

# Menu Labelling is effective in reducing energy ordered and consumed

An update of the evidence 2012-14



## Menu Labelling is effective in reducing energy ordered and consumed - An update of the evidence 2012-14

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## Abstract

Disclosing energy values on menus is now considered an important tool to inform consumers of the energy content of meals in the eating-out environment. Menu Labelling is deemed necessary with the increase of foods eaten outside the home and most consumers underestimate the energy value of such foods, which are associated with unhealthy weight gain. Energy declarations in other formats are rarely noticed or accessed, which helps explain the overwhelming public support for point-of-purchase energy disclosure.

The purpose of this document is to supplement a previous review conducted in 2012, to provide an update of the evidence of the effects of Menu Labelling relevant for all Danish stakeholders, which is warranted due to the momentum with which Menu Labelling is being adopted around the world and the considerable volume of articles published subsequent to the previous review.

To allow a comparison of the effects of Menu Labelling on reducing calories ordered or consumed, methods were replicated from the previous review conducted in 2012. Peer-reviewed articles, identified through a PubMed search, met the inclusion criteria if they were full-text, in English, published from 2012 and measured the effects of Menu Labelling regarding changes in purchase behaviour or purchase intentions relating to energy ordered or consumed.

Of the 14 articles reviewed, eight resulted in overall clinically and statistically significant reduction in energy ordered or consumed. Four studies reported some positive effects, most often relating to consumer characteristics, type of food establishment or the format of Menu Labelling presentations. Only two articles reported no effects. Compared with the previous review, new evidence more consistently and robustly supports that Menu Labelling is an effective intervention of informing consumers of the energy content of their food and beverage choices while demonstrating it has a positive effective in reducing energy ordered and consumed.

Menu Labelling is found to be effective in various settings and compared to the previous review it is now considered an 'equitable' initiative between the genders and across socio-economic status. Menu Labelling is an important means to inform consumers of the caloric consequences of their food and beverages choices, and such prominent energy disclosures better allows patrons to exercise personal responsibility in the eating-out environment. Menu labelling should therefore be considered an important component to any multi-faceted approach to reduce the burden of overweight and obesity.



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## 1. Introduction

In the realm of public health, Menu Labelling is now considered an important tool to inform consumers of the energy content of meals in the eating-out environment. The initiative applies the principles of nutrition labelling to foods consumed outside the home, through the disclosure of energy content at the point-of-purchase<sup>[1, 2]</sup>. More than ever, it is deemed necessary in Denmark as the consumption of food outside the home increases<sup>[3, 4]</sup> and most consumers underestimate the energy content of such foods<sup>[5]</sup>, which are associated with increased energy intake<sup>[6-8]</sup> and unhealthy weight gain<sup>[9]</sup>. Overweight and obesity puts individuals at greater risk of developing type II diabetes, cardiovascular diseases and certain cancers<sup>[10]</sup>, while the cost of overweight and obesity is estimated to consume up to 8% of the Danish healthcare budget<sup>[10]</sup>. Another argument used to support the disclosure of energy values at the point-of-purchase is the overwhelming public support for it, both in Denmark<sup>[11, 12]</sup> and internationally<sup>[1, 13-16]</sup>, especially since energy declarations provided by food service establishments, in any other format, are rarely noticed or accessed<sup>[14, 17, 18]</sup>. Menu Labelling should also be considered essential if consumers are expected to exercise any degree of personal responsibility in the eating out environment.

First implemented in New York City in 2008, Menu Labelling has been adopted in other jurisdictions in the United States of America (USA) and in other countries. In its primary form, Menu Labelling was referred to as Menu Board Labelling, since the initiative primarily addressed the frequent consumption of fast food from chain restaurants selling standardised food, where menu options typically appear on menu boards. It is now more commonly known as Menu Labelling as energy disclosure at the point-of-purchase, in various countries, now extends to standardised foods sold in chain cafés, bakeries, juice bars, ice-cream parlours, table-service restaurants and supermarkets. The expansion of food outlets Menu Labelling applies to is warranted for a number of reasons. The food and beverages consumed from these chains, for example, increasingly contributes to overall energy intake<sup>[2, 19]</sup> even in Denmark<sup>[4]</sup>, consumers should be informed of the energy content of discretionary/non-essential calories, even if they are perceived as healthy (such as fruit smoothies, frozen yoghurt or carrot cake) and some items may be overlooked as being caloric (such as flavoured mineral water or sweetened tea)<sup>[20]</sup>. Further, many meals served at table-service restaurants are high in calories, even compared to fast foods<sup>[21, 22]</sup> mostly due to larger portion sizes<sup>[23]</sup>.

In addition to appearing on menu boards, energy amounts may also be displayed on hand held menus, place cards/food tags and websites for online orders. For the purpose of this document, Menu Labelling is defined as the prominent display of energy values appearing on menus so it clearly relates to the menu item and its respective price. Menu Labelling has been regulated by voluntary agreements (in the United Kingdom and Ireland) and under mandatory regulations (in various states of Australia and the USA). In accordance with other Menu Labelling literature, the



term ‘healthier’ throughout this document refers to lower-energy food choices, since energy is the most important nutrition value related to overweight and obesity. The extent of Menu Labelling implementation around the world and definitions used by various authorities are summarised in Appendix I.

This document supplements a previous review <sup>[24]</sup>, which considered studies published between 2005 and 2012. At that time, Menu Labelling had a small but notable impact on consumers. Of the 18 articles previously reviewed, 15 studies showed a decrease in calories ordered or consumed ranging from 30 to 106 calories, but the effects were often limited to some socio-demographic characteristics. The review also revealed other barriers to use including the time needed for consumers to notice and understand Menu Labelling, pricing structures that offer financial incentive to purchase more and that energy disclosure had to invoke a level of ‘surprise’ to affect consumer choices.

The momentum with which Menu Labelling is being adopted, the broadening of the food service outlets it applies to and the considerable volume of articles recently published, collectively provide logical motive to conduct a subsequent review. The purpose of this document is to provide an update of the evidence, relevant for all stakeholders, of the effects of Menu Labelling on consumer behaviour, in relation to energy ordered or consumed, through assessing the extent to which barriers to Menu Labelling use remain and gauging the strength of the evidence supporting Menu Labelling implementation.



## 2. Methods

For consistency, the methods used for the review conducted in 2012 <sup>[24]</sup> were repeated for this literature search conducted in June 2014. Using PubMed, search terms included “Menu Board Labelling”, “Menu Labelling”, “Calorie Labelling” and “Energy Labelling”. Peer-reviewed studies met the inclusion criteria if they were full-text articles, in English, published from 2012 and measured the effects of Menu Labelling on purchase behaviour or purchase intentions relating to (changes in) energy ordered or consumed. Studies were excluded if they were included in the previous review (taking into account republished articles and the cross-over year of 2012).



### 3. Results

Of the 14 articles reviewed (Appendix II), eight of the articles resulted in overall clinically and statistically significant reduction in energy ordered or consumed <sup>[2, 25-31]</sup>. Four studies reported some positive effects, relating to consumer characteristics <sup>[32]</sup>, type of food establishment <sup>[33]</sup>, different components or ‘courses’ of a meal <sup>[34]</sup>; or the format of Menu Labelling presentations <sup>[13]</sup>. Only two articles reported no effects <sup>[35, 36]</sup>.

This current review identified instances where reductions in energy *ordered* exceeded 150 calories <sup>[30]</sup> and energy *consumed* decreased by as much as 21% <sup>[25]</sup>. Furthermore, participants, who reported *using* nutrition information when ordering meals, purchased 400 fewer food calories <sup>[30]</sup>. This outcome is a vast improvement compared to the earlier review <sup>[24]</sup>, which described the effects of Menu Labelling as ‘small but meaningful’.

Overall, the apparent impact of Menu Labelling on consumers’ food choices is progressively becoming more positive and more consistent. But, as the results remain somewhat mixed, it is worth paying closer attention to when, where, and with whom, Menu Labelling has the greatest (or least) impact. The following sections investigate such relationships.

#### 3.1 Research setting

When segregating studies into those conducted in the real-world (n=7) <sup>[25, 27, 30, 31, 33-35]</sup> compared to those where consumers participated online, by post or in laboratory settings (n=7), <sup>[2, 13, 26, 28, 29, 32, 36]</sup> aggregate results for real-world versus experimental setting were virtually identical, whereby the proportion of studies showing overall positive outcomes, some positive outcomes, or no changes, were the same in both settings (4:2:1 respectively).

#### 3.2 Food selected, ordered or consumed

There are various expressions used to describe menu choices. In experimental settings where participants made hypothetical food choices of ‘intended’ purchases, this is referred to ‘energy **selected**’. Where consumers’ actual food purchases were recorded and verified with purchase receipts, this is referred to ‘energy **ordered**’ and where ‘left-overs’ or unfinished portions of meals are measured and taken into account, this is referred to as ‘energy **consumed**’. When considering the two studies that measured energy consumption, they both resulted in positive outcomes <sup>[25, 26]</sup>. There was little difference between the results when considering studies that measured energy selected or ordered, whereby Menu Labelling had the desired effect in most, but not all, instances.



### 3.3 Restaurant type

The articles reviewed, reported on research conducted in various types of food outlets. When comparing the results, cafés <sup>[33]</sup>, cafeterias <sup>[25]</sup> and snack food <sup>[2]</sup> all showed Menu Labelling to be effective in reducing energy selected, ordered or consumed. The majority of fast food outlets <sup>[26-29]</sup> resulted in overall positive outcomes, with the exception of two studies <sup>[35, 36]</sup>. Menu Labelling in table-service restaurants tended to have a less pronounced impact on consumers' choice, where two studies resulted in energy reductions <sup>[15, 31]</sup> and in the other two studies energy reductions were detected, depending on the Menu Labelling format/design (further described in Section 3.7) <sup>[13, 34]</sup>.

### 3.4 Meal type

When data was collected for a specific meal, there tended to be a more positive response to Menu Labelling for evening meals/dinners <sup>[26, 28-30]</sup>, compared to lunch-time orders <sup>[32-34]</sup>. No study exclusively considered the effects of Menu Labelling on breakfast selections.

### 3.5 Meal component/course

In the context of ordering a 'meal' from a table-service restaurant, Menu Labelling was most likely to be used when choosing the main component, such as 'main course' compared to entrée/starter/appetisers, side orders, dessert and drinks <sup>[13, 34]</sup>. Menu Labelling was used, however, when choosing a single snack item in other settings <sup>[2]</sup>.

### 3.6 Socio-demographic differences

Various socio-demographic and purchasing patterns were recorded in some of the studies in an effort to detect which population segments were more likely to respond to Menu Labelling. Body mass index (BMI) <sup>[13, 25, 28, 29]</sup>, race/ethnicity <sup>[25, 27, 33]</sup>, age <sup>[25, 27, 29, 33]</sup> and socio-economic status (SES) <sup>[25, 27, 29, 33]</sup> had little impact on the effective use of Menu Labelling.

There was a tendency for those who have an interest in health, and were self-reported 'users' of nutrition labels when supermarket shopping, to be more attentive to Menu Labelling <sup>[25, 27, 32]</sup> though in one study the level of 'interest in health' had no impact <sup>[29]</sup> and another study showed those who were least health conscious to be most responsive to energy information <sup>[34]</sup>.

Females were found to be more attentive to Menu Labelling compared to males in three studies <sup>[25, 27, 33]</sup> though two studies showed no differences between the genders <sup>[28, 29]</sup>.

The effects of Menu Labelling on children's meal choices were contrasting, where one study showed a positive effect <sup>[31]</sup> but the other had no impact <sup>[36]</sup>.



