Rapid Evidence Review: How Effective is Calorie Labelling in the Out of Home Sector?

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1. Background

Mandatory calorie labelling has been recommended by FSS [1] as one of a range of interventions to improve the out of home (OOH) food environment and support a healthier diet for the population in Scotland. Out of home calorie labelling is defined as the provision of energy information (kcal and/or kJ) at the point of choice. This information can be used to help consumers make informed decisions on what they are purchasing. Calorie labelling includes information on menus, display boards, and online when purchasing food or drink that is prepared for immediate consumption[1]. By providing calorie information to consumers, the hypothesis is that they may choose something lower in calories than they would in the absence of this information.

A recent study, exploring branded OOH businesses in Scotland , found only around 20% provided calorie labelling at the point of choice [2]. This contrasts with the retail environment where consumers have access to calorie information on the labels of all pre-packed food and drinks .

Currently, there is no legislation in Scotland[2] requiring calorie labelling in the OOH sector or to non-prepacked foods, for example loose bakery items. The UK Department of Health & Social Care (DHSC) have confirmed they plan to progress legislation in England for mandatory calorie labelling for businesses with more than 250 employees, and are encouraging smaller businesses to implement it voluntarily. As some of these businesses will operate in Scotland, this may lead to an increase in the number of outlets providing calorie labelling here. In July 2020, DHSC also announced plans to consult on proposals to introduce mandatory calorie labelling on pre-packaged alcoholic drinks[3].

To inform the economic modelling required for the Business and Regulatory Impact Assessment (BRIA) of proposals for mandatory calorie labelling, FSS conducted this rapid evidence review. This review evaluates the effectiveness of calorie labelling as an intervention, and provides an estimate of any resulting impact on population level calorie intakes. A rapid evidence review was chosen as it provides a more structured and rigorous search of the evidence than a literature review, but is not as exhaustive as a systematic review.

[1] Note a list of definitions can be found in the Appendix
[2] This estimated figure has been extrapolated from Robertson et al. [2] to take account of businesses operating in Scotland only
[3] Front of pack labelling is a voluntary scheme. Back of pack nutrition information is a legal requirement

2. Aims of this paper

- To review the current evidence to ascertain what level of impact calorie labelling may have on the calorie value of items ordered or consumed OOH at each meal occasion.
- To obtain from the evidence an estimated numerical calorie value that represents the mean difference of calories ordered or consumed after calorie labelling for inclusion in economic modelling.

3. Methodology

3.1 Eligibility criteria

Included studies for this rapid review had to be English language systematic reviews from 2011 onwards. The systematic reviews had to include intervention studies where the intervention was calorie labelling. The impact of calorie labelling had to be explored numerically at the point of choice, therefore the systematic reviews had to include meta analyses (MA) with numerical calorie figures. For inclusion, the outcome measure of the meta analyses had to be reported as the mean difference in calories between pre and post intervention periods.

We did not explore the effect of intervention studies that were other forms of calorie labelling, such as physical activity calorie equivalents or traffic light labelling.

3.2 Information sources

A search for systematic reviews in the bibliographic database MEDLINE (Ovid) was undertaken. The MEDLINE Systematic Review Search Strategy was adopted, in addition to search terms such as ‘menu labels’, ‘calorie labels’, ‘nutrition information’, ‘nutrition labels’ and ‘out of home’. The search strategy can be found in Appendix – Table 1.

The database was searched for English language systematic reviews and meta-analyses of intervention studies published since 2011-2021. The search identified 311 papers and following assessment of the reviews against the eligibility criteria (see Appendix – Table 2), six reviews were selected, of which a total of 36 individual studies were included. This process is shown in the flow chart in Appendix – Figure 1. The individual studies included in each meta-analysis were tabulated to ensure that there was no duplication.

Due to the rapid nature of this review it was not possible to carry out an assessment of the quality of the included evidence.

4. Results

4.1 Results from systematic reviews

The six systematic reviews evaluated contain a mixture of real world and laboratory based studies. It should be noted that a variety of OOH sectors were explored within the real world studies, for example, workplace canteens, fast food outlets and restaurants, however the delivery and takeaway sectors were not included. A summary of the results from the systematic reviews can be found in Table 1 below, and a table of results that provides more detail can be found in the Appendix – Table 3.

