

Literature Review

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The rising level of obesity has been a growing concern worldwide. (Finucane et al. 2011) In the United States, health issues caused by overweight and obesity, such as cardiovascular diseases and increased mortality rate (Kramer et al., 2012), account for approximately 20% of national medical spending (Cawley and Meyerhoefer, 2012). According to past research, the prevalence of obesity can be attributed to high calorie diets, popularized due to increasingly accessible and low-cost high calorie food (Swinburn et al., 2011; Gortmaker et al., 2011). Other factors, such as lack of knowledge (Krukowski et al., 2006; Elbel, 2011), automatic or habitual choice processes (Marteau, Hollands, and Fletcher, 2012; Wanskink, Just, and Payne, 2009), and preference for convenience (Rozin et al., 2011; Dayan and Bar-Hillel, 2011; Schwartz et al., 2012), were also found to contribute to unhealthy eating patterns and lead to weight gain.

In an attempt to reduce obesity at the population level, policy makers in the United States have made various efforts to target overconsumption of calories (Bray et al., 2012; Swinburn and Ravussin, 2009; Cutler et al., 2003), focusing on calorie and nutritional labeling. For example, the US Food and Drug Administration (FDA) released final regulations in December 2014, requiring restaurants with 20 or more locations to have calorie labels and a suggested daily total calorie intake on all menus (Federal Register, 2014). The focus on menu labeling policies have mainly relied on the assumption that obesity is largely driven by a lack of accurate information (Black, 2014), supported by the argument that the consumers often underestimate the calorie content of their food without correct information (Pomeranz and Brownell, 2008) and past

evidence that some consumers choose healthier food when nutrition information is present at the point of purchase (Roberto, Schwartz, and Brownell, 2009). The popularity of menu calorie labeling as informational interventions can also be explained by the fact that it is a relatively low-cost and easier to implement compared to other interventions such as taxes on unhealthy food or size restrictions on items (Goswami and Urminsky, 2017).

However, the heavy reliance on calorie labeling also raises the question of whether such intervention is effective at reducing calorie consumption. First, calorie labeling based on providing persuasive information may be inconsistent as the effectiveness depends not only highly on recipients' literacy (Kutner et al., 2003; Williams, 2003), but also on interpretability of the messages. Moreover, the potential for information-based calorie labeling may be fundamentally limited because most human behavior is driven by automatic processes instead of deliberation upon the consequences of actions (Strack and Deutsch, 2004).

An alternative, non-informational approach of calorie labeling instead focuses on increasing individual's self-regulatory capacity to engage in healthier diet. According to psychological research, the fundamental conflict between hedonic short-term impulses and self-control cognitions involving goals and long-term consequences (Ainslie, 1975; Hoch and Loewenstein, 1991; Hoffmann et al., 2009) is a significant deciding factor on people's food choices. According to this account, identification of self-control conflicts (Bartels and Urminsky, 2015; Myrseth and Fishbach, 2009) and contextual influences on self-control (Ruderman, 1986), such as decision timing (Milkman et al., 2010), menu design (Parker and Lehmann, 2014) and convenience (Rozin et al., 2011), are two important influencing factors of calorie consumption. As a result,

calorie labeling can reduce individuals' calorie intake by promoting cognitions and creating decision contexts that facilitate self-control.

There are four systematic reviews on the impact of calorie labeling on food choices in cafeterias and restaurants, but most of them showed inconsistent results for the effect of calorie labels on reducing calorie choices (Harnack and French, 2008; Krieger and Saelens, 2014; Swartz et al., 2011; Sinclair et al., 2014). The most recent meta-analysis reported a small but statistically significant inverse association between calorie labeling and calories purchased per meal or transaction (-18.13 kcal; 95% confidence interval [CI] = -33.56, -2.70; $p = 0.021$), based on data from 23 comparisons across 19 studies (Long et al., 2014). However, the meta-analysis also found significant between-study heterogeneity. More specifically, studies conducted in non-restaurant settings showed a significant reduction in average calories purchased per transaction compared to control conditions (-58.16 kcal; 95% CI = -102.44, -13.87; $p = 0.01$), whereas studies conducted in restaurants did not show a significant association between menu calorie labeling (-6.70 kcal; 95% CI = -20.21, 6.81; $p = 0.331$) (Long et al, 2014).