### 3.7 Energy labelling format

In addition to testing the effects of displaying energy information, a number of studies also tested the effects of other Menu Labelling formats or designs, which offered contextual or interpretive guidance, as described below:

#### Traffic light colour coding

The most often tested variation of Menu Labelling formats was the addition of single traffic light to denote if the menu item was low (green), medium (amber) or high (red) in calories. Traffic lights enhanced the noticeability<sup>[36]</sup>, facilitated comprehension<sup>[29, 34]</sup> and subsequent use<sup>[26]</sup> of Menu Labelling.

#### Physical activity equivalents

Using physical activity equivalents, by presenting energy information in terms of how much physical activity is required to expend the calories of a specific menu item, also improved was effective in reducing calories selected<sup>[2, 28]</sup>.

#### Other Menu Labelling formats

Ranking menu items according to ascending energy content<sup>[13]</sup> had a positive influence on consumers' choices while including other nutrient values (fats and sodium, for example)<sup>[26, 36]</sup>, or adding health logos<sup>[30, 31]</sup> had little impact.

#### Reference values

Reference values offer contextual guidance as to how energy values of menu items compare to a full day's energy requirement, which intend to enhance the salience of energy labelling. Reference values appear on menus as statements such as *'The average adult daily energy intake is 8700 kJ'* or *'The recommended daily caloric intake for an average adult is 2000 calories'*.

Four experimental studies explicitly included reference values in energy labelling conditions. The single study that compared the effects of 'calorie labelling' and 'calorie labelling *with* reference values' (amongst other menu formats), showed that reference values enhanced the effects of calorie labelling. It was found to be the most effective of all labelling formats and rated by participants as the most 'understandable'<sup>[2]</sup>. The remaining studies tested calorie labelling with reference values against other formats (including traffic light labelling and ranking menu items according to ascending calorie content), two of which showed that calorie labelling with reference values significantly (clinically or statistically) reduced energy selected, compared to 'control' menus with no information<sup>[13, 29]</sup> and one showed Menu Labelling with reference values had no significant impact in reducing energy selected<sup>[36]</sup>.



### 3.8 Combining Menu Labelling implementation with product innovation

Product innovation incorporates a number of measures, which can change the nutritional profile of menu items including, introducing new products, or reformulating existing products through altering cooking methods, substituting ingredients, modifying meal composition, changing the default extras for combo meals, or varying portion sizes <sup>[37]</sup>.

In addition to adding nutrition information to the menus, two studies also reformulated existing menu items and added new items to increase the selection of healthier options made available. Both studies showed positive results in reducing energy content of meals ordered or consumed, especially with in-store promotions of the 'healthy' choices <sup>[25, 31]</sup>.

### 3.9 The effect on purchases

Only one study reported the effects of purchasing patterns in terms of sales and revenue. Customers in food outlets with Menu Labelling purchased 0.3 fewer items and spent \$1 USD less compared to customers at food outlets without Menu Labelling <sup>[30]</sup>.



## 4 Discussion

Given the increased frequency of consumption of food and beverages outside the home, the eating out environment is of key importance in making Danish dietary habits healthier, and reducing the number of food related illnesses and deaths <sup>[4]</sup>. Based on the review findings, the following section explores if Menu Labelling can contribute to improving Danish dietary habits and reduce energy ordered or consumed.

### 4.1 Menu Labelling can reduce energy ordered or consumed – the evidence is building

Though it is difficult to make direct comparisons between the studies due to their varying designs (Appendix II), a crude tally of results provides a positive outlook. These results present an overall improved effect of Menu Labelling compared to previous reviews <sup>[14, 38, 39]</sup>. When paralleling these results with those from the literature review conducted in 2012, using the same methodology <sup>[24]</sup>, the most notable and progressive shift is in the increased proportion of overall positive results with a corresponding reduction in positive results which only applied to some sub-groups.

This positive trend may be attributable to results emerging from countries other than the USA, where the initiative was vehemently opposed by industry, gaining negative press <sup>[35, 40-42]</sup>, where implementation was sporadic and inconsistent across jurisdictions (Appendix I) and practical utility and policy compliance were low <sup>[43]</sup>. Time is needed to ensure industry compliance and consistency in Menu Labelling displays.

The progressive strengthening of the evidence over time, could also reflect the complexity of food-related decisions and the fact that eating behaviours take time to change <sup>[16, 44]</sup>. The notion that repeated exposure is needed for consumers to notice and understand Menu Labelling <sup>[13, 25, 45, 56]</sup> is demonstrated by studies collecting multiple sets of post-labelling data. In such studies Menu Labelling had a greater impact after one year, compared to six months <sup>[16, 33]</sup>.

The results, however, remain somewhat mixed which can be expected for various reasons, relating to both consumer characteristics and varying degrees of industry compliance to Menu Labelling regulation. This is best exemplified by a study from New York City's 'poorer neighbourhoods' where Menu Labelling had no impact on consumers' choices <sup>[35]</sup>. But, data was collected at a time when many chains were not complying with regulations <sup>[27]</sup>, many calorie counts were given in wide ranges<sup>1</sup> and only 38% of consumers reported noticing the energy information (more typically at least 75% notice). Further, the participants resided in a neighbourhood with a high concentration of

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<sup>1</sup> Ranges have been shown to cause consumer confusion and doubt as to the information's accuracy <sup>[49]</sup> especially when the range is large <sup>[47]</sup>



fast food outlets<sup>[47, 48]</sup>, and poverty, hunger and lack of understanding of caloric values were self-perceived barriers to Menu Labelling use<sup>[47, 49]</sup>. The residents also expressed intention to maximise calories for their dollar or blatantly dismissed Menu Labelling information in their purchasing decisions<sup>[32, 43, 49]</sup>. Such conditions do not accurately reflect the Danish context, minimising the likelihood that similar results would be experienced in Denmark.

Mixed results could also arise from sample sizes that are unable to detect statistical significance in meaningful energy reductions. The statistically non-significant reduction of 69 calories detected in the study by Ellison, Lusk and Davis<sup>[34]</sup>, for example, could be considered significant in terms of public health outcomes, especially for regular out-of-home eating. Some have suggested that sustained energy decreases as small as 50 calories per restaurant visit<sup>[50, 51]</sup> could avert weight gain. More specifically, Vanderlee & Hammond<sup>[25]</sup> calculated that reductions of 130 calories, twice a week, could avoid 3.7 kg weight gain over the course of a year.

## 4.2 Positive outcomes are real

This review found equally positive results for Menu Labelling in both the real-world and those conducted in experimental settings. This is a progressive and positive step compared to the findings of Krieger & Saelens' review<sup>[14]</sup>, which found only those studies conducted in experimental settings resulted in positive outcomes, while studies conducted in the real-world tended to have no overall effect. The impact of Menu Labelling on consumer behaviour in the real-world is probably best highlighted by the results of a study recently conducted in Australia, which is considered robust in design. In this outcome evaluation, the effects of Menu Labelling on consumer behaviour showed the median energy purchased decreased by 9% from May 2011 to January 2013<sup>[16]</sup>. These more recent findings effectively disband any speculation that positive outcomes in experimental settings are largely attributable to response bias.

## 4.3 Menu Labelling reduces energy consumption

Both studies identified in this review, which measured energy consumption, resulted in significant energy reductions of 21%<sup>[25]</sup> or 96 calories<sup>[26]</sup>. Measuring energy intake, as opposed to considering energy ordered (either hypothetically or in reality), provides a more accurate measure of the effects of Menu Labelling on consumer behaviour, since consumers could respond to Menu Labelling by eating less<sup>[26]</sup> and it also minimises social desirability bias<sup>[45]</sup>. Compared to the previous review<sup>[24]</sup>, Menu Labelling is now more consistently reducing energy consumption.

## 4.4 Menu Labelling is effective in various settings

When comparing the effects of Menu Labelling in different food establishments, energy ordered or consumed decreased most consistently with menus based on 'typical' fast food. This should be considered very encouraging since the consumption of such foods is frequent, primarily due to the



affordability and convenience <sup>[47, 52, 53]</sup>. The provision of point-of-purchase energy information can effectively help overcome passive overconsumption or ‘mindless eating’ <sup>[54]</sup> thereby countering incentives to ‘up-size’ or ‘bundle’ and promotional messages such as “*Don’t cook, just eat*”.

Most patrons appreciate calorie information on table-service restaurant menus <sup>[13, 55, 56]</sup>, though the effect on their meal choices is not consistent. This may reflect attitudes towards allowing the occasional indulgence, even if they are becoming more regular <sup>[55]</sup>. It has been shown that table-service restaurant meals are high in calories, even in comparison meals from large fast food chains, and it is not uncommon for consumers to order three-quarters of the recommended average daily energy intake for a single meal <sup>[13, 30, 57]</sup>.

Chain table-service and family-style restaurants, such as Jensen’s Bøfhus and STICKS N SUSHI, are therefore important locations for Menu Labelling as is chain cafés and bakeries, such as Baresso, JOE AND THE JUICE and Lagkagehuset, given the positive outcomes of studies conducted in these food establishments <sup>[30, 31, 33]</sup> and their increasing popularity in Denmark <sup>[3, 4, 58]</sup>.

The chain itself often accounted for more variation in energy ordered compared to consumer characteristics. Energy content of similar dishes served at leading family-style restaurants can vary ‘tremendously’ <sup>[26]</sup> and a ‘small burger and fries’, can range from 480 to 1,100 calories between chains <sup>[27]</sup>. The variations are largely due to portion sizes, as opposed to ingredient composition <sup>[23, 54]</sup>. These findings support the need for Menu Labelling to extend beyond the fast food setting into table-service/family-style chain restaurants, to enable consumers to make between-chain comparisons. Furthermore, Menu Labelling should encourage chain outlets to reduce calorie content through reformulation if their meals are comparably calorific, particularly down-sizing given the strong influence of portion sizes on calorie content.

Evidence is growing to suggest that consumers no longer want large servings <sup>[59]</sup>. Further, a greater proportion of patrons choose healthier options when they are promoted and are less inclined to supersize in the absence of counter/service staff prompts to do so <sup>[12, 60]</sup>. In fact, inviting consumers to downsize can significantly reduce energy consumption, without impacting satiety at the end of the meal <sup>[54]</sup>. Danes want healthier fast food options and 59% would prefer a burger with more fibre and less fat, compared to a regular burger <sup>[4]</sup>. These findings highlight the importance of appropriate portion sizes and assisting consumers to activate self-control. It is worthwhile communicating the powerful influence, of offering and promoting healthy defaults, to industry during consultations. Industry can play an active role in amplifying the positive effects of Menu Labelling, which is also said to be ‘good for business’ <sup>[1, 4, 48, 61, 62]</sup>. Coinciding with Menu Labelling implementation in Australia, McDonald’s, for example, began offering salad *or* fries as a standard value-meal option, a choice that could save 1426 kJ (340 calories) <sup>[63, 64]</sup>.



## 4.5 Menu Labelling effects on different meals, and meal component

Studies that assessed the effects of Menu Labelling on different meals, found that it was most effective on evening meals. This reflects the Danes' attitudes towards healthy eating, which is of greater importance when eating dinner, compared to eating lunch <sup>[65]</sup>. Menu Labelling is of equal importance across all menu items to fully inform consumers at each meal or snack time. Many consumers, for example, may be unaware that breakfast items are typically high in calories and breakfast combos can contain over half the recommended daily energy intake <sup>[32,66]</sup>.

It was also found that patrons used Menu Labelling to choose less caloric main meals, but not for choosing beverages or desserts <sup>[25, 28, 30, 34]</sup>. This could represent a 'trade-off' or 'reward trigger', whereby being calorie-conscious at the time of ordering the main course could alleviate guilt associated with ordering an energy-dense dessert or appetizer. It could also demonstrate that beverages and desserts are considered inconsequential calories <sup>[20, 34]</sup>. Campaigns supporting Menu Labelling implementation may therefore need to communicate the importance of calorie consciousness with regards to all meals, all components of an entire meal and treats.