A review performed by Sinclair et al. (2014) [3], conducted meta analyses on a mixture of laboratory and real world studies, exploring both calories ordered and consumed. Six studies explored calories ordered, reporting a mean reduction of 31 calories (95% CI: -96, 34), and four studies explored calories consumed, reporting a mean reduction of 13 calories (95% CI: -62, 37), between pre and post intervention periods. However, neither of these reductions were statistically significant.

Littlewood et al. (2015) [4] conducted meta analyses exploring calories ordered from real world and laboratory settings. A meta-analysis of five real world studies exploring calories ordered reported a statistically significant mean reduction of 78 calories (95% CI: -122, -34) between pre and post intervention periods. Two meta-analyses looked at a mixture of real world and laboratory studies, exploring both calories ordered and consumed. For calories ordered, seven studies were explored reporting a mean reduction of 75 calories (95% CI: -108, -41), and for consumed, three studies reported a mean reduction of 100 calories (95% CI: -146, -54) between pre and post intervention periods. Both of these were statistically significant.

Published in the same year, Long et al. (2015) [5] conducted meta analyses from 19 real world and laboratory studies exploring calories ordered, finding a statistically significant mean reduction of 18 calories (95% CI: -34, -3) between pre and post intervention periods. A further meta-analysis of ten laboratory studies found a statistically significant reduction of 58 calories (95% CI: -102, -14) ordered, and a final meta-analysis of eight real world studies found a mean reduction of seven calories ordered (95% CI: -20,7) between pre and post intervention. However this was not statistically significant.

Also in 2015, Nikolaou et al. (2015) [6] conducted a meta-analysis of six real world studies. A mean reduction of six calories (95% CI: -19, 8) ordered between pre and post intervention periods was found, however this was not statistically significant.

Cantu-Jungles et al. (2017) [7] conducted two meta-analyses, the first on 14 studies from both real world and laboratory settings. This found a mean reduction of 0.2 calories (95% CI: -1, 1) ordered or consumed between pre and post intervention periods, however this was not statistically significant. Five laboratory only studies were also explored, where a statistically significant mean reduction of 115 calories (95% CI: -100, -131) ordered or consumed was found between pre and post intervention periods.

The most recent systematic review, a Cochrane review, by Crockett et al. (2018) [8] conducted a meta-analysis on three randomised controlled trials (RCTs) from real world settings. This found a statistically significant mean reduction of 47 calories (95% CI: -78, -15) ordered between pre and post intervention. Crockett et al. carried out another meta-analysis on eight RCTs from laboratory settings, finding a mean reduction of 50 calories (95% CI: -104, 4) consumed between pre and post intervention periods. However, this difference was not statistically significant.

Table 1: Summary of results from Meta Analyses (MA)

Authors	MA results from real world studies – mean difference between pre and post intervention periods	MA results from laboratory studies – mean difference between pre and post intervention periods	MA results from real world and laboratory studies combined – mean difference between pre and post intervention periods
Sinclair et al. (2014)	n/a	n/a	Ordered = -31 kcal (95% CI: -96, 34) Consumed = -13 kcal (95% CI: -62, 37)
Littlewood et al. (2015)	-78 kcal ordered* (95% CI: -122, -34)	n/a	Ordered = -75 kcal* (95% CI: -108, -41) Consumed = - 100 kcal* (95% CI: -146, -54)
Long et al. (2015)	- 7 kcal ordered (95% CI: -20,7)	-58 kcal ordered* (95% CI: -102, -14)	-18 kcal ordered* (95% CI: -34, -3)
Nikolaou et al. (2015)	- 6 kcal ordered (95% CI: -19, 8)	n/a	n/a
Cantu-Jungles et al. (2017)	n/a	-115 kcal ordered or consumed* (95% CI: -100, -131)	0.2 kcal ordered or consumed (95% CI: - 1, 1)
Crockett et al. (2018)	- 47 kcal ordered* (95% CI: -78, -15)	- 50 kcal consumed (95% CI: -104, 4)	n/a

* denotes ($p<0.05$)

The results from all six systematic reviews explored, with the exception of the real world meta-analysis from Cantu-Jungles et al., found a reduction in calories ordered or consumed as a result of calorie labelling, with over half of these reductions being statistically significant. However, it is important to note that the reductions found ranged from -6 to -115 calories.