Many different factors were proposed as potential sources of such heterogeneity. For example, although not significant, children and adolescents were found to have greater reduction in calories in response to calorie labeling. (Long et al., 2014; Roseman et al., 2013; Tandon et al., 2010; Tandon et al., 2011) In addition, some studies suggested that women tend to show stronger reduction in calories purchased compared to men in response to menu calorie labeling, although the relationship was not consistent across all the studies that presented results by gender. (Krieger, 2013; Bollinger, 2011) Moreover, race/ethnicity, BMI category, and neighborhood

socioeconomic status may also play a role in determining the effect of calorie labeling.

In addition to the factors mentioned above, the way in which calorie labels are presented may influence the effectiveness of the labels in reducing calorie consumption. For example, warning labels were found to outperform calorie labels in many cases (Donnelly et al., 2018). Similar to calorie labels, warning labels aim to induce healthy behavior change by providing health-relevant information to consumers. In contrast to calorie labels, however, warning labels does not only convey information in a straightforward and easy to interpret way, but also communicate an explicit recommendation.

A potential explanation for warning labels having larger effects than common calorie labels is that people may have difficulty understanding the numbers on traditional calorie labels (Downs, Loewenstein, and Wisdom, 2009; Fagerlin, Zikmund-Fisher, and Ubel, 2011; Korfage et al., 2013), and the labels are therefore not as helpful as an aid to consumers in decision making. Indeed, some recent studies showed that calorie information presented in terms of physical activity equivalents (e.g., number of minutes of running to burn off the calories) are more effective in motivating consumers to choose healthier beverages compared to traditional calorie labels due to improved interpretability (Bleich, Barry, Gary-Webb, and Herring, 2014; Bleich, Herring, Flagg, and Gary-Webb, 2012).

There is evidence that graphic labels may have the strongest effects on behavior. Long before studies were conducted on calorie labeling, graphic labels were found to be more effective than text labels for smoking cessation across a variety of outcomes (Noar et al., 2017; Noar, Francis,

et al., 2016; Noar, Hall, et al., 2016; Purmehdi, Legoux, Carrillat, and Senecal, 2017). To examine whether similar patterns generalize to food labels, Thorndike et al. conducted a field study at Massachusetts General Hospital (MGH). The study used a traffic-light food labeling system based on the 2005 U.S. Department of Agriculture My Pyramid recommendations, labeling every item in the cafeteria as either red, yellow, or green. The study reported that, the proportion of red items purchased dropped from 24% to 21% ($p < 0.001$) during the intervention period, while the proportion of green items increased from 41% to 45% ($p < 0.001$) of all items. (Thorndike et al., 2014)

Another recent study conducted at a hospital cafeteria also showed that more evocative, graphic warning caloric labels on sugary drinks had a much stronger effect at reducing calorie choices, as compared to text warning labels. (Donnelly et al., 2018) While 21.4% of bottled drinks purchased were sugary drinks during the baseline/control period, the percentage was 21.5% during the calorie-label intervention ($p = 0.84$) and 21.0% during the text-warning-label intervention ($p = 0.66$), meaning that neither of these two interventions effectively reduced consumption of sugary drinks. In contrast, the share of sugary drinks was brought down to 18.2% during the graphic warning intervention ($p < 0.001$), which is a 14.8% reduction compared to the baseline consumption.