Industry contributions to the positive effects of Menu Labelling, in relation to reducing the total energy ordered or consumed, can be substantial by making low-calorie side dishes and beverages the default option when bundling items into meal-deals <sup>[25, 31, 48, 60]</sup>. Lagkagehuset offering discounts on bottled water, with a sandwich purchase, provides a simple example of 'bundling' which supports reducing calorie consumption in Denmark.

## 4.6 Menu Labelling is 'equitable'

Many consumer socio-demographic differences, such as SES, BMI, race and age had little effect on Menu Labelling use, supporting the observation by Morley and colleagues <sup>[29]</sup> that Menu Labelling is an 'equitable' initiative.

What is particularly encouraging from these findings is that low SES has earlier been associated with little or no response to Menu Labelling in studies originating from the USA <sup>[24, 67]</sup>. Recent data from various countries, however, essentially quells previous concerns by showing that Menu Labelling is an equitable initiative across social grades.

In some instances however, those with higher education, those with an interest in health and females tended to respond more to Menu Labelling than those who have low levels of education, those with a low interest in eating healthily and males.

Higher levels of education have consistently been related to increased use of nutrition labelling, especially where calorie displays require numerical skills or when the information is more difficult



to interpret <sup>[43, 47]</sup>. A similar profile of nutrition-label users exists in Denmark where those with further education have better knowledge of the keyhole symbol and are more likely to use it than those with a short education <sup>[68]</sup>. Low levels of education have been associated with consumers' decreased likelihood of noticing the information, the misconception that high calorie menu options are 'better value for money' <sup>[35, 47]</sup> and an increased likelihood of overestimating energy expenditure <sup>[15, 55, 69]</sup>. Menu Labelling has to be concise and simple to be easily understood and appeal to those with lower levels of literacy or numeracy <sup>[29]</sup>. Social marketing and educational efforts supporting implantation have to demonstrate how all consumers can make use of the information. The [caloriewise](#) scheme in Northern Ireland offers a good example <sup>[70]</sup> while interpretative guidance (section 4.7) can also be used to improve consumer understanding.

This review found that consumers were more likely to respond to Menu Labelling if they had an interest in health, which is consistent with studies concluding that nutrition information has to be perceived as relevant to provide the motivation to use it <sup>[15, 55, 71]</sup>. A positive relationship also exists between those with an interest in health, and the use of nutrition labels when grocery shopping. It is anticipated that Menu Labelling will, however, facilitate wider usage than evidenced with nutritional labelling on packaged foods since i) it requires less effort to find the information, ii) there are fewer socio-demographic groups reported as non-users and iii) there is a greater impact on purchase intentions in relation to Menu Labelling compared to packaged foods <sup>[29]</sup>. These are promising findings, since the Danes are considered to have a 'high' interest in healthy eating and 'high' nutrition knowledge <sup>[72]</sup>, while around half of Danish supermarket shoppers purposely select products with the wholegrain logo <sup>[73]</sup>.

Women have traditionally taken responsibility for the household food shopping and meal preparation <sup>[72, 74]</sup> which makes them more familiar with nutrition labelling and more likely to be attentive to Menu Labelling. Also, women are typically more often associated with 'watching their weight' or 'calorie counting' <sup>[55]</sup>, increasing their perceived relevance and subsequent use of Menu Labelling information. Though women's elevated awareness and their endeavour to eat healthily is more pronounced than their male counterparts, there is an increasing proportion of Danish men who are adopting health-conscious attitudes and becoming more responsible in the home-kitchen <sup>[72]</sup>. The emerging new norm implies that Menu Labelling may have a population-wide, rather than gender-biased, effect in Denmark, which aligns with Danish stakeholder opinion <sup>[24]</sup>.

The inconsistent effects of Menu Labelling on children's food choices may reflect a lack of cognitive ability to understand the information or their desire for tasty foods which predominates health concerns <sup>[75]</sup>. High-energy meals are often misconstrued as 'healthy' by parents who believe they provide necessary energy for children's physical activity and growth <sup>[76]</sup>. This misconception may cause parents to either not consider Menu Labelling or to use it to maximise calories. Social marketing efforts and education campaigns supporting implementation should provide



recommendations for child daily average energy requirements. The [8700 campaign](#), launched by the NSW Government <sup>[77]</sup> in Australia, provides an example of how the general public can calculate the individual energy requirements for children of varying ages, sex, weight and physical activity levels.

Lack of effect of Menu Labelling on children's choices may also reflect typically energy dense options being offered <sup>[19]</sup> and promoted to youngsters, particularly children's combo meals <sup>[60, 78]</sup>. Reiterating the importance of healthy defaults is important, as is calorie-appropriate portion sizes. The food service industry should be encouraged to improve the availability of healthy options to children, particularly with meal-deals. The feasibility of doing so is exemplified by McDonald's in Australia, where one in three Happy Meals purchased now include healthier side orders and beverages <sup>[63]</sup>.

#### 4.7 Menu Labelling formats that enhance use

A noticeable change in this review, compared to studies published up to 2012, was the increase in various Menu Labelling designs tested. Many authors sighted the purpose of testing different formats was to determine if there is a better way to display energy information <sup>[13, 26, 29]</sup>, given the mixed results of previous studies.

The need for simple, clear and concise Menu Labelling cannot be understated <sup>[26, 29]</sup>. This reality, together with the fact that calories are considered by consumers as the most important and 'looked at' nutrition information <sup>[25, 30]</sup> provides solid justification why Menu Labelling should be limited to energy information only. In any case, evidence supports that including other nutrients does not enhance the effects of Menu Labelling <sup>[26, 36]</sup>.

While simplicity is essential, this does *not* imply that some menu items should be exempt from Menu Labelling. When brand-name non-alcoholic drinks <sup>[30]</sup> and à la carte meals <sup>[31]</sup> remained unlabelled, calories purchased increased for these menu items while there was a corresponding decrease for total calories purchased <sup>[30]</sup> and for combo meals as a result of energy labelled <sup>[31]</sup>. All menu items therefore need to be labelled to ensure the 'shifts' in purchase patterns are fully informed.

When Menu Labelling offered interpretive guidance, traffic light colour coding <sup>[13, 29, 34, 36]</sup> and physical activity equivalents <sup>[2, 29]</sup> notably enhanced the visibility, understanding and use of Menu Labelling.

These findings are consistent with other studies that found traffic lights 'drew attention to' and 'facilitated understanding' <sup>[79]</sup> in various settings and across socio-demographic groups <sup>[45, 80]</sup>, while overcoming barriers to Menu Labelling use, such as having low numeracy skills, and time needed to consider and act on the information <sup>[35, 81]</sup>.



Similarly other studies have found physical activity equivalents to be effective in reducing energy ordered or consumed <sup>[82-84]</sup>. Evidence suggests that this format frames energy information in a more familiar and tangible way, which allows consumers to comprehend the trade-offs of energy consumption and energy expenditure <sup>[69]</sup>. Consumers also find the information more personally applicable, compared to calorie labelling. A difference of 60 calories, for example, was considered trivial, but an extra 20 minutes of walking effectively prompted participants to consider menu options more carefully <sup>[69]</sup>. It could also address cognitive distortions that high calorie meals could be sufficiently counteracted with a small amount of physical activity <sup>[15]</sup>. Physical activity equivalents may not only encourage consumers to eat less, but may encourage them to be more active too, further supporting obesity prevention. Another advantage of this Menu Labelling format is that it should not be opposed by the food service industry given their expressed commitment to promote active lifestyles <sup>[85, 86]</sup>. Physical activity equivalents should therefore be considered important tools in social marketing and educational efforts to support implementation by installing a sense of energy balance and expediting familiarity with caloric requirements.

It is difficult to isolate the effects of reference values from the studies considered in this review, due to study designs, most notably they all measured energy content of 'intended purchases'.

Methodological short-comings, such as in the study best demonstrating the positive effects of adding reference values to energy labelling <sup>[2]2</sup>, and the study which showed Menu Labelling with reference values had no impact <sup>[36]3</sup>, further obscure the impact of reference values.

While this review provides no consistent evidence as to the effects reference values, a meta-analysis recently published found that disclosing energy only on menus had marginal effects, while adding contextual information in the form of reference values assisted consumers to significantly reduce energy ordered or consumed by 67 calories ( $P=0.008$ ) <sup>[87]</sup>.

#### 4.8 The effect on the food service industry

Auchincloss and colleagues <sup>[30]</sup> found that Menu Labelling reduced the average number of items sold and the average amount of money spent by \$1 USD. This finding is inconsistent with other studies, which report no effects <sup>[88]</sup> or increases in revenue <sup>[48, 89]</sup>.

This inconsistent finding could be explained by the study's cross-sectional design which does not detect if the variations in money spent and number of items purchased were apparent between the

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<sup>2</sup> Small sample size, the varying demographic characteristics across the four menu conditions, the experimental setting and the small menu selection of snacks only, with no healthy alternatives, on a fabricated menu with no price

<sup>3</sup> Menu selections were made during a telephone survey conducted at random times of the day (between 9:00 and 18:00) with no instruction as to whether participants were ordering a snack or a meal. The fabricated fast food menu contained 36 generic food and beverage items



two outlets in pre-labelling conditions. This is a likely scenario given that customers of outlets *with* Menu Labelling were younger, more often African-American and ‘poorer’, three socio-demographic characteristics that are associated with spending less, compared to older, ‘White’ and a more affluent customers who visited the non-labelled outlets<sup>[30]</sup>.

The findings of the study by Auchincloss and colleagues<sup>[30]</sup> is further countered by reports that customers prefer frequenting food service outlets that provide point-of-purchase nutritional information and more healthful foods<sup>[90]</sup>. Increasingly, the food service industry is providing healthier food options and this trend began around the same time as Menu Labelling regulation was being initiated. There are numerous examples of product reformulation (to reduce energy content), which is believed to be attributable to Menu Labelling<sup>[91, 92]</sup>. A study analysing fast food menu offerings before and after Menu Labelling found that healthier options increased from 13% to 19% in US counties with Menu Labelling, while the availability of healthy options remained steady at 8% in counties without Menu Labelling<sup>[93]</sup>.

Similarly, the introduction of the keyhole symbol and the wholegrain logo in Denmark has significantly increased the number of qualifying products available on supermarket shelves. There are now 660 different products bearing of the wholegrain logo<sup>[94]</sup>, representing a progressive and substantial increase since the inception in January 2009, and the ‘almost 400’ products that were available in 2011<sup>[95]</sup>. Likewise, the sale of keyhole products increased by 13%, between 2010 and 2012, and the number of products available doubled from 1,000 to nearly 1,900 in the corresponding period<sup>[96]</sup>. This exemplifies Danish consumers’ preference for healthier options and the capacity and willingness of the food service industry to meet the demand. This implies that Menu Labelling will trigger similar product innovation and reformulation trends in the eating out environment in Denmark. Such improvements have already been demonstrated with the 260 restaurants authorised to display the keyhole symbol<sup>4</sup>, whereby 75% began supplying healthier dishes since joining the scheme. Furthermore, restaurants who were motivated to improve their menus, to be perceived as healthier and to attract new customers, estimated that three quarters of their customers had positive attitudes to the changes<sup>[61]</sup>.