The reason for these mixed results could be due to the authors using different inclusion and exclusion criteria, with some focussing on specific study designs and settings. Additionally, the variability and diversity of some of the study designs and settings, for example the length of the intervention, resulted in high heterogeneity, meaning it was often difficult for the authors to draw comparisons and conclusions. The authors also conducted different types of quality assessments to determine which studies were included within their meta analyses, which could also have contributed to these differences in result (see Appendix - Table 3).

It should also be noted that the majority of the studies explored came from the US, where purchasing patterns and responses to calorie labelling may differ to the population in Scotland.

5. Results from Additional Studies

During the process of conducting the rapid review, a number of studies were noted as they explored important factors to consider due to the potential impacts identified through implementing calorie labelling. These explore the display of contextual information (or reference intakes) alongside calorie labelling, reformulation by businesses as a result of implementing

calorie labelling, and the potential for a compensatory effect of calorie labelling on subsequent calorie intake.

A summary of the results of the studies below are included in Appendix - Table 4. Note that as these were not part of the original search terms, there may be related papers that are not covered here. So, whilst indicative, it cannot be considered conclusive and some areas may warrant further consideration during the development of the policy proposal.

5.1 The Effect of the Display of Contextual Information (reference intakes) alongside Calorie Labelling

Contextual information stating the reference intake[4] for energy in addition to calories of each menu item has been investigated to explore the influence on how the calorie information is used.

A real world study by Downs et al. (2013) [9] assessed the impact of providing reference intakes alongside calorie labelling. It found no direct impact on calories ordered as a result of displaying contextual information on menus.

In a laboratory study by Roberto et al. (2010) [10] participants were randomly assigned to either a menu without calorie labels; a menu with calorie labels; or a menu with calorie labels plus additional information stating the recommended daily caloric intake for an average adult. Out of the three groups, the calorie labels plus additional information group consumed the least number of calories at the study meal, which was 79 calories less than for calorie labelling alone, however this was not statistically significant.

5.2 Reformulation by Businesses as a Result of Implementing Calorie Labelling

Calorie labelling may act as a driver to encourage businesses to reformulate their food and drink offerings to reduce the calorie content. Evidence from a number of studies has shown that calorie labelling has encouraged reformulation of menu items, which could lead to indirect health benefits for customers.

A comprehensive meta-analysis of 41 studies conducted by Zlatevska et al. (2018) [11], explored response of businesses, including fast food and large chain restaurants, to the introduction of voluntary calorie labelling. They found a statistically significant reduction of 15 calories per menu item as a result of businesses voluntarily reformulating.

A recent study by Theis and Adams (2019) [12] compared the calorie content of 42 UK restaurant chains who provided calorie information online with 14 chains who voluntarily provided calorie labelling on menus within their establishments. The study found that items from restaurants with calorie labelling on menus had 32% less energy (95% CI: -57, 7) than those who provided online only, however the result was not statistically significant.

[4] Previously referred to a Guideline Daily Amount (GDA)

5.3 The Compensatory Effect of Calorie Labelling on Subsequent Calorie Intake

It is suggested that calorie labelling may lead to subsequent compensatory behaviours, such as increased or decreased calorie consumption at a later point in the day.

A laboratory study by Roberto et al. (2010) [10], which was referred to previously, looked into calories consumed in the evening after a study dinner using dietary recall assessment. It found that when the calories consumed during the meal and in the evening hours were combined, there was no advantage for calorie labelling only over no calorie labelling. However, an advantage occurred when the menu included calorie labelling plus information on recommended daily caloric intake, with a statistically significant reduction of 250 calories over the day.

In a similar study, James et al. (2015) [13] compared the effect of calorie labelling on energy consumption during an intervention lunch and the remainder of the day. The group exposed to calorie labels consumed fewer calories during the intervention lunch, but there were no statistically significant differences in energy consumption for the remainder of the day between groups. No evidence was found of a compensatory response to a less calorific choice earlier in the day.

We cannot draw any specific conclusions from these papers, however the findings may want to be considered as part of the economic modelling process when moving to developing more specific policy proposals.

