Title: Availability of HFSS items in food shops in the communities first area of central Rhyl; what is on offer at checkouts and promotional area and how does it compare with healthy eating guidelines?

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Student Declaration In Respect of Individual Work

I declare that the whole of this work is the result of my individual effort and that all quotations from other authors have been acknowledged.

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Signed: L. Holland

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Abstract

**Introduction**: In Wales around 23% of adults are obese, the highest rates are in the most deprived areas. Snack foods may be in part to blame for an increase in obesity rates. Checkouts in food shops have been found to contain a high number of high fat, salt or sugar (HFSS) snacks particularly in low income areas. Fruit and vegetable availability and consumption is reported to be low in more deprived areas, with the lowest rates of consumption being in the North Wales area.

**Methods**: The study is a cross-sectional audit, with data collected through observations. It took place in the Rhyl West 2 area (RW2A) which is a deprived area in Wales. Snacks on and in view of checkouts were audited, to identify the range of healthy versus HFSS snacks available. Fruit and vegetable availability in the shops within (RW2A) were also recorded.

**Results**: All shops had snack foods on at least some of their checkouts. 78% of checkouts audited contained snack foods. Of these 48% contained healthy snack and 58% contained HFSS snacks. This shows a greater availability of HFSS snacks on checkouts. Supermarkets had greater availability of healthy snack items compared to in-town shops. All in-town shops offered fruit and vegetables in some form however the quality and variety varied between shops.

**Conclusion**: It would be possible to make healthy snack swaps from the items available at the supermarket checkouts however not at most in-town shop checkouts. It would also be possible to meet the 5-a-day recommendations for fruit and vegetables when shopping in the in-town shops however, the variety and quality available would be reduced compared to a supermarket.

**Introduction**

In Wales, around 23% of adults are obese with the highest rates being in the most deprived areas (Welsh government, 2017). Without intervention this is estimated to rise to over 50% of the adult population by 2050, costing the NHS an estimated 10 billion pound per year
(Foresight, 2007). This is almost 4 billion pounds more than it currently costs a struggling
NHS (Tovey, 2017). Obesity is defined as an excess of body fat to the point it causes an
increased risk to health (Gandy, 2014). It is classified as having a BMI above 30kg/m2 (WHO,
1995). It is a major risk factor for many health conditions (SIGN, 2010) including type 2
diabetes mellitus (T2DM), stoke and cardiovascular disease (CVD) (WHO, 2016). Obesity is
also associated with 7.1% of premature deaths (Tovey, 2017).
Weight gain occurs when energy intake exceeds energy expenditure.
On average, each snack adds 216kcal to the diet (Llaurado et al, 2016). Those of a lower
socioeconomic status and young adults have a higher snacking frequency (O’Connor, et al
2015). Increased snack frequency has a positive correlation with increased waist
circumference among overweight and obese individuals (O’Connor, et al, 2015). However,
for those with a healthy BMI snacking is inversely related to body fat percentage (O’Connor
et al, 2015) suggesting the type of snack is important in weight management. They also
found obese individuals consumed more crisps, chocolate, sweets and fewer nuts than
individuals of a healthy weight
Snacks such as fruit, vegetables and nuts are beneficial in the diet providing a source of
vitamins, mineral and fiber, they are also often less energy dense than other popular snacks
such as chocolate and crisps (Finglas et al, 2015). Consumption of fruit and vegetables has
been shown to have a dose dependent effect on reducing all-cause cancer and CVD
mortality, (Oyebode et al, 2014), and is linked with healthy body weight (WHO, 2018)
A study on snacking patterns of adolescence highlighted crisps, chocolate and confectionary
as popular snack options (Llaurado et al, 2016). These foods are typically energy dense, high
in non- milk extrinsic sugars (NMES) salt and saturated fat, they are also poor in
micronutrients, except for sodium (Finglas et al, 2015). High intakes of saturated fat
increases risk of CVD (Hooper et al, 2015). A high salt diet is linked to an increased blood
pressure and therefore risk of CVD (Graudal et al, 2017). Also, a high consumption of added
sugars in the diet has been linked to an increased overall energy intake and weight gain
(SACN 2015). Choosing healthier snacks such as fruit, vegetables and unsalted nuts to
replace HFSS snacks, could help weight management and reduce risk factors for diseases
such as CVD (BHF, 2018).
Supporting this the NDNS (2017) showed the UK population are consuming over the
recommendations for saturated fat, NMES and salt and below the recommendations for fruit, vegetables and dietary fiber. These statistics are exaggerated within lower socioeconomic areas. The lowest fruit and vegetable consumption in Wales is in the North Wales area.

The non-government organization Sustain (2012) found supermarket checkouts and queuing areas had a higher availability of HFSS snacks than healthy snacks. This is comparable to results found by Basch et al (2016) and Thornton et al 2012 in American and Australian study’s respectively, these studies also reported high percentage of promotional areas to contain HFSS snacks. Additionally, 60% of shoppers report to purchasing sweets or chocolate at checkouts (Masterfoods, 2010). It may therefore be beneficial for public health if retailers stocked healthier products at checkouts. An intervention study by, Winkler et al (2016) found replacing HFSS snacks with healthier options at checkouts increased sales of vegetables but did not affect sales of HFSS snacks. The intervention took place at just one checkout per store and only continued for four weeks. Replacing HFSS snacks with healthy ones on all checkouts may have a greater impact. The intervention had good public support, suggesting consumers would prefer healthier options at checkouts. In 2014 the supermarket Lidl banned HFSS foods at their checkout, they reported good public support for this. The research may be bias due to being conducted by the supermarket involved. Nevertheless, other supermarkets have begun to remove HFSS items from their checkouts.