This review found that Menu Labelling implementation coupled with simultaneous improvements in the nutritional quality of foods offered, resulted in energy reductions<sup>[25, 31]</sup>. Other interventions have shown similar success such as the *Baltimore healthy carry-outs<sup>5</sup> feasibility trial*<sup>[48]</sup>. By providing healthier, lower-calorie options and promoting these items, sales increasing by 36.8%. This reiterates the importance of providing healthy choices, and where possible, making them the

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<sup>4</sup> The symbol requires that the meal has to be an appropriate portion size and contain more wholegrain, fruits and vegetables and less salt, sugar and fat<sup>[61]</sup>

<sup>5</sup> Carry-outs were defined as non-franchised, small local food establishments that sell ready-to-eat food and beverages for off-premises consumption<sup>[48]</sup>



default option, so consumers have to ‘actively work to engage in less desirable behaviours’<sup>[60]</sup>. Studies have demonstrated that Danes choose healthier options when they are the default option or when they are promoted and aptly labelled<sup>[12]</sup>, which should encourage Danish food-service businesses to adopt these marketing approaches.

It is also worth mentioning that Menu Labelling has been strongly opposed by some multi-national companies<sup>[42]</sup>. But, McDonald’s self-described “leadership” and willingness to voluntarily display calories on their menus, to help customers “make informed nutrition choices”<sup>[97]</sup> indicates that the initiative is feasible. In the US and Australia, where Menu Labelling is only mandatory in some States, McDonald’s restaurants provide Menu Labelling nation-wide<sup>[63, 97]</sup>. Similarly, in the UK, McDonald’s menu items display calorie content voluntarily as a part of their commitment to the Public Health Responsibility Deal<sup>[98]</sup>. Others, often small- and medium-sized businesses, have undertaken Menu Labelling voluntarily to ‘respond to consumer demand’ and ‘remain competitive’<sup>[55]</sup>. Provisions have been made within US and Australian regulations to allow businesses to voluntarily display Menu Labelling, even if they fall outside requirements, anticipating their willingness and desire to do so.

It has also been shown that industry concerns about implementation difficulties are easily overcome with stakeholder engagement and with appropriate support and guidance during the implementation phase<sup>[16, 48, 55, 62]</sup>. A major concern for small- and medium-sized businesses in Ireland was the cost of determining the energy content of menu items. To overcome this, [‘MenuCal’](#), an online calorie calculator, was developed by the Food Safety Authority Ireland, to allow food businesses to undertake their own energy analysis<sup>[99]</sup>. Consultation with industry provides a good opportunity to share international experiences, which may alleviate their concerns.



## 5 Conclusion

The review found that Menu Labelling can increase awareness and use of nutrition information in the eating out environment and highlights the importance of menus as a critical location for the display of energy values.

Compared to the previous review, the evidence now more consistently and robustly demonstrates that Menu Labelling results in significant reductions in calories ordered or consumed.

Barriers to Menu Labelling have diminished over time, as consumers become more accustomed to the information and better understand how they can use it. Time is also needed for the food service industry to comply with regulations and improve their selection of healthy items. Menu Labelling is effective in various food service settings and positively affects a large portion of the population, quelling previous inequality concerns.

To facilitate industry compliance, consultations with food service businesses should be held prior to implantation to address their concerns. The active role industry can take in improving the effects of Menu Labelling, through providing and promoting healthy and portion-appropriate menu options, should be communicated to them.

Menu Labelling is an important component to any multi-faceted approach to reduce the burden of overweight and obesity and is considered a 'promising means' to bolster the positive effects of mandatory labelling on pre-packaged food. The distinction between requiring nutrition information to appear on pre-packaged food, but not in the eating out environment is no longer reasonable. A lack of understanding of the energy content of foods eaten outside the home, raises the question of how can consumers be expected to make informed choices, in the absence of Menu Labelling?



## 6 Recommendations

Based on the findings of this study, the following recommendations are provided to guide Menu Labelling implementation in Denmark:

- Menu Labelling needs to be simple, clear and concise
- Menu Labelling should be limited to disclosing energy content and not other nutrient values
- All items offered on the menu should be labelled to ensure all choices and any 'shift' in purchase patterns are fully informed
- Contextual information, in the form of reference values, is essential to inform consumers of the recommended daily energy intake for an average adult
- Education campaigns supporting implementation should also clearly communicate the daily energy requirements for children
- Interpretive guidance, such as using physical activity equivalents, should be considered valuable tools in educational and social marketing efforts supporting implementation
- Menu Labelling should extend beyond quick service settings and include chain restaurants and cafés, to inform a larger proportion of the population and to allow comparisons across settings
- Campaigns supporting Menu Labelling implementation should communicate the importance of calorie consciousness with regards to all components of a meal (such as accompanying beverages, appetizers, side dishes and desserts), all meals (including breakfast, lunch and dinner) drinks, snacks and treats
- Evidence as to the growing demand for healthier choices and smaller portion sizes should be communicated to the food service industry
- Industry should be encouraged to:
  - Create healthier default combo-meals
  - Improve the availability of healthy options for children particularly with combo meals
  - Place more promotional emphasis on 'healthy' products
  - Realign portion sizes so they are more consistent with average energy requirements although consumer reaction to Menu Labelling may drive such industry responses
- Stakeholder consultations should guide the development of regulation
- A body should be established to support and provide practical guidance to the food service industry during the implementation phase
- An online calorie calculator should be made available for businesses to measure the energy content of their menu options



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## Appendix I - Summary of international Menu Labelling implementation status

Menu Labelling appears in various formats, which are regulated by numerous national, State or local jurisdiction policy. What changes most notably is:

- whether the Menu Labelling is regulated by law or a voluntary undertaking,
- the food service outlets it applies to (in all cases it applies to chain fast food outlets, but chain table- service restaurants, supermarkets, petrol stations and convenience stores is more contentious)
- how 'chain' is defined (the number of outlets for example, can range from as few as seven per State to as many as 50 nationally)
- and what information is required to be displayed (calories only or together with other nutrient values, and the provision of reference values and how it is worded)

Voluntary Menu Labelling agreements currently exist in Great Britain <sup>[1]</sup>, Northern Ireland <sup>[2]</sup>, and the Republic of Ireland <sup>[3]</sup> while Menu Labelling is mandatory in various States of the USA<sup>[4]</sup> and Australia<sup>[5-7]</sup>.

### Voluntary agreements

#### Great Britain, Northern Ireland, and the Republic of Ireland

Voluntary Menu Labelling agreements currently exist in Great Britain, Northern Ireland, and the Republic of Ireland. The latter two, initiated Menu Labelling with pilot projects, with a view of implementing mandatory regulation agreements based on process evaluations of the pilot voluntary agreements.

The respective voluntary agreements are all similarly based on four principles namely;

1. Calorie information is displayed clearly and prominently at point of choice;
2. Calorie information is provided for all standardised food and drink items sold;
3. Calorie information is provided per portion/item/meal and, for multi-portion or sharing items, the number of portions will also be provided;
4. Reference information on calorie requirements is displayed clearly, prominently, and in a way that is appropriate for the consumer.

The respective agreements in Northern Ireland and the Republic of Ireland are purposely harmonised to facilitate better consumer understanding across borders, to realise potential cost and time savings for food businesses operating in both jurisdictions and to exploit potential cost



saving synergies for Government developed training support and Government provision of technical support for food service businesses.

By 2013/14, 48 businesses in England, including BurgerKing, McDonald's, Domino's Pizza Company and Starbucks Coffee Company had signed up, representing more than 9,000 outlets and covering approximately 23% of all meals sold and one-third of all meals served on the high street <sup>[8, 9]</sup>.

Almost 80% of fast food outlets are displaying calories on their menus while the Food Safety Authority of Ireland (FSAI) have recently created a 'MenuCal' tool to assist food business operators to calculate calorie contents of their own menu items<sup>[10]</sup>.

The success of the six-month pilot project prompted the Food Standards Agency in Northern Ireland to rollout the Caloriewise Scheme<sup>[2]</sup>. Through their evaluation report, it was found that companies' motivation to take part in the voluntary Menu Labelling pilot scheme was to: promote public health, to maintain market share or to gain a competitive advantage and, to help shape and prepare for (possible) future Menu Labelling legislation <sup>[11]</sup>.

It is worth noting that a number of large, often multi-national fast food chains voluntarily displayed energy values on menu boards prior to any regulation or agreement being put in place. McDonald's in the USA, for example, announced in 2012 that they would add calorie counts to their menus nationwide <sup>[12]</sup>. In Australia, a number of coffee, burger, sandwich, donut, pizza and juice chains adopted Menu Labelling prior to regulation <sup>[13]</sup>. Many table-service restaurants adopted Menu Labelling because they think it will be 'good for business' <sup>[11, 14]</sup>. Provisions have been made in mandatory regulations to allow small and independent eateries to voluntarily display Menu Labelling, anticipating the desire of food businesses to do so.

## Mandatory Regulations

In parts of the USA and Australia Menu Labelling legislation mandates that chain restaurants and other quick-service establishments serving standardised food must display energy values on menus and other materials displaying the product and/or the price.

### USA

In the USA, various cities, counties and States have introduced varying Menu Labelling legislation ahead of the Federal law, which was passed in 2010, but enactment is not expected until mid- 2015. At least half of the States have Menu Labelling laws passed, whether they be State-wide, county specific or limited to a single city <sup>[15]</sup>. Initially in New York City, Menu Labelling targeted fast food chains requiring them to display calorie values for standardised menu items. Across borders, Menu Labelling morphed in other jurisdictions to include other quick service establishments, and even table-service restaurant chains, and to display other nutrient values (including salt, fat, saturated fat



and carbohydrates) in addition to calories. Under the Federal law, a clear statement as to the average daily energy requirement will also need to be included on the menu, though this requirement only applies to some of the local jurisdiction laws currently in place. 'Standardised menu items' generally refers to food and/or beverages, which are offered for at least 30 days, and is made according to a consistent recipe of standard ingredients measured in standard quantities, so there is little variation within and between, food service outlets. While 'chain' generally refers to a restaurant, or similar retail food establishment, that is part of a chain with 15 or 20 locations under the same name nationally.

## Australia

Around half of Australia's States and Territories have implemented Menu Labelling. NSW was the first State to implement sweeping changes, whereby the NSW Government introduced legislation mandating the disclosure of kJ information at standard menu restaurants only three months after the initial stakeholder consultation. Quick service food outlets had 12 months to comply before penalties came into force on 1 February 2012.

'Chain' is defined as food service businesses that have as few as seven outlets in the one Territory (as is in the case of the Australian Capital Territory which is one-quarter the size of Fyn) but more generally applies to 15-20 outlets in the one State or 50 outlets nation-wide. The definition embraces traditional fast food and burger chains as well as other chains including cafés, bakeries, cake and donut shops, snack foods, juice bars, ice-cream parlours, pizza houses and chains selling pasta, noodles, stir fry, sushi, prepared salads and even supermarket chains selling ready to eat food.

Convenience stores, service stations, food businesses that primarily provide food catering services and food businesses that only sell food that is intended to be consumed on the premises and retail outlets at health care facilities are however exempt.

'Standard food items' apply to ready-to-eat food of standard size and content that is listed on a menu with a price tag or other label for at least 60 days.

The various laws in Australia have been made consistent to facilitate cross border consumer understanding and to enable a smooth transition, should a federal law come into effect.