6. Discussion

This rapid review explored six systematic reviews that carried out a number of meta-analyses for a variety of settings and study types. The results indicated that a reduction of up to 115 calories per meal occasion may be achieved if calorie labelling was implemented in the OOH sector in Scotland.

A recent observational study by Petimar et al. (2019) [14], which is not included within the systematic reviews above, is also worth noting as it was a longitudinal study of real world settings. It explored 104 US fast food restaurants from pre to post calorie labelling, to evaluate whether calorie labelling on menus was associated with a change in calories ordered per transaction. They found a statistically significant mean reduction of 60 calories (95% CI: -72, -48) ordered between pre and post intervention periods.

The limitations of the evidence must be acknowledged, including variability of study design and heterogeneity, and the lack of long term studies and settings which are comparable to the OOH environment and context in Scotland. The authors of the reviews often commented on the poor quality of some of the papers and acknowledged that better designed and adequately powered studies are needed in this area of research.

The Crockett et al. (2018) [8] systematic review was conducted under the Cochrane review quality assessment guidelines, therefore was deemed the strongest and most reliable due to the rigorous quality standards required. It conducted a meta-analysis exploring three RCTs, the gold standard of study designs, in the real world, therefore they accounted for influential factors, such as taste, price, convenience and social relationships. However, the authors commented that the three RCTs were ranked as “lower quality” studies, and as they were conducted in the US, the results

may not be transferrable to Scotland. The paper also found two interrupted time series studies that were at low risk of bias that supported the meta-analysis.

It was also recognised that some emerging areas have not yet been investigated and require further research. The impact of calorie labelling when ordering food online/via apps or getting a delivery or takeaway should be prioritised, due to the newly evolving way that people interact with the OOH food environment, particularly as a result of the COVID-19 pandemic. Data has shown that the takeaway sector in Scotland grew by 31% in 2020, an increase of £253 million. Takeaway trips doubled over this time, equating to an additional 21 million trips in 2020 compared to 2019 [15].

Consumer knowledge of daily nutritional requirements, whether this affects the choice of food consumed OOH, and how these choices are balanced with other food intake throughout the day would also benefit from further investigation.

6.1 How this evidence review will be used

We aim to use the mean reduction of 47 calories found by Crockett et al. (2018) [8] as the calorie value for the estimated impact of calorie labelling, as part of our economic modelling. This reduction may appear like a small number of calories, however when scaled up across the Scottish population, and taking account of how frequently people eat out of home, it could lead to a highly significant reduction in calories overall. This is expected to positively contribute to reducing levels of overweight and obesity. An example of this for England can be seen within the DHSC impact assessment [16].

When developing the policy proposal further, we will explore the potential differential impact of calorie labelling on different population groups, such as those living with socio-economic disadvantage, people living with obesity or an eating disorder, and different age groups. For example, the reformulation of products to be less calorie dense as a result of the requirement for calorie labelling, could benefit those from more deprived areas, as they may be less engaged with calorie labelling itself [17].

7. Conclusion

Based on the best available evidence, whilst acknowledging some limitations in the research, the evidence reviewed shows that calorie labelling could lead to a reduction in population level calories being ordered and consumed in the out of home sector. Therefore, this is an important policy intervention to support improvements in dietary health and reduce levels of overweight and obesity in Scotland.

8. Appendix

8.1 Definitions

The following definitions were developed for the purpose of this paper:

- Calorie Labelling - the provision of energy information (kcal and/or kJ) to help consumers make informed choices at the point of choice, when purchasing food or drink that is prepared for immediate consumption
- Out of Home - FSS has defined the OOH sector as:
    - Cafes, all types of restaurants, takeaways, pubs/bars, vending machines, workplace canteens, hotels, leisure and entertainment venues
    - Supermarkets and convenience stores who provide “food on the go”, e.g. food purchased from the store but taken away for consumption
    - Places where food is purchased when commuting or travelling
    - Manufacturers and suppliers of food and drink to the OOH sector
    - Food delivery services, including online
    - OOH businesses in the public sector, including food provided for staff and visitors in health care settings.
- Point of Choice - the most influential point in the consumer decision making process, defined to be close to the price, description or image of the product e.g. menus, menu boards.
- Laboratory settings - term used to describe studies carried out in artificial settings and scenarios.
- Real world settings - term used to describe studies carried out in non-artificial, real-life scenarios.
- Calories ordered - refers to actual food or drink items ordered, purchased or selected.
- Calories consumed - refers to actual food and drink items consumed, taking into account uneaten portions of meals.