Based on the inconsistent results of previous studies on calorie labeling and recent studies on graphic labeling, I try test in this study a novel explanation that the ineffectiveness of certain calorie labeling interventions may have little to do with interpretability of the information and may instead be explained by the effects of visual salience on decision making. (Goswami, Dai,

and Urminsky, 2017). According to this account, visual salience plays an import role not only because it ensures information to be noticed, but primarily because it facilitates active deliberation about cues (Shen and Urminsky, 2013) and incorporation of cues into decisions (Weber and Kirsner, 1997). My hypothesis is that visually salient information affects foods choices primarily through a reminder effect, prompting people to consider nutrition rather than merely providing new information. If such hypothesis holds true, I expect to find that even non-informative “mere-reminders” yield similar results as salient new information.

References

- Ainslie, G. (1975). Specious reward: a behavioral theory of impulsiveness and impulse control, *Psychological Bulletin*, 82(4), 463.
- Bartels, D. M. and O. Urminsky (2015) To Know and To Care: How Awareness and Valuation of the Future Jointly Shape Consumer Savings and Spending, *Journal of Consumer Research*, 41(6), 1469-1485.
- Bleich, S. N., Barry, C. L., Gary-Webb, T. L., & Herring, B. J. (2014). Reducing sugar-sweetened beverage consumption by providing caloric information: How Black adolescents alter their purchases and whether the effects persist. *American Journal of Public Health*, 104, 2417–2424.
- Bleich, S. N., B. J. Herring, D. D. Flagg, T. L. Gary-Webb (2012). Reduction in purchases of sugar-sweetened beverages among low-income black adolescents after exposure to caloric information, *American Journal of Public Health*, 102(2), 329-335.
- Bollinger B, Leslie P, Sorensen A (2011). Calorie posting in chain restaurants. *Am Econ J*. 3:91---128.
- Bray, G. A., S. R. Smith, L. de Jonge, H. Xie, J. Rood, C. K. Martin, M. Most, C. Brock, S. Mancuso, L. M. Redman (2012) Effect of Dietary Protein Content on Weight Gain, Energy Expenditure, and Body Composition During Overeating: A Randomized Controlled Trial, *Journal of the American Medical Association*, 307(1), 47-55.
- Cawley, J., C. Meyerhoefer (2012). The medical care costs of obesity: an instrumental variables approach. *Journal of Health Economics*, 31(1), 219-230.
- Cutler, David M., Edward L. Glaeser, and Jesse M. Shapiro (2003). Why Have Americans Become More Obese? *Journal of Economic Perspectives*, 17(3): 93-118.
- Dayan E, Bar-Hillel M (2011). Nudge to nobesity II: Menu positions influence food orders. *Judgement and Decision Making*. Jun; 2011 6(4):333-42.
- Donnelly, G. E., Zatz L. Y., Svirsky, D., & John L. K. (2018). The effect of graphic warnings on sugary-drink purchasing. *Psychological Science*, Vol. 29(8) 1321-1333.
- Downs, J. S., Loewenstein, G., & Wisdom, J. (2009). Strategies for promoting healthier food choices. *American Economic Review*, 99, 159–164.
- Dowray, S., Swartz, J. J., Braxton, D., & Viera, A. J. (2013). Potential effect of physical activity based menu labels on the calorie content of selected fast food meals. *Appetite*, 62, 173-181.
- Elbel B (2011). Consumer estimation of recommended and actual calories at fast food restaurants. *Obesity (Silver Spring)*. 19(10):1971-8. [PubMed: 21779085]
- Fagerlin, A., Zikmund-Fisher, B. J., & Ubel, P. A. (2011). Helping patients decide: Ten steps to better risk communication. *Journal of the National Cancer Institute*, 103, 1436–1443.
- Finucane MM, Stevens GA, Cowman MJ, et al. (2011) Global Burden of Metabolic Risk Factors of Chronic Diseases Collaborating Group (Body Mass Index). National, regional, and global trends in body-mass index since 1980: Systematic analysis of health examination surveys and epidemiological studies with 960 country-years and 9.1 million participants. *Lancet*. 2013; 377(9765):557-67. [PubMed: 21295846]
- Flegal, K. F., M. D. Carroll, B. K. Kit, C. L. Ogden (2012) Prevalence of Obesity and Trends in the Distribution of Body Mass Index Among US Adults, 1999-2010, *Journal of the American Medical Association* 307 (5), 491-497.