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## Appendix II – Summary of articles

Year and authors	Country	Aim and Study design	Sampling	Setting Real-world or experimental?	1. Meals selected, ordered or consumed? 2. Nutrients and interpretive guidance 3. Meal type	Co variants measured	Outcomes	Attributes (+) and Limitations (-) of study design <i>Study's implications and concluding remarks</i>
Vanderlee & Hammond, 2013 [25]	Canada Ontario	<p>AIM: Examine the effect of nutrition labelling in a cafeteria setting through measuring:</p> <ul style="list-style-type: none"> <li>self-reported consumer noticing</li> <li>self-reported use</li> <li>energy ordered and consumed</li> </ul> <p><b>Cross sectional exit/intercept survey Control/Intervention design</b></p> <p><b>Control</b> limited nutrition (energy, fat and sodium) information and no changes to food offered)</p> <p><b>intervention</b> 5 digital menu boards with point-of-purchase nutrition (energy fat and sodium) information, health logos and favourably reformulated products. Daily specials and pre-packaged food items were not labelled</p> <p><b>Intercept survey</b> Data collected M-F 11:00-19:00 and weekends 8:30 – 16:30 over 5 weeks - in August and September about 8 months Post ML implementation.</p>	<p>1003 cafeteria patrons aged 18+ (intervention n=497 control n=506)</p> <p>60% female 53% hospital Staff 75% higher education 75% White 50% overweight/obese</p>	<p>Real world 2 cafeterias on hospital campuses in large Canadian cities</p>	<p>1. Calories ordered and consumed</p> <p>2. Calories, sodium, saturated fat and total fat Use of health logo</p> <p>3. Breakfast, Lunch, Dinner and snacks</p>	<p>Staff / patients / visitors</p> <p>Demographics measures - Ethnicity, gender, BMI, education, income and age</p> <p>Degree of using nutrition labels when shopping for food</p> <p>Food vs. beverages</p>	<p><b>Notice</b> *79.5% intervention vs. 36.2% control Noticed ML *ML was most often noticed on the digital menu boards than other locations *Energy was noticed more often than other nutrients 51.7% (sodium 37.4%, total fat 32.8%) – intervention site</p> <p><b>Use</b> *More respondents were influenced by ML at the intervention sight 26.6% vs. 10.7%, though the proportion who saw and used was about the same (about one third) *Intervention participants <i>ordered</i> fewer (500 vs. 627) calories than control.</p> <p><b>Consumption</b> *Intervention participants <i>consumed</i> 21% less (P = 0.001) energy than control. *Significant differences in <i>food consumption</i> (intervention mean 435 calories vs. control mean 563 calories (P&lt;0.001) but not for <i>beverages</i> *Among the entire sample, those who noticed <i>consumed</i> 77 calories less *Among the entire sample, those who <i>used</i> nutrition labelling consumed 105 calories less than those who reported not being influenced by ML *At the intervention site those who <i>used</i> nutrition labelling consumed 60 calories less than those who were not influenced</p> <p><b>Socio-demographic differences</b> *Staff were more likely to notice than visitors (OR = 1.77, P= 0.011) and patients (OR = 3.06, P&lt;0.001) *Females noticed more than males (OR = 1.55, P= 0.011) *Staff, non-Hispanic/Whites and users of nutrition labels of packaged foods were more likely to use ML</p> <p><b>Perception of ML</b> *95% thought ML was a good idea in hospital cafeterias. 90% thought that all restaurants and fast food outlets should have nutrition labelling *83% supported health logos on menus *72% wanted calorie labelling (more so than fat 54%, sodium 51% and other nutrients)</p>	<p>-Results cannot be attributed to ML alone, since lower calorie options were made available at the intervention site -Self reported purchases and consumption amounts -Pre-packaged food and daily specials were not labelled</p> <p><i>ML is equitable – it was equally effective on low and high SES groups</i></p> <p><i>Highlights the importance of prominent POP information and repeated exposure and that menu boards are a critical location for calorie information</i></p> <p><i>“A nutritional programme, including nutrition information on menus and improved nutrition profile of food offerings, was associated with substantial reduction in energy, sodium and fat consumption”</i></p>
<p><b>Does nutrition information on menus impact food choice? Comparisons across two hospital cafeterias</b></p>								



Year and authors	Country	Aim and Study design	Sampling	Setting Real-world or experimental?	1. Meals selected, ordered or consumed? 2. Nutrients and interpretive guidance 3. Meal type	Co variants measured	Outcomes	Attributes (+) and Limitations (-) of study design <i>Study's implications and concluding remarks</i>
Hammond et al., 2013 [26]	Canada Ontario	AIM: Examine the effect of calorie labelling on consumer awareness, food purchasing and food consumption, and the effect of providing other nutrient values and using traffic lights. <b>Blinded randomized between-group experiment</b> Participants receive 1 of 4 menus (1)no nutritional information (2)calories (3)calories and traffic lights (4)calorie, fat, sodium and sugar amounts with multiple traffic lights <b>Survey</b> used to assess recall, knowledge and use of nutrition information and degree of influence on meal selection. Data collected November 2010 – June 2011 Participants received \$20	635 adults recruited in South-Western Ontario via newspapers, bus and online advertising.  50% female 63% >35 years old 75% White/Caucasian 80% higher education 53% overweight/obese	Experimental setting – participants ordered a meal to consume after a 'lifestyle' survey Fictitious menu design based on Subway offerings	1. Calories ordered and consumed  2. Calories, fat, sodium and sugar Use of traffic lights  3. Dinner	Demographics measures – sex, age, ethnicity, education and BMI	<b>Notice</b> *Significantly more participants from the calorie only (78%), calorie and traffic light (82%) and multi-traffic light (86%) conditions noticed nutrition information compared to the control group with no information (14%) *Recall of calorie information was significantly higher in the calorie only (72%) and calorie traffic light (71%) conditions compared to the multiple traffic light condition (49%) <b>Use</b> *Compared to the control group, calorie only ( $x^2 = 40.2$ , $P < 0.001$ ) calorie traffic light ( $x^2 = 68.8$ , $P < 0.001$ ) and multi traffic light ( $x^2 = 63.0$ , $P < 0.001$ ) reported <i>being influenced</i> by the nutrition information *A greater proportion of participants in the calorie only (32.1%) and the calorie traffic light (30.1%) correctly estimated/recalled the calorie content of their meal compared to no information (14.2%, $p < 0.001$ ) and multiple traffic lights (21.1%) *No significant differences were observed in the number of calories <i>ordered</i> between conditions: no information (mean=903.4, SD=318.5), calorie only (mean=850.9, SD=389.9), Calorie traffic light (mean=857.4, SD=366.0), and Multi-traffic light (mean=855.5, SD=344.5). <b>Consumption</b> *Participants in the calorie only condition <i>consumed</i> significantly fewer calories (mean = 744.2, SD = 368.1) compared to participants in the no information condition (mean = 839.6, SD = 318.8; $\beta = -68.1$ , $p = .048$ )	-Participants limited to ordering 1 main, 1 side and 1 drink. -No price was included on the menus and participants did not have to pay for the meal +Meals were weighed before delivered to participants and leftovers were also weighed to calculate energy consumption +There was no differences in socio-demographic characteristics between groups  <i>Providing nutrition information on menus increases recall and use of nutrition information and improves knowledge of calorie content</i>  <i>On average, the intervention groups ordered approximately 50 calories fewer than the control group and consumed an average of 96 calories less– a reduction of 11%</i>  <i>The inclusion of other nutrients had little effect.</i>  <i>“The current research suggests that calorie information on menus may reduce caloric intake as a function of both meal selection and the amount of food and beverages that are consumed”</i>



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Dodds et al., 2013 [36]	Australia New South Wales	AIM: Examine the effects of energy and single traffic lights labelling systems on the energy content of child and adult intended food purchases. Also determine if the impact of menu labelling systems differed according to participant demographic or weight-related characteristics and the awareness and use of labelling information. <b>Double blinded randomised control trial.</b> Participants were randomized to receive, by mail, 1 of 3 menus: (1) no label – control (2) energy menu or (3) single traffic light menu for overall nutrient profile All menus contained 36 generic food and beverages items, based on typical fast foods from various outlets which including healthy options, volume measures for beverages and prices The energy menu included a reference value (“the average daily energy intake for adults is 8700kJ”) Traffic light menus included interpretative guidance to explain the colour coding Primary outcome measured was the total energy of intended food purchases for parents and children First telephone scripted survey June/July 2011. Second follow up June and August ~ 18 days after the first survey. Participants were phoned at random times of the day (between 9.00 and 18.00) ‘to give their orders’	329 Parent/child (aged 3 – 12) pairs from an existing cohort, residing in the Hunter New England region Randomly recruited by telephone  83% adults female 42% children female Mean age of children was 7.7 years 50% of adults overweight/obese 30% of children were overweight/obese Parents and children consumed fast food meals 2.66 and 2.52 times per month respectively 83% of parents had higher education	Experimental setting Fictitious menus and hypothetical orders	1. Calories selected (purchase intentions)  2. Traffic light condition – single traffic light to indicate overall nutritional value and levels of fat, sugar, salt and energy  Included reference values  3. ‘a meal’	<b>Child</b> age, gender and BMI Frequency of eating fast food meals <b>Parent</b> age, gender, education and BMI Frequency of eating fast food meals	<b>Notice</b> *Those in the traffic light condition (96%) were significantly more likely than the energy labelling condition (82%) to notice the labelling (p=0.001) <b>Use</b> Of those who noticed the nutritional information *9% from the energy labelling group and 6% from the traffic light labelling group reported that this information influenced what they chose for their child *22% of the energy labelling group and 19% of the traffic light labelling group indicated that they used this information in making their own food choices *There were no significant differences in total energy content of intended purchases or between the energy content of beverages, main meals or dessert across the 3 conditions for either children or parents meals <b>Socio-demographic differences</b> *There were no significant differences in total energy content of intended purchases between menu labelling conditions by demographic or weight status *Adults who consumed fast food more than twice per month ordered significantly more energy than those that consumed fast food less frequently but only in the no labelling (p<0.01) and the traffic light labelling conditions (p<0.05)	+Demographic differences were the same between conditions -Participants were phoned at random times of the day (between 9:00 and 18:00 Monday to Friday) to give their order -Participants were not prompted regarding a specific ‘meal’ though menu items were selected from a typical lunch/dinner fast food menu (Personal correspondence with authors 2/6/2014) -Participants could select as many menu items as they wished for themselves and their children +Price was included on menu +(Adult) reference values included on menu -Energy content of children’s (mean age 7.7 years) meals (range 2580 to 2639kJ) were higher than their parents (range 1919 to 2130kJ) -Even the calorie range of meals for children aged under 8 (2238-2435) were higher than parents’ meals -All orders, for both children and adults, fell below the study design’s assumed order average of approximately 2903 kJ (sd 1481 kJ) -Energy ordered was comparatively low for a ‘typical meal’ as was the average frequency of fast food restaurants visits (only 2-3/month)  <i>The findings suggest that energy labelling and single traffic light labelling may not be effective in reducing the energy [...]. Additional public health initiatives which target other key drivers of fast food meal selection such as price and taste, reducing portion sizes or product reformulation may be required to improve public health nutrition. Coupling such strategies with supportive educational campaigns may support the implementation of these initiative”</i>