Table 1: Search Strategy used on Medline (OVID) for Systematic Reviews & Meta Analyses that explored the impact of Menu Calorie Labelling

1. meta-analysis/
2. exp review literature/
3. (meta-analy$ or meta analy$ or metaanaly$).tw.
4. meta analysis.pt.
5. review academic.pt.
6. review literature.pt.
7. letter.pt.
8. review of reported cases.pt.
9. historical article.pt.
10. review multicase.pt.
11. 1 or 2 or 3 or 4 or 5 or 6
12. 7 or 8 or 9 or 10
13. 11 not 12
14. animal/
15. human/
16. 14 and 15
17. 14 not 16
18. 13 not 17
19. menu label$.ti. or menu label$.ab.
20. calorie label$.ti. or calorie label$.ab.
21. nutrient$ information.ti. or nutrient$ information.ab.
22. nutrition$ information.ti. or nutrition$ information.ab.
23. nutritio$ label$.ti. or nutritio$ label$.ab.
24. out of home.ti. or out of home.ab.
25. nutrition policy.ti. or nutrition policy.ab.
26. 19 or 20 or 21 or 22 or 23 or 24 or 25
27. 18 and 26
28. limit 27 to yr="2009 - 2020"
29. limit 28 to english language

Table 2: Inclusion and Exclusion Criteria for Systematic Reviews & Meta Analyses that Explored the impact of Menu Calorie Labelling

Inclusion	Exclusion
Studies from 2011 to 2021	Studies prior to 2011
English language systematic reviews that include meta analyses	Not published in English
Intervention studies, where intervention is menu calorie labelling	Intervention studies where intervention is not menu calorie labelling, or specific menu calorie labelling intervention results cannot be easily interpreted
The impact of menu calorie labelling is explored numerically	Systematic reviews that did not include meta analyses
	Systematic reviews that explored specific populations only, e.g. children, adolescents, socioeconomic groups

Figure 1: Flow Chart to show the Selection Process for the Systematic Reviews and Meta Analyses chosen to explore the impact of Menu Calorie Labelling

