *J Community Health* **39**, 1248–1269.
21. Echevarria IM & Walker S (2014) To make your case, start with a PICOT question. *Nursing2020* **44**, 18–19.
22. San Francisco City and County, CA Ordinance No. 40–08 (2008).
23. San Mateo County, CA Bill 19–07 (2008).
24. Santa Clara County, CA Ordinance No. NS-300-793 (2008)
25. King County, WA Board of Health Reg. 08–02-2 (2008)
26. Philadelphia, PA Code § 6–102 (2008)
27. NYC Health Code Article 81 (2015)
28. Philadelphia, PA Code § 6–308 (2018).
29. California SB 1420 (2008).
30. New York City Department of Health and Mental Hygiene. (2020) Sodium Initiatives. <https://www1.nyc.gov/site/doh/health/health-topics/national-salt-reduction-initiative.page> (accessed May 2020).
31. Fit Food Philly (2020) Sodium Warning Label. <http://foodfitphilly.org/sodium-warning-label/> (accessed March 2019).
32. California SB 120 (2007).
33. Patient Protection & Affordable Care Act (2010).
34. National Restaurant Association v. New York City Department of Health & Mental Hygiene. N.Y. App. Div; 2017.
35. Ge L, Behnke C & Almanza B (2014) An evaluation of three nutrition labeling formats for restaurant menus. *Hospit Rev* **31**, 6.
36. Schmitz MF & Fielding JE (1986) Point-of-choice nutritional labeling: evaluation in a worksite cafeteria. *J Nutr Edu* **18**, S65–S68.
37. Pulos E & Leng K (2010) Evaluation of a voluntary menu-labeling program in full-service restaurants. *Am J Public Health* **100**, 1035–1039.
38. Musicus AA, Moran AJ, Lawman HG *et al.* (2019) Online randomized controlled trials of restaurant sodium warning labels. *Am J Prev Med* **57**, e181–e193.
39. Newson RS, Elmadfa I, Biro G *et al.* (2013) Barriers for progress in salt reduction in the general population. An international study. *Appetite* **71**, 22–31.
40. NY A10129, (2010).
41. Angell SY, Cobb LK, Curtis CJ *et al.* (2012) Change in trans fatty acid content of fast-food purchases associated with New York City's restaurant regulation: a pre-post study. *Ann Intern Med* **157**, 81–86.
42. U.S. Food & Drug Administration. Draft Guidance for Industry: Voluntary Sodium Reduction Goals: Target Mean and Upper Bound Concentrations for Sodium in Commercially Processed, Packaged, and Prepared Foods 2016. <https://www.fda.gov/Food/GuidanceRegulation/GuidanceDocumentsRegulatoryInformation/ucm494732.htm> (accessed March 2019).
43. Riordan M, Zeitz A, Fulton B *et al.* (2019) Culinary scientists collaborating with city health department and manufacturers to improve public health: a case from Philadelphia's sodium reduction in communities program. *J Culinary Sci Technol* 1–8.
44. Long CR, Rowland B, Langston K *et al.* (2018) Reducing the intake of sodium in community settings: evaluation of year one activities in the sodium reduction in communities program, Arkansas, 2016–2017. *Prev Chronic Dis* **15**, E160–E.
45. New York City Department of Health and Mental Hygiene. National Salt and Sugar Reduction Initiative (NSSRI) 2019. <https://www1.nyc.gov/site/doh/health/health-topics/national-salt-sugar-reduction-initiative.page> (accessed March 2019).
46. Curtis CJ, Clapp J, Niederman SA *et al.* (2016) US Food Industry Progress During the National Salt Reduction Initiative: 2009–2014. *Am J Public Health* **106**, 1815–1819.
47. Byrd K, Almanza B, Ghiselli RF *et al.* (2018) Adding sodium information to casual dining restaurant menus: beneficial or detrimental for consumers? *Appetite* **125**, 474–485.
48. Auchincloss AH, Young C, Davis AL *et al.* (2013) Barriers and facilitators of consumer use of nutrition labels at sit-down restaurant chains. *Public Health Nutr* **16**, 2138–2145.
49. Hobin E, Lillico H, Zuo F *et al.* (2016) Estimating the impact of various menu labeling formats on parents' demand for fast-food kids' meals for their children: an experimental auction. *Appetite* **105**, 582–590.
50. Feldman C, Murray D, Chavarria S *et al.* (2015) Menu label accuracy at a university's foodservices. An exploratory recipe nutrition analysis. *Appetite* **92**, 24–28.
51. Vanderlee L & Hammond D (2014) Does nutrition information on menus impact food choice? Comparisons across two hospital cafeterias. *Public Health Nutr* **17**, 1393–1402.