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Brissette et al., 2013 [27]	USA New York State	AIM: Examine purchase patterns at fast food restaurants and their relation to restaurant characteristics, customer characteristics and the use of calorie information during purchasing decisions <b>Cross sectional survey.</b> 35-40 participants at each site were interviewed and provided their purchase receipts. Intervention sites (in 3 counties requiring labelling: Albany, Schenectady and Ulster) and Control sites (Suffolk county considering menu labelling regulation, and Oneida county with no intentions to introduce menu labelling). Data collected between September 22 and November 19 2010 during lunch 12.00 – 14.30 and 8% collected at dinner-times 16.30 - 19.00 Participants received \$2	of 1.094 adult fast food restaurant customers at 4 fast food chains in 5 counties of New York State A total of 31 sites Albany (5), Schenectady (6) Ulster (6) Suffolk (8) and Oneida (6) = 14 Control sites and 17 Intervention sites  40% female 70% White 41% lower education 72% ate fast food weekly 50% knew RDA for calories	Real world 4 fast food chains that existed in all counties, including McDonald's, Burger King, Wendy's and Five Guys	1. Calories ordered. 2. Calories only 3. 92% of data collected at lunch-times and 8% collected at dinner-times	Restaurant characteristics -chain type, presents of ML, and poverty level of location.  Customer characteristics -demographics (age, sex, ethnicity and education) , calorie knowledge, awareness and use of labelling  Purchasing patterns i) ordering low calorie or no beverages, ii) small or no fries, or iii) < 3 items	<b>Use</b> *Patrons at labelled restaurants ordered an average of 888 calories compared to 948 calories ordered at non-labelled sites – a significant reduction of 60 calories (P = 0.05) *14.4% of intervention sample reported using the calorie information *Those who reported using calorie information, ordered 152 fewer calories (p=0.04) Purchasing fewer calories were associated with the provision of menu labelling (calorie labels vs. no labels P=0.02) *Knowledge of recommended daily energy intakes was not associated with ordering fewer calories *Purchasing a low-calorie beverage or no beverage at all, ordering small or no fries, and buying fewer than 3 items were purchasing patterns associated with ordering fewer calories *Restaurant chain accounted for more variance in total calories purchased than measured individual characteristics (eg.1.the variance in total calories purchased ranged from 784 to 1,348, p = <0.001) (eg.2 the calorie total for a small burger and fries ranged from 380 to 1,100 calories) <b>Socio-demographic differences</b> *In addition to self-reported use of menu labelling, other independent measures of purchasing fewer calories include: • being over 55 (P≤0.01) • having a college degree (P≤0.01) • being female (P≤0.01) • always considering calories when purchasing food (compared to sometimes or never considered) (P=0.02)	+Intervention restaurants limited to those fully complying to ML regulation -8% of participants were recruited at 'dinner' time (16:30 and 19:00) at some (unknown) sites to ensure a consistent sample size from each site, although dinner could have included 'snacks' instead of 'meals' given the time  <i>"Reference values for a single meal may be more relevant than for an entire day"</i>  <i>"Nutrition education should provide explicit instructions on simple behavioural strategies for ordering fewer calories"</i>  <i>"Promoting use of calorie information, purchase strategies, and calorie awareness represents complimentary ways to support lower-calorie choices at fast food chains"</i>  <i>The restaurant chain was a stronger predictor of calories purchased than consumer characteristic measured, reinforcing the importance of interventions that change the food environment</i>



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Dowray et al., 2013 [28]	USA North Carolina	AIM: Examine the effect of calorie and physical activity based labels on total energy of fast food meals hypothetically ordered. Also examined ML effects on the selection of Burgers, Salads, Side dishes, Desserts and Beverages <b>A between-group experiment</b> Participants were randomly assigned 1 of 4 calorie conditions (1) no information (2) calorie information (3) calorie information and minutes to walk to burn those calories and (4) calorie information and miles to walk to burn those calories Menus based on common fast food Unknown dates of data collection Participants could win 1 of 4 \$100 gift cards	802 employees recruited from online news-letters for a medical center and a medical school in the University of North Carolina Included adult participants who ate fast food at least once in their life-time  88% female 96% higher education 71% White 62% >40 years old 63% overweight/obese 2/3 were limiting calories or trying to lose weight	Experimental setting Web-based survey	1. Calories selected (purchase intentions)  2. Calories and physical activity equivalents  3. Unspecified 'typical meal'	Gender, BMI, trying to lose weight, limiting calorie intake, diagnosed with a chronic condition, exercise frequency, consider fast food a splurge, consider the health of food purchased, calorie literacy and numeracy	<b>Use</b> *Significant difference in the mean number of calories ordered between no labels (1020), calories (927), calories and minutes (916) calories and miles (826) (P= 0.02) *Greatest effect was with calories and miles (compared to no labels) (P = 0.0007) *Calorie label compared to no label (P=0.02) *Menu labelling had the greatest effect on burger selection (difference between no labels vs. the 3 labelling conditions P= 0.03) *Greatest effect on burger selection was with calories and miles (compared to no labels) (P = 0.001) *Calorie information affected side dish orders, compared to no label (P=0.02) *Greatest effect on side dish selection was with calories and miles (compared to no labels) (P = 0.007) followed by calorie labelling (compared to no labels) (P = 0.02) *There was no significant caloric differences in selection for salad, beverage or dessert orders between the 4 conditions <b>Socio-demographic differences</b> *BMI was the only variable with significant interaction with menu type compared to no labelling, calories ordered for the 3 calorie labelling conditions did not change for overweight (P= 0.07) or obese respondents (P=0.42) but changed significantly for underweight/normal BMI (P<0.001) <b>Consumer perception of ML</b> *82% reported a preference for physical activity based menus over calorie information alone or no nutrition information	-Did not include reference values +A decent menu selection was offered (10 burger choices, 6 side selections, 6 salads and 6 dressing options, 36 drinks and 10 different desserts) +No apparent differences between the groups with regards to demographic characteristics *Numeracy was considered low in the sample *Calorie literacy and numeracy were lower among overweight and obese participants compared to normal/underweight  <i>In experimental settings, physical activity equivalents on menus were more effective in reducing calories selected</i>
<b>Potential effect of physical activity based menu labels on the calorie content of selected fast food meals</b>								



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Morley et al., 2013 [29]	Australia Victoria	AIM: Assess whether the inclusion of kJ labelling alone or accompanied by further nutrition information on menus led to reduced energy selections at fast food outlets <b>A between-subjects experiment</b> Participants were randomly emailed 1 of 5 online menus, based on typical fast food (1) no information (control), (2) kJ labelling (3) kJ with % daily intake (4) kJ + traffic light (5) kJ + traffic lights + % daily intake Unknown when data was collected	1294 Victorian adults aged 18-49 who had eaten fast food in the past month – recruited from an existing online panel  74% female 76% aged 30-49 40% ate fast food ≥4 times in the last month 34% low SES 21% high SES 45% higher education 61% self-reported overweight	Experimental study using a fictitious menu Email survey	1. Calories selected (purchase intentions)  2) Traffic lights based on overall 'healthiness' considering fat, salt and sugar content  Included reference values  3. Evening meal	Sex, age, SES, education, Perceived weight, frequency of fast food consumption in the last month, importance of nutrition when eating out, knowledge about health and nutrition issues, correctly described kJ as a measure of energy, read kJ or nutrition information on food packs	<b>Use</b> *No information selected evening meals with the highest mean energy content (4627 kJ) vs. kJ (4137, p<0.05), kJ + traffic lights (4127, p<0.05) *Compared to no labelling, energy labelling conditions chose meals with 490 less kJ (117 calories) where they viewed the kJ labelling and 500 kJ for the kJ + traffic lights labelling, equating to an 11% reduction *The 2 conditions using % daily intake resulted in non-significant calorie reductions and was the least used information of nutrition labelling <b>Socio-demographic differences</b> *There was no significant interactions between ML condition and each of the demographic characteristics and nutrition knowledge and use factors assessed <b>Consumer perception of ML</b> *Participants most commonly reported using traffic light labels in making their decisions *37% used at least some of the nutrition information when making food choices, 36% used traffic lights, 25% used kJ information, 20% used % daily intake *When kJ, traffic lights and % daily intake were all together, 20%, 38% and 15% used the respective information	-Reference values included on intervention menus -The average order consisted of half a full day's calorie intake +Participants could choose up to 3 items from the mains and side options and up to 2 items from the drinks and desserts. They were required to select at least 1 item overall. +Participant demographic characteristics, frequency of eating fast food, kJ awareness, and perceived knowledge use and importance of health and nutrition, did not vary across conditions +sample size and randomization -Only provided 9 mains and side dishes (with various portion sizes or cooking methods) , 6 drinks (in various sizes) and 5 desserts (with 1 option for regular or large size) +Prices were included on the menu  <i>"This study reports a statistically and clinically significant reduction in the energy content of meals selected [...] when presented with nutrition information"</i>  <i>"The provision of kJ information, with or without traffic lights, is associated with lower energy content of selected meals (...). This reduction also did not differ by demographic factors, nutrition information knowledge or usage, suggesting this is an equitable method for encouraging adults to select healthier fast food meals."</i>
<b>What types of nutrition menu labelling lead consumers to select less energy-dense fast food? An experimental study</b>								



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Roseman, Mathe-Soulek & Higgins, 2013 [32]	USA Medium sized US city	AIM: Explore relationships between consumers' usage of grocery nutrition labels and restaurant menu labels. In addition, study consumers' menu selection behaviour when a restaurant menu provides or does not provide caloric information. Further, explore attitudes toward restaurant menu labelling <b>Randomised between-group experiment</b> No calorie information vs. calories Focused on lunch and snacks 11:00-14:00 and 16:00 to 17:00 Intercept surveys conducted in busy high streets, concluding with selecting a 'meal'  Data collected June-November 2010 and May-August 2011	302 adults (154 intervention 148 control)	Experimental setting	1. Calories Selected (purchase intentions)  2. Calories only  3. What they would choose if the menu was presented to them in a restaurant	Those who use grocery nutrition labels Those who believed they would make healthy menu selections BMI	<b>Use</b> *78% of all participants look at nutrition labelling when grocery shopping *Participants, from both conditions, who used nutrition labels ( $\mu = 700.59$ , s.d. = 179.4) in selecting menu items and those who did not ( $\mu=781.95$ , s.d. = 216.19) ( $P=0.002$ ) *79% indicated that they would make healthier selection at restaurants if calorie information was provided <b>Socio-demographic differences</b> *Individuals(from both conditions) who indicated they would make healthier choices with ML, did select lower caloric choices ( $\mu = 696.61$ , s.d. = 183.08), compared to those who did not indicate they would make healthier choices ( $\mu = 801.19$ , s.d. = 197.87; $P < 0.001$ ) *Those who use grocery nutrition labels and who believed they would make healthy menu selections made healthier choices, regardless of whether the menu displayed calories or not *No significant differences existed between caloric selections based on restaurant menu labelling alone *The lowest average calorie selection was made by participants who saw the calorie information and believed they would make healthier choices if provided with ML ( $P = 0.038$ ) *Menu labelling still affected almost 80% of participants, who subsequently chose 30 calories less than those who did not get calorie labelling	-Only 7 main menu items where sandwiches could be accompanied only by fries (or no fries) and salads had an option of adding a fat-free or standard dressing if desired +Good caloric range of menu items minimum 390 to 1127 calories -Not able to tell if consumers had previously been exposed to ML (location described but not revealed) -Prices were not included  <i>"An individual's positive attitude toward nutrition information must first be present to change the intentions to select healthful items"</i>
<b>Relationships among grocery nutrition label users and consumers' attitudes and behaviour toward restaurant menu labelling</b>								