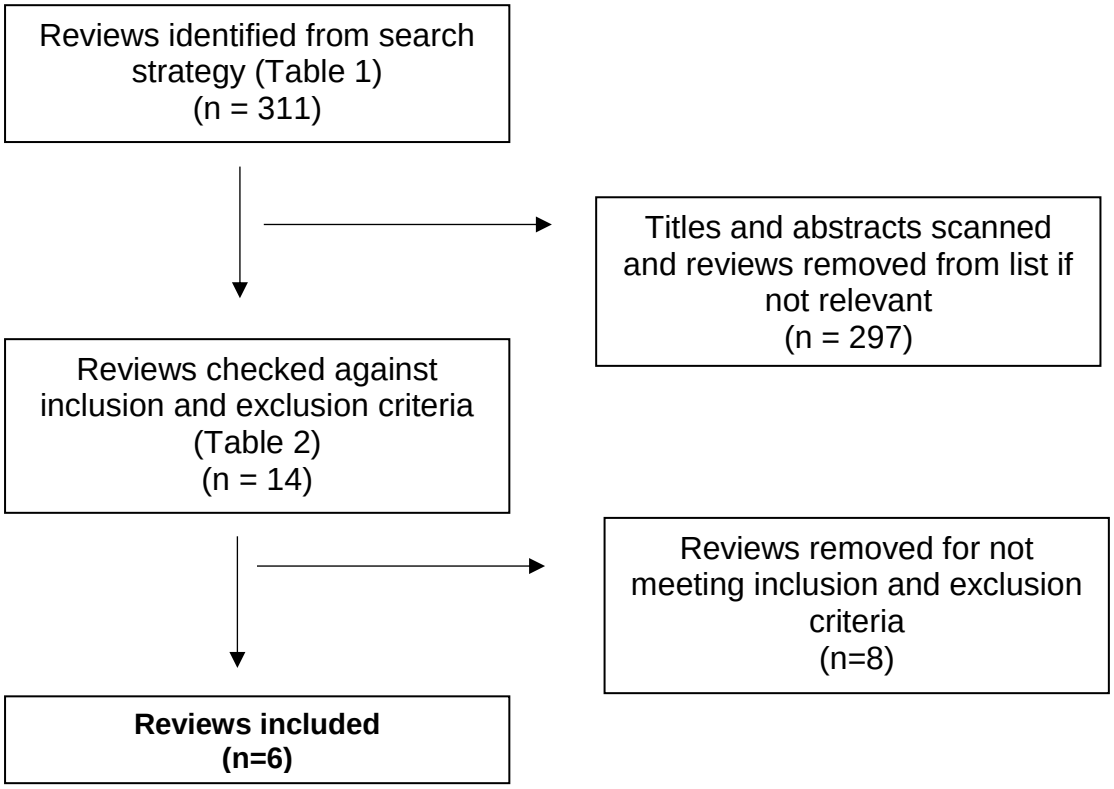

Table 3: Summaries of Systematic Reviews and Meta Analyses (MA) that explored the Impact of Menu Calorie Labelling

Title	Intervention	Outcomes	Included Studies	Overall findings	Quality assessment
Sinclair et al. (2014) The Influence of Menu Labelling on Calories Selected or Consumed: A Systematic Review and Meta-Analysis	Informative, contextual, or interpretive menu labelling compared with control condition	Calories selected or consumed	Controlled experimental and quasi-experimental studies	MA of 6 studies found a non-statistically significant reduction for calories selected of 31 kcal (95% CI: -96, 34) between pre and post intervention periods MA of 4 studies found a non-statistically significant reduction for calories consumed of 13 kcal (95% CI: -62, 37) between pre and post intervention periods	Quality appraisal by two independent reviewers Scottish Intercollegiate Guidelines Network methodology checklists used
Littlewood et al. (2015) Menu Labelling is Effective in Reducing Energy Ordered and Consumed: A Systematic Review and Meta-Analysis of Recent Studies	Menu calorie labelling compared with control condition	Calories consumed, ordered, or selected	Real world and experimental studies	MA of 5 studies found a statistically significant reduction for overall energy ordered in real world settings of 78 kcal (95% CI: -122, -34) between pre and post intervention periods MA of 7 studies found a statistically significant reduction for overall energy ordered in a mix of real world and laboratory settings of 75 kcal (95% CI: -108, -41) between pre and post intervention periods	Used a rating scheme inspired by previous reviews

				MA of 3 studies found a statistically significant reduction for overall energy consumed in a mix of real world and laboratory settings of 100 kcal (95% CI: -146, -54) between pre and post intervention periods	
Long et al. (2015) Systematic Review and Meta-analysis of the Impact of Restaurant Menu Calorie Labelling	Menu calorie labelling compared with control condition	Calories ordered/purchased or consumed in a single meal	Experimental and quasi-experimental studies	MA of 19 studies found a statistically significant reduction of 18 kcal (95% CI: -34, -3) between pre and post intervention periods MA of 8 studies in real world controlled settings found a non-statistically significant reduction of 7 kcal (95% CI: -20, 7) between pre and post intervention periods MA of 10 studies in laboratory settings found a statistically significant reduction of 58 kcal (95% CI: -102, -14) between pre and post intervention periods	Assessed risk of bias
Nikolaou et al. (2015)	Menu calorie labelling compared with control condition	Calories purchased	Real world studies	MA of 6 real world studies found a non-statistically significant reduction of 6 kcal (95% CI: -19, 8) between pre and post intervention periods	Quality assessed using the Cochrane risk of bias assessment tool