- Goswami, I and Urminsky, O. (2017). "The 'Mere Reminder' Effect of Calorie Labeling," Working paper.
- Gortmaker, S. L., Swinburn, B. A., Levy D, et al. (2011) Changing the future of obesity: Science, policy, and action. *Lancet*. 378(9793):838–47. [PubMed: 21872752]
- Harnack, L. J., & French, S. A. (2008). Effect of point-of-purchase calorie labeling on restaurant and cafeteria food choices: a review of the literature. *Int J Behav Nutr Phys Act*. 5:51.
- Hoch, S. J., & Loewenstein, G. F. (1991) Time-inconsistent Preferences and Consumer Selfcontrol, *Journal of Consumer Research*, 492-507.
- Hoffmann, W., Friese, M., & Strack, F. (2009). Impulse and self-control from a dual-systems perspective, *Perspectives on Psychological Science*, 4(2), 162-176.
- Korfage, I. J., Fuhrel-Forbis, A., Ubel, P. A., Zikmund-Fisher, B. J., Greene, S. M., McClure, J. B., . . . Fagerlin, A. (2013). Informed choice about breast cancer prevention: Randomized controlled trial of an online decision aid intervention. *Breast Cancer Research*, 15, Article R74.
- Kramer, C. K., B. Zinman, R. Retnakaran (2013). Are metabolically healthy overweight and obesity benign conditions? A systematic review and meta-analysis, *Annals of Internal Medicine*, 159(11), 758-769.
- Krieger, J., Chan, N. L., Saelens, B. E., Ta, M. L., Solet, D., & Fleming, D.W. (2013). Menu labeling regulations and calories purchased at chain restaurants. *Am J Prev Med*. 44(6):595---604.
- Krieger, J., Saelens, B. E. (2013) Impact of menu labeling on consumer behavior: a 2008---2012 update. *Healthy Eating Research*.
- Krukowski, R. A., Harvey-Berino, J., Kolodinsky, J., Narsana, R.T., Desisto, T.P. (2006). Consumers may not use or understand calorie labeling in restaurants. *J AM Diet Assoc*. 106(6):917-20. [PubMed: 16720133]
- Long, M. W., D. K. Tobias, A. L. Cradock, H. Batchelder, S. L. Gortmaker (2015). Systematic Review and Meta-analysis of the Impact of Restaurant Menu Calorie Labeling, *American Journal of Public Health*, 105(5), e11-e24
- Marteau TM, Hollands GJ, Fletcher PC (2012). Changing human behavior to prevent disease: The importance of targeting automatic processes. *Science*. 337(6101):1492-5. [PubMed: 22997327]
- Myrseth, K., and A. Fishbach. (2009) Self-control a Function of Knowing When and How to Exercise Restraint, *Current Directions in Psychological Science* 18, no. 4: 247-252.
- Noar, S. M., Francis, D. B., Bridges, C., Sontag, J. M., Brewer, N. T., & Ribisl, K. M. (2017). Effects of strengthening cigarette pack warnings on attention and message processing: A systematic review. *Journalism & Mass Communication Quarterly*, 94, 416–442.
- Noar, S. M., Francis, D. B., Bridges, C., Sontag, J. M., Ribisl, K. M., & Brewer, N. T. (2016). The impact of strengthening cigarette pack warnings: Systematic review of longitudinal observational studies. *Social Science & Medicine*, 164, 118–129.
- Noar, S. M., Hall, M. G., Francis, D. B., Ribisl, K. M., Pepper, J. K., & Brewer, N. T. (2016). Pictorial cigarette pack warnings: A meta-analysis of experimental studies. *Tobacco Control*, 25, 341–354.
- Pomeranz, J. L., Brownell, K. D. (2008). Legal and public health considerations affecting the success, reach, and impact of menu-labeling laws. *Am J Public Health*. 98(9):1578-1583.
- Ruderman, A. J. (1986). Dietary restraint: a theoretical and empirical review, *Psychological Bulletin*, 99(2), 247.