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Krieger et al., 2013 [33]	USA King County, Washington	AIM: Evaluate the longer-term effects of ML on calories purchased (at 6 and 18 month post-regulation) and assess whether the use of ML varied across restaurant neighbourhood SES, restaurant type, demographic characteristics and assess self-reported awareness <b>Single-community pre-post-post natural experiment.</b> Regulation imposed 1 January 2009 Data was collected in 2008 to 2010 Baseline 1-3 months pre-regulation vs. 4-6 months post regulation vs. 18 months post regulation Data was collected for each period between 11:00 and 16:00 for food chains and 9:00 and 14:00 for coffee chains at the same 50 sites from 10 chain restaurants. Chains included 'top-10' most common regulated chains in the county, including Subway (11), McDonald's (6), Taco del Mar (8), Taco time (5), Starbuck's (5), Quizno's (4), Tully's (5), Jack in the Box (4), Burger King (4) and Taco Bell (1) = 40 food and 10 coffee chains. Pizza restaurants were excluded because most order online and do not see the ML. Coffee chain data was limited to barista-prepared beverages since these were consistently labelled and were subject to regulation Interviewers administered an exit survey and then collected itemised receipts \$2 awarded for participation	7325 English speaking customers aged ≥14 who had an itemised receipt 50 customers from each sight. 6125 from food chains and 1200 from coffee chains 41% females 76% White, non-Hispanic 53% aged <40	Real-world chain fast food establishments and coffee chains	1. Calories ordered 2. Calories only 3. Late breakfast, Lunch and snacks	Neighbourhood SES, restaurant type, demographic characteristics (sex, age, over / under 40, and customer awareness	<b>Notice</b> *Awareness of calorie information over the 3 periods increased from 18.8% to 58.3% to 61.7% (increase relative to baseline p<0.001) in food chains *Awareness of calorie information over the 3 periods increased from 4.4% to 31.2% and 30% (increase relative to baseline p<0.001) in coffee chains *More females than males reported seeing information (65.6% vs. 57.7%, P=0.01) but there were no difference by race or age <b>Use</b> *No significant changes occurred between baseline and 4-6 months post-regulation. *Mean calories per purchase decreased from 908.5 to 870.4 at 18 months post-regulation (38 calories, 95% CI = -76.9, 0.8, P = 0.06) in food chains and from 154.3 to 132.1 (22 calories, 95% CI = -35.8, -8.5, P = 0.002) in coffee chains. *Among customers seeing ML, the proportion using it (about 36% in food chains and 28% in coffee chains) remained steady at about 1/3 in the post-regulation periods *Food chain customers using ML, in both post labelling periods, purchased fewer calories than those seeing but not using ML (143.2 fewer calories, P< 0.001, 95% CI = -186.1, -100.3) and fewer than those not seeing ML (135.5 fewer calories, P< 0.001, 95% CI = -189.5, -81.5) *Calories decreased significantly in taco restaurants (113 calories, P<0.001, 95% CI = -164.1, -61.6) but not in burger (13 calories, P = 0.8, 95% CI = -110.4, 84.7) or sandwich (10 calories, p = 0.73, 95% CI = -64.5, 45.5) chains at Post 2 <b>Socio-demographic differences</b> *Calories decreased more among women than men in coffee chains *More females than males reported using ML (46.8% vs. 34.1% P=0.04) but there were no difference by race or age *Baseline to post 2 calories purchased in food chains declined significantly among females and younger patrons and in non-low income/diverse areas. *Baseline to post 2 calories purchased in coffee chains declined significantly among women, customers of all ages White/non-Hispanics and all SES areas *In all data collection periods the proportion of people seeing and using ML remained steady at about 1/3 *Fully adjusted analyses showed significant reductions of 35.5 calories in food chains and 26.3 calories in coffee chains	+Large sample size +Included a variety of popular chains +1/2 the selection of restaurants were located in low-income/diverse areas +Participant characteristics were similar across waves, except that more food restaurant participants were aged ≥40 in the second post-period -ML compliance was an issue since 8 outlets had point-of-purchase calorie information (on menu boards and on signs in the queue) pre-regulation, while 10% did not display ML in both post-labelling data collection periods -Caloric estimates were used to validate indecipherable receipt items by using the most frequent/main non-diet version within that item category -Results not solely attributable to ML, cannot rule out concurrent factors such as temporal trends in customer purchasing behaviour, changes in marketing promotions, reformulation and product innovation, price changes, decreased patronage by more health-conscious customers and increased purchases of higher calorie items by customers seeking to maximize calories <i>Although there was no change in the proportion of those seeing calories and using ML (about 1/3), the higher proportion of awareness translates into a greater overall number of patrons seeing and using calorie information</i>  <i>Mean calories per purchase decreased 18 months after implementation of ML in some restaurant chains and among females but not males</i>  <i>"No single intervention will reverse the epidemic [...] these findings [...] suggest that menu labelling has potential to contribute to obesity prevention"</i>
<b>Menu Labeling Regulations and calories Purchased at Chain Restaurants</b>								



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Auchincloss et al., 2013 [30]	USA Philadelphia and bordering cities within a 130-mile radius	AIM: Determine whether purchase decisions, relating to food, beverages and total orders at full-service restaurants, varied depending on the presence of nutritional labelling <b>Cross-sectional between-condition study</b> , comparing 2 outlets of a full-service chain with menu labelling in Philadelphia vs. 5 outlets of the same chain without labelling (in Delaware, Maryland and New Jersey). Outlets were conveniently sampled. Menus were identical at all outlets except for the nutrition labelling, which according to Philadelphia law must include calories, sodium, saturated fat, trans fats and carbohydrates for each item on the menu. All sites displayed 'healthier choice' tags on the menus Alcoholic beverages were labelled Only 40% of non-alcoholic beverages were labelled where brand name soft drinks did not appear on the menu and were therefore not labelled 15% of all menus displayed the chain's "healthier choice" tags Data collected over a 1-month period in August 2011 Surveys and receipts were collected between 18:00 and 21:00 on Sundays, Tuesdays and Thursdays	648 customers at 7 outlets of a large mid-priced national chain, among the top 20 in the US  60% female 50% Black/African American 50% had incomes ≥ \$60,000 40% aged 25-39 35% aged ≥40 26% aged 18-24 75% had higher education	Real-world full-service restaurants	1. Calories ordered  2. Calories + sodium, saturated fat, trans fat and carbohydrates  3. Dinner	Did noticing ML effect order? Demographic characteristics (age, gender, race, income, education), day of the week and frequency of eating out Recommended diet restrictions? Surveyors estimated body size	<b>Notice</b> *At labelled restaurants, 76% noticed menu labels, of which 98% noticed calories, 70% noticed other nutrients At unlabelled sites, 25% noticed the 'healthier choice' tags <b>Use</b> *At labelled restaurants, 26% of all customers and 34% of customers who noticed said the information affected their choice – nearly all said calories had an affect (compared to 24% who said sodium) *Only 6% (at unlabelled sites) were affected by the "healthy choice" logo *After adjusting for age, gender, race, income, education body size, day of the week and frequency of dining at full-service restaurants, customers at labelled sites purchased 151 fewer food calories (95% CI = -270, -33) and 155 total calories including beverages (95% CI = -284, -27), representing a relative difference of 9% *When considering the ~80% who noticed labelling these customers on average purchased 400 fewer calories than others, representing a relative difference of 20% *Total orders at labelled sites contained on average 1556 calories in contrast with 1690 calories at unlabelled sites (P=0.02) *Customers at labelled sites purchased more non-alcoholic beverage calories (32 calories, 95% CI= 2, 62) remembering that non-alcoholic beverages were <i>not</i> labelled at any site. *There was no difference with purchases of alcohol calories between the site <b>Socio-demographic differences</b> *At labelled restaurants certain socio-demographic characteristics had a significant impact on calories ordered whereby ML use increased with age (P = 0.0002), income level (P<0.0001) and educational attainment (P<0.0001), while Black/African Americans were least likely to use the information (P = 0.0006) <b>Effect in the food service industry</b> *On average, customers purchased 2 or 3 food items costing about \$15 (on average, at labelled restaurants, customers ordered 0.3 fewer items and spent \$1 less)	-Reference values were not displayed despite the regulation to do so *Average calories ordered for meals were high at 1830 calories (or 1600 excluding drinks) -Labelled restaurants had younger customers (27% vs. 18% aged 18-24) more African Americans (56% vs. 44%) and fewer customers with higher incomes (>60,000 41% vs. 54%) – all characteristics typically associated with decreased noticing and use of ML information and spending less -40% of non-alcoholic drink not labelled (e.g. brand name soft drinks were excluded)  <i>"This study suggests that mandatory menu labelling is a promising strategy for improving the nutrient content of meals purchased by full-service restaurant customers"</i>
<b>Consumer Responses to Mandatory Menu Labeling at Full-Service Restaurants</b>								



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Holmes et al., 2012 [31]	USA Unspecified primarily White town with 53,000 residents	AIM: Examine the effects of various menu labelling design for children's meals, and test the effects in substitution patterns <b>Longitudinal within-subject design intervention</b> Data collected October 2010 to May 2011 at a private club restaurant where families visit monthly (or be charged \$25) Short survey for parent-child dyads Children could either choose 1 of 6 'combo meals' (water was the default drink) or choose a la carte items, which included all mains and sides available in the combos, with an additional 3 mains and 2 sides. All meals cost \$4 4 x 2-month intervention periods displaying the following menu designs (1) No information (control), (2) Nutrition labelling with calorie and fat information (3) Healthy apple symbol was added to 3 selected 'low-fat/cal' combos (4) Nutrition Bargain Price a more immediate indicator of the nutritional cost/reward <i>Only</i> combo meals were labelled in the intervention phases	Children aged 1-13 years, mean age 6.4  1275 children's meals 35.5% (n=453) were combo meals  74% of children were primarily responsible for meal decisions.	Real-world setting A locally-owned table-service family-oriented restaurant at a private club, catering to mid- and upper-income families	1. Calories ordered  2. Calories and fat content  3. Lunch/dinner	None recorded due to privacy issues	<b>Use</b> *Non-significant declines in total calories purchased across intervention menus *When considering total calories, the biggest overall decline (9.54 calories) was observed with nutrition labelling (P=0.46) *Nutrition bargain price labelling resulted in fewer unhealthy combo calories and more healthy a la carte calories purchased, compared to baseline *There were shifts in purchasing patterns with a significant decrease in calories purchased for combo meals (labelled) and a corresponding increase in calories purchased for a la carte menu items (unlabelled) *Compared to No information, energy content of combos (279 calories) <i>decreased</i> by 56 calories with Nutrition labelling, 46 calories with Healthy symbols and 75 calories with Nutrition bargain price labelling (all P<0.05) *Meanwhile, compared to No information, energy content of a la carte items <i>increased</i> by 47 calories with Nutrition labelling, 42 calories with Healthy symbols and 69 calories (P<0.05) with Nutrition bargain price labelling *Adding the healthy symbol to 3 combos resulted in a decrease in calories purchased for unhealthy combos. *'Healthier' choices were also made from the a la carte meals *Customers began to purchase more a la carte items	+Tracked the same sub-set of patrons +Complete sales data supplied by the restaurant -Unclear the frequency of family visit per month, presumably it could have been more than once for some families -No indication of average age of children for each of the 2 month trial periods (only gave for the overall study) -Large difference for meal/calorie requirements children aged 1 and those aged 13 years. -The symbol used to highlight 'healthier' combo options may have been confusing since it was an apple with the club initial printed on it -Beverages were not included (water was the default drink) -Only combo meals were labelled  <i>This study did not focus on total calories and fat, but decomposed totals into combos and a la carte selections to provide insight on substitution effects Although ML did not have a positive net effect on total calories purchased, there were positive shifts that took place in response to selective ML</i>
<b>Effect of different children's menu designs on family purchases</b>								