Cantu-Jungles et al. (2017) A Meta-Analysis to Determine the Impact of Restaurant Menu Labelling on Calories and Nutrients (Ordered or Consumed) in US Adults	Menu calorie labelling compared with control condition	Calories consumed or purchased.	Real world and experimental studies	MA of 14 studies found a non-statistically significant reduction for energy ordered or consumed of 0.2 kcal (95% CI: -1, 1) between pre and post intervention periods MA of 5 lab studies found a statistically significant reduction for energy ordered/consumed of 115 kcal (95% CI: -100, -131) between pre and post intervention periods	Quality assessed using the Cochrane risk of bias assessment tool
Crockett et al. (2018) Nutritional Labelling for Healthier Food or Non-alcoholic Drink Purchasing and Consumption (Cochrane Review)	Nutritional labelling group compared with control	Food or drink consumed or purchased	Real world and experimental studies	MA of 3 studies found a statistically significant reduction for calories purchased of 47 kcal (95% CI: -78, -15) between pre and post intervention periods, per person, per meal, an energy reduction of 7.8% per meal MA of 8 laboratory based studies found a non-statistically significant reduction of 50 kcal (95% CI: -104, 4) between pre and post intervention periods, per person, per meal	Quality assessed using the Cochrane risk of bias assessment tool

Table 4: Summaries of Key Studies

The table below summarises further key studies considered in determining the potential benefits of the proposed policy.

Title	Intervention	Outcomes	Overall Findings
Roberto et al. (2010) Evaluating the Impact of Menu Labelling on Food Choices and Intake	Participants in a dinner study (n=303) were randomly assigned to either: • a menu without calorie labels • a menu with calorie labels • a menu with calorie labels and additional information stating the recommended daily caloric intake for an average adult Food choices and intake during and after the study dinner were measured	Calories ordered and consumed	For calories ordered there were statistically significant reductions of 327 kcal between the no calorie labelling and calorie labelling condition, and 329 kcal between the no calorie labelling and calorie labelling + info condition For calories consumed there was a statistically significant reductions between the no calorie labelling and calorie labelling and calorie labelling + info conditions combined together For dinner plus post-dinner calories there were statistically significant reductions of 250 kcal between the no calorie labelling and calorie labelling + info condition, and of 245 kcal between the calorie labelling and calorie labelling + info condition
James et al. (2015) Menu Labels Displaying the Kilocalorie Content or the Exercise Equivalent: Effects on	Participants (n=300) in a dining area in a metabolic kitchen at a US university were randomised to a menu with no labels, a menu with calorie labelling, or a menu with exercise labels displaying the	Calories ordered and consumed	The calorie labelling group ordered (-75 kcal) and consumed (-48 kcal) less calories than the no calorie labelling group, however these differences were not statistically significant

Energy Ordered and Consumed in Young Adults	minutes of brisk walking needed to burn the food energy Food intake during and after the study dinner were measured		The calorie labelling group consumed 47 kcal less than the no calorie labelling group post lunch, however this difference was not statistically significant
Downs et al. (2013) Supplementing menu labelling with calorie recommendations to test for facilitation effects	Examined the effect of adding recommended calorie intakes on food purchases Two US McDonald's restaurants (n=1121) receipt and survey responses on exit	Calories purchased	Providing recommended calorie intakes did not reduce calories purchased A trend that approached significance ($p = 0.07$) suggested that the calorie recommendations might have a direct effect on purchases, although it was in the opposite direction from what would be desired
Zlatevska et al. (2018) Mandatory Calorie Disclosure: A Comprehensive Analysis of its Effect on Consumers and Retailers	Menu calorie labelling compared with control condition MA carried out to explore the effect of calorie disclosure on retail behaviour (n=41)	Calories selected or purchased	On average businesses reduced their nutritional offerings statistically significantly by about 15 kcal after introducing calorie labelling
Theis & Adams (2019) Differences in Energy and Nutritional Content of Menu Items Served by Popular UK Chain Restaurants With Versus Without Voluntary Menu Labelling: A Cross-Sectional Study	Assessed the differences in energy and nutritional content of menu items served by UK restaurants that do and do not provide voluntary menu labelling Identified 100 most popular UK restaurant chains 42/100 provided nutrition and energy content online, of these 13 voluntarily provided menu labelling	Energy content of menu items vs energy content of online energy content	Items from restaurants with menu calorie labelling had 45% less fat, and 60% less salt than items from restaurants with no menu calorie labelling (online only). Both these differences were statistically significant Items from restaurants with menu calorie labelling had 32% less energy than items from restaurants with no