- Parker, J. R., & Lehmann, D. R. (2014). How and When Grouping Low-Calorie Options Reduces the Benefits of Providing Dish-Specific Calorie Information, *Journal of Consumer Research*, 41(1), 213-235.
- Roberto CA, Schwartz MB, Brownell KD (2009). Rationale and evidence for menu-labeling legislation. *Am J Prev Med*. 37(6):546-551.
- Roseman, M. G., Mathe-Souleik, K. & Higgins, JA. (2013) Relationships among grocery nutrition label users and consumers' attitude and behavior toward restaurant menu labeling. *Appetite*. 71: 274---278.
- Rozin, P., Scott, S., Dingley, M., Urbanek, J. K., Jiang, H., & Kaltenbach, M. (2011). Nudge to nobesity I: Minor changes in accessibility decrease food intake, *Judgment and Decision Making*, 6(4), 323-332.
- Schwartz, J., Riis, J., Elbel, B., & Ariely, D. (2012). Inviting consumers to downsize fast-food portions significantly reduces calorie consumption. *Health Aff (Millwood)*. 31(2):399-407.
- Shen, L., O. Urminsky (2013). Making Sense of Nonsense: The Visual Salience of Units Determines Sensitivity to Magnitude, *Psychological Science*, 24(3), 297-304.
- Sinclair, S. E., Cooper, M., & Mansfield, E. D. (2014) The influence of menu labeling on calories selected or consumed: a systematic review and meta-analysis. *J Acad Nutr Diet*. 114(9):1375---1388.e15.
- Strack, F., Deutsch, R. (2004) *Pers. Soc. Psychol. Rev.* 8, 220.
- Swinburn, B., G. Sacks, E. Ravussin (2009) Increased food energy supply is more than sufficient to explain the US epidemic of obesity, *American Journal of Clinical Nutrition*, 90(6), 1453-1456.
- Swinburn, B.A., Sacks, G., Hall, K. D., et al. (2011) The global obesity pandemic: Shaped by global drivers and local environments. *Lancet*. 378(9793):804–14. [PubMed: 21872749]
- Swartz, J. J., Braxton, D., & Viera, A. J. (2011) Calorie menu labeling on quick-service restaurant menus: an updated systematic review of the literature. *Int J Behav Nutr Phys Act*. 2011;8:135.
- Tandon, P. S., Wright, J., Zhou, C., Rogers, C. B. & Christakis, D. A. (2010) Nutrition menu labeling may lead to lower-calorie restaurant meal choices for children. *Pediatrics*. 125(2):244---248.
- Tandon, P. S., Zhou, C., Chan, N.L., et al. (2011) The impact of menu labeling on fast-food purchases for children and parents. *Am J Prev Med*. 41(4):434---438.
- Thorndike, A. N., Riis, J., Sonnenberg, L., M., Levy, D. E. (2014) Traffic-light labels and choice architecture promoting healthy food choices. *American Journal of Preventive Medicine*, 46(2), 143-149.
- Wansink, B., Just, D. R., Payne, C. R. (2009). Mindless eating and healthy heuristics for the irrational. *American Economic Review: Papers & Proceedings*. 99(2):165-9.
- Weber, E., B. Kirsner, B. (1997). Reasons for rank-dependent utility evaluation, *Journal of Risk and Uncertainty*, 14(1), 41-61.