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Pang & Hammond, 2013 [2]	Canada Waterloo	AIM: Evaluate the effectiveness and consumer preferences of different formats for displaying calorie information on menus through assessing participant snack selection. <b>Between-group experiment.</b> Participants were randomised to receive 1 of 4 experimental menus (1) No calorie information (control), (2) Calories only, (3) Calories and Reference values ( <i>The recommended daily energy intake for adults is 2000 calories</i> ) and (4) Calories and physical activity scale menu ( <i>caloric content required XX minutes of running to expend the energy consumed, clarified with the statement "10 minutes of running burns about 100 calories"</i> )  Participants also answered survey questions about attitudes towards the various menu conditions	214 (out of 371 eligible) undergraduate students, 18+ enrolled in Kinesiology and Health Studies  Average age 20 75% female 66% considered a healthy diet as very or extremely important	Experimental, University classroom	1. Calories Selected (purchase intentions)  2. Calories and Physical activity  Included reference values  3. Snacks	-	<b>Use</b> *Control condition chose snacks with significantly more calories (333) than calories only condition (302) ( $\beta=34.5$ , $P=0.02$ ) and the reference values condition (298) ( $\beta=37.5$ , $P=0.01$ ) and the physical activity condition (310) ( $\beta=21.5$ , $P=0.05$ ) *Calories only and calories + reference values ordered > 30 fewer calories on average compared to the control condition, representing a difference of about 9% *Reference values were selected as the most understandable menu labelling format (47.2%) then Physical Activity (42.9%) <b>Consumer perception of ML</b> *Students considered the physical activity labelling as the most effective (64%) followed by reference values (34.6%), which doesn't correspond to their 'preference' of labelling design *The provision of reference values improved the effects of calorie labelling and was considered the most understandable	+Reference values accompanied energy information -Small sample size -There were significant differences for gender among the 4 conditions. There were 3 times as many females as males in the no calories group and 4 times as many females as males in the physical activity group. Other labelling conditions were more gender balanced -Convenience sample of educated predominately females participants -Only 6 items to choose from (ranging from 210 to 410 calories) and could only choose 1 item -No items could be promoted as healthy options  <i>"This study provides preliminary evidence that menu labelling may promote healthier food selection among young adults" and reference values "can increase comprehension of calorie amounts displayed on menus"</i>
<b>Efficacy and Consumer Preferences for Different Approaches to Calorie Labeling on Menus</b>								



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Ellison, Lusk & Davis, 2013 [34]	USA Oklahoma	AIM: Explore the potential relationships between caloric intake and diners' demographic characteristics and health attitudes and menu formats in a restaurant where menus were systematically varied with caloric information <b>Field experiment</b> at full-service restaurants where patrons were randomly seated at 1 of 3 sections of the restaurant, each distributing the same menu which varied only by labelling conditions: (1) no nutrition information, (2) calories or (3) calorie + traffic light (indicating ranges red >800, amber 400-800 and green <400 calories Relevant sales data was collected for a 2-week period in Fall 2010, for lunch meals served 11:00-14:00 A survey was also administered after the meal was eaten Patrons' survey responses (which included what they ordered) were matched to restaurant's records	138 Diners at Oklahoma State University Campus table-service restaurant  55% female 63% enrolled student 70% aged 18-35 62% were repeat visitors Overall level of health consciousness was 10 (on a scale of 3-15) 40% came from households with >\$250,000	Real world State University Campus full-service restaurant  Restaurant was divided into 3 sections, each section received 1 of 3 menus	1. Calories Ordered  2. Calories and Single Traffic Light for calories  3. Lunch	Level of health consciousness, Frequency of and reason for dining at restaurant, determinants of food choice, demographic characteristics (sex, age, education, income)	<b>Use</b> Average energy ordered for main meals varied across conditions Calories + traffic lights (534 calories), Calories (648), No information (663) *In terms of main meals Calories + traffic lights reduced energy ordered by 114 calories (compared to the Calories only menu) and 129 calories (compared to Control menu) (p=0.033) *In terms of side dishes ML had no effect across labelling conditions (though many were not labelled) *In terms of total ordered, no statistical significant differences existed between the conditions, though Calories + traffic lights diners ordered 69 fewer calories than those receiving the Control menu which could be considered clinically significant. *Those in the Calorie only condition ordered 52 more calories than the Control group <b>Socio-demographic differences</b> *The effects of the menu labelling were less pronounced for more health conscious individuals, however as health consciousness increased, the Calorie + traffic lights condition was more effective *Young people (18-34) and students were more likely to order medium and high calorie options *Those with a bachelor degree and older were more likely to order low calorie options *Individuals who considered health to be the most important characteristic when making menu selection were more likely to be low calorie diners *Social eating was more associated with medium and high calorie choices while business lunches were more associated with low calorie options *Low income earners made up the greatest percentages of medium (60%) and high (45.2%) calorie orders <b>Consumer perception of ML</b> Calories +traffic lights were most effective, though preferred by only 27.5%, whereas Calories only were preferred by 42% but had virtually no effect	*Calories purchased for average total order 759, average main 606 and average 'extras' 142 calories +51 menu options -Small sample -Some 'extra' items (including some drinks and all desserts) were not listed on the menu, but less than 25% of diners ordered these unlabelled items -No reference values -Unable to determine if 'repeat customers' (62% of the sample) were assigned to the same restaurant section, to prevent contamination or cross-over effect -When provided with calorie counts, main meal selections decreased in energy content, which may entice consumers to 'treat' themselves with side orders (especially in the absence of Reference values)  <i>"calorie labels in restaurants can be effective, but only among those restaurant patrons who have lower levels of health consciousness"</i>
<b>Looking at the label and beyond: the effects of calorie labels, health consciousness, and demographics on caloric intake in restaurants</b>								



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Elbel et al., 2013 [35]	USA Philadelphia vs. Baltimore	AIM: Determine whether ML policy was associated with increased consumer awareness, self-reported use, reduction of calories purchased and changes in frequency of fast food restaurant visits <b>Difference in difference design comparing pre-/post-labelling and intervention/control cities</b> Simultaneous data collection in Philadelphia (intervention) and Baltimore (control) from (1) customer surveys (data and purchase receipts collected from fast food customers) and (2) phone surveys (data obtained via random digit dial). Baseline data collected 2 months pre-regulation (December 2009) and post-regulation data collected 4 months after (June 2010) Received \$2 for participation 'Customer surveys' conducted on-site between 11:30 and 14:30 and 17:00 and 20:00. Customers were asked how frequently they visited big chains in the last week and whether they noticed and used ML 'Telephone surveys' obtained information on usual weekly frequency of visiting big chain fast food restaurants and BMI	Customer surveys - 2083 participants aged 18-64 with any food or beverage purchase 54% male 71% Black 62% lower education Age was evenly distributed  Telephone surveys - 2815 adults 65% female 46% White 60% higher education 49% aged 50-64 Income ranges were comparable 60% overweight/obese	'Customer surveys' conducted at 23 sites (McDonald's and Burger King)  Telephone surveys	1. Calories ordered  2. Calories only  3. Any food or beverage purchase was considered	Demographic characteristics race and education	<b>Notice</b> *Pre-post noticing in Philadelphia increased from 9% to 38% (vs. Baltimore 14%) the difference in differences impact in this measure was 33 percentage points (p<0.001) *Noticing varied across chains; 34% noticed at McDonald's vs. 49% at Burger King *Whites were more likely to notice than Blacks (43% vs. 31% PP impact, P<0.001) *Those with higher education were more likely to notice ML than lower education (42% vs. 28% PP impact, P<0.001) <b>Use</b> *Overall, 10% of post-regulation customers used ML, equating to 26% of those who noticed ML used the information *Whites increased ML use by 15% (P=0.06) *Blacks increased ML use by 5% (P=0.03) *There was an increase in self-reported use of ML to purchase fewer calories (net 8 PP, P<0.001) *And a rise in self-reported use to purposely increase calories (net 4 PP, P<0.001) *Mean calories purchase did not change significantly over time in either city. Though energy reduced by over 50 calories in both locations, particularly with female participants *Both overall and for all subgroups, there was no net impact of the policy neither on total calories nor for food or beverages considered separately. <b>Impact on frequency of eating outside the home</b> *The mean number of visits per week increased non-significantly among the Consumer Survey participants in Philadelphia from 5.6 to 7.3, particularly with males, those aged 25-39, Blacks and those with lower education	-Very low notice rate (38%) and difference across the chains may lead one to question the extent of industry compliance to ML regulation -Included food and/or beverage purchase.  <i>"The findings indicate that many consumers, particularly vulnerable groups, do not report seeing calorie information and very few report using labeling to purchase fewer calories. No large-scale population level changes in fast food visits are noted"</i>  <i>"The context and significance of calorie information could be better conveyed [...] to resonate more powerfully"</i>  <i>Labels should be made easier to interpret and should consider using heuristic based symbols</i>



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Liu et al., 2012 [13]	USA North-Eastern US	<p>AIM: To test whether calorie information presented in different formats influence calories ordered and perceived restaurant healthfulness</p> <p><b>Between group experiment</b> where participants were randomly assigned to 1 or 4 ML formats: (1) No calories (2) Calories with reference values (3) Ranked calories (low to high) with reference values (4) Ranked calories with Colour coding (red/green) and reference values</p> <p>Participants hypothetically selected their meals and then  *estimated how many calories they ordered  *indicated how hungry they were  *indicated how often they use nutrition labels  *indicated how healthy they thought the restaurant was  *indicated their preferred ML format</p> <p>Food items offered were based on Chili's Grill, and Bar (a family style chain restaurant) with beverages from Applebee's  Online survey administered 12 - 21 November 2010  Participants had a 1/50 chance to win a \$20 Amazon voucher</p>	<p>418 consumers from an online database  102, 106, 101 and 110 were assigned to the 4 conditions</p> <p>69.5% female  11% lower education  Predominantly White</p>	<p>Experimental setting  Online survey with menus based on family style chain restaurants</p>	<p>1. Calories selected (purchase intentions)</p> <p>2. Calories, ranked calories and Coloured calories (using traffic light Red and Green)</p> <p>Included reference values</p> <p>3. Dinner</p>	<p>Age, gender, BMI, frequency of nutrition label use, degree of hunger, and perceived healthfulness of the restaurant (according to the menu provided)</p>	<p><b>Notice</b>  *Among the 317 who received ML, 93% noticed</p> <p><b>Use</b>  *Among the 317 who received ML, 35.3% reporting using the information.  *Absolute value of total calories ordered were not significantly different when comparing No label condition (1760) with each of the labelling conditions: 1676 Calories (= 94 fewer calories), 1606 Ranked calories (= 154 fewer calories), 1455 Coloured calories (= 305 fewer calories)  *When adjusted, the reduction in calories selected by participants with Ranked calories menus was significant (p = 0.013) and was marginally significant for Ranked calories with Colours compared to No calories (p=0.095)  *Reductions in total calories selected resulted from choosing lower calorie items as opposed to selecting fewer items from the menu  *Including covariates, there was no significant reduction in calories selected between the No calories and Calories conditions (p=0.262)  *No consistency in findings to indicate if ML was more effective in specific components of a meal (ie side vs. beverage vs. appetizer vs. main meal)  *Those in the control condition were much more likely to underestimate the calorie content of their meals (p=0.01) compared to the 3 ML conditions</p> <p><b>Socio-demographic differences</b>  *BMI was the only covariant with no significant association with total calories ordered</p> <p><b>Consumer perception of ML</b>  *Participants with Coloured calories menus perceived the restaurant to be healthier compared to other conditions, particularly the No calories group  *80% thought <i>all chain restaurants</i> should offer calorie information on the menus, while 72% though <i>all restaurants</i> should have ML  *75.2% thought restaurants should highlight healthier choices on the menu  Participants from the 3 labelled groups very much liked and understood the calorie information and believed it to be very salient</p>	<p>+High notice rate  +Included reference values with all 3 ML conditions  +Chili's chosen because a wide range of calorie options and include appetizers, salads, sandwiches, burgers, grilled and bettered items, desserts and side dishes  +Applebee's offer a wide range of high- and low-calorie drinks  +The final menu offered 71 menu items with 24 of them labelled 'green'  +Price also appeared on the menu  +No significant differences between socio-demographic characteristics or eating practices between the 4 ML conditions  -Small sample size  -Absolute reductions in energy selected between No calories and Calories was 94 calories which was statistically non-significant but could be considered clinically significant.</p> <p><i>"The results suggest that presenting calorie information in the modified Ranked-order or Coloured calories formats may increase menu labelling effectiveness"</i></p>

Abbreviations: %DI (% daily intake), BMI (Body Mass Index), CI (confidence interval), kJ (kilojoule), ML (Menu Labelling), OR (odds ratio), PP (percentage points) RDA (recommended daily allowance) SD (standard deviation), USA (United States of America)