			menu calorie labelling (online only), however this was not statistically significant
Petimar et al. (2019) Estimating the Effect of Calorie Menu Labelling on Calories Purchased in a Large Restaurant Franchise in the Southern US: Quasi-Experimental Study	Longitudinal US study of 104 fast food restaurants from pre-calorie labelling (2015-2017) to post-labelling (2017-2018) to evaluate whether calorie labelling of menus was associated with a change in mean calories purchased per transaction 156 week study period (14,736 total restaurant weeks)	Changes in mean purchased calories per transaction	A small decrease in mean kcal purchased per transaction was observed For all purchases there was a statistically significant mean decrease of 60 kcal per transaction after implementation (4% decrease) This decrease was strongest for sides (-40 kcal) compared to entrees (-11 kcal). Both were statistically significant Increasing post implementation trend of 0.71 kcal/transaction/week. By end of study the estimated reduction in kcal per transaction was a 23 kcal

9. References

1. *Diet and Nutrition: Recommendations for an Out of Home Strategy for Scotland (Board Paper)*. 2019, Food Standards Scotland.
2. Robinson, E., et al., *Point of choice kilocalorie labelling in the UK eating out of home sector: a descriptive study of major chains.* BMC Public Health, 2019. **19**(1): p. 649.
3. Sinclair, S.E., M. Cooper, and E.D. Mansfield, *The Influence of Menu Labeling on Calories Selected or Consumed: A Systematic Review and Meta-Analysis.* Journal of the Academy of Nutrition and Dietetics, 2014. **114**(9): p. 1375-1388.e15.
4. Littlewood, J.A., et al., *Menu labelling is effective in reducing energy ordered and consumed: a systematic review and meta-analysis of recent studies.* Public Health Nutrition, 2016. **19**(12): p. 2106-2121.
5. Long, M.W., et al., *Systematic review and meta-analysis of the impact of restaurant menu calorie labeling.* American journal of public health, 2015. **105**(5): p. e11-e24.
6. Nikolaou, C.K., C.R. Hankey, and M.E.J. Lean, *Calorie-labelling: does it impact on calorie purchase in catering outlets and the views of young adults?* International Journal of Obesity, 2015. **39**(3): p. 542-545.
7. Cantu-Jungles, T.M., et al., *A Meta-Analysis to Determine the Impact of Restaurant Menu Labeling on Calories and Nutrients (Ordered or Consumed) in U.S. Adults.* Nutrients, 2017. **9**(10): p. 1088.
8. Crockett, R.A., et al., *Nutritional labelling for healthier food or non-alcoholic drink purchasing and consumption.* The Cochrane database of systematic reviews, 2018. **2**(2): p. CD009315-CD009315.
9. Downs, J.S., et al., *Supplementing menu labeling with calorie recommendations to test for facilitation effects.* American journal of public health, 2013. **103**(9): p. 1604-1609.
10. Roberto, C.A., et al., *Evaluating the impact of menu labeling on food choices and intake.* American journal of public health, 2010. **100**(2): p. 312-318.
11. Zlatevska, N., N. Neumann, and C. Dubelaar, *Mandatory Calorie Disclosure: A Comprehensive Analysis of Its Effect on Consumers and Retailers.* Journal of Retailing, 2018. **94**(1): p. 89-101.
12. Theis, D.R.Z. and J. Adams, *Differences in energy and nutritional content of menu items served by popular UK chain restaurants with versus without voluntary menu labelling: A cross-sectional study.* PloS one, 2019. **14**(10): p. e0222773-e0222773.
13. James, A., B. Adams-Huet, and M. Shah, *Menu Labels Displaying the Kilocalorie Content or the Exercise Equivalent: Effects on Energy Ordered and Consumed in Young Adults.* American Journal of Health Promotion, 2015. **29**(5): p. 294-302.
14. Petimar, J., et al., *Estimating the effect of calorie menu labeling on calories purchased in a large restaurant franchise in the southern United States: quasi-experimental study.* BMJ, 2019. **367**: p. l5837.
15. *The impact of Covid-19 on the out of home sector in Scotland*. 2021, Food Standards Scotland.
16. *Impact Assessment - Mandating calorie labelling of food and drink in out-of-home settings*. 2020, Department of Health & Social Care.

17. Robinson, E., et al., *Will calorie labels for food and drink served outside the home improve public health?* BMJ, 2021. **372**: p. n40.