A study of convenience supermarkets by Horsley and colleagues (2014), found 89% of the food items displayed in full view of children were unhealthy, as classified by the FSA nutrient profiling score (DH 2011). This can prompt children to request them, this pester power from children is reported by parents as an unwanted problem when taking their child shopping (Sustain, 2012). It has been reported that 59% of sales and 61% of profits come from HFSS snacks (Masterfoods, 2010). This provides a problem for public health campaigns such as change for life promoting healthy snack swaps, as the convenient store owners and shareholders main goal is to make good profits. This makes it unlikely they will reduce the amount of shelf space particularly in high footfall areas of the shop, as this risks significantly reducing profits. Therefore, HFSS snacks need to be replaced by equally profitable healthy snack swaps to make the swaps more attractive to retailers and consumers.
Town-center convenient shops in low socioeconomic areas have been found to have a greater availability of these energy dense foods and less availability of fruit and vegetables (Horsley et al, 2014). In contrast, Millichamp et al (2013) found no difference in availability of fruit and vegetables, however commented in low socioeconomic areas fruit and vegetables were cheap but of low quality. Smith et al, 2010 also found no difference in fruit and vegetable availability between socioeconomic areas, however measured distance via motorized transport meaning those in lower socioeconomic areas may have less accessibility due to lower rates of car ownership. Additionally, Macdonald et al (2011) showed proximity to convenience stores is linked with obesity and higher snack frequency, however this does not necessarily show a cause and effect as many factors contribute to obesity (Foresight, 2007).

The cost of fruit and vegetables is reported as a barrier to choosing them as snacks (Cassdy et al, 2007). This is supported by Rao and colleagues, (2013) who report a healthier diet, including snacks, cost more than an unhealthy diet. However, DeWeese & Ohri-Vachaspati (2017) found where ready-to-eat fruit and vegetables were available alongside crisps in shops surrounding schools, fruit and vegetables were not significantly more expensive when analyzed using the paired t test. They also found almost half the shops did not stock ready to eat fruit or vegetables but all stock crisps. Lent et al (2014) found improving availability alone did not significantly alter snack purchases. Therefore, to improve dietary intake of healthy snacks the availability and affordability of healthier snacks needs to be improved together. This is supported by Powell et al (2013) who conducted a systematic review finding reducing the cost of fruit and vegetables by 20% increased sales by 10% while increasing the tax on unhealthy foods reduced sales of these items. Subsidization of fruit and vegetables therefore may increase uptake. Change for life vouchers and the sugar tax aim to improve population diet based on these principles.

Although there is much research on the availability and cost of healthy versus HFSS snacks at supermarket checkouts and convenient stores there is little data to show what the situation is currently like in lower socioeconomic areas in Wales. This research therefore aims to assess how realistic it is for those living the RW2A to swap HFSS snacks for change-for-life (2016) health snacks at checkouts and to meet the five-a-day recommendation. To do this the current availability of healthy versus HFSS snacks on checkouts in the Rhyl West 2 area
(RW2A) will be assessed, as well as assessing the current availability of fruit and vegetables in the in-town shops of the RW2A.

**Research design and methods**

**Design**
The study is a cross-sectional audit, with data collected though observations. A cross-sectional audit is an observational study providing a snapshot of the current situation. Advantages of this type of study are that it takes less time and requires less resources than a longitudinal or repeated measures study (Sedgwick, 2014). Data can be analysed quickly producing results. In a rapidly changing environment this allows interventions to be implemented more quickly. However, this type of study cannot provide evidence of causal effect (Sedgwick, 2014). The study therefore can make conclusions about product availability but not about the population’s diet. Audits are a good method of identifying how the current situation compares to guidelines (Wade, 2005). In this case, it is to compare snacks available to the change-4-life snack swaps (2015). Using observations allows data to be collected without affecting the outcome, however observations can be subject to inter-observer bias (Denscombe, 2003). To reduce this all observations were recorded by one observer using a pre-prepared research tool.

**Sample**
The shops in the study are the main shops in the RW2A selling snack foods and the closest supermarkets to this area. RW2A has been selected as in 2011 it was ranked as the most deprived area within Wales (Welsh Government, 2015). It is also central to five Communities First areas. The indices used to determine deprivation include access to services, including food shops (Welsh Government, 2015). Shops were identified by visiting the area. Four food shops were identified within the town-centre in addition to the three closest and most accessible supermarkets to this area. Although the supermarkets are not within the RW2A they have been included as this is where much of the UK food spend occurs (Carroll, 2016b). Shops were classed in groups according to Sustain (2012), Carroll (2016a) and Slide, (2016) criteria and given a code name (see appendix 2). All shops visited are part of a chain and therefore present in many locations throughout the country increasing external validity. Shops with less than one aisle of food items available were excluded as these shops are less
often visited to purchase food items (Carroll, 2016a).

Snack foods are being considered in this study as they are often unplanned purchases based on availability, and are likely to be in addition to planned meals (Kerr et al, 2012). This is supported by Carroll (2016a) finding the number one reason for snacking is hunger, therefore consumers are likely to purchase snacks impulsively.

There is no universally accepted definition of a snack food. Journals use varied definitions, from any food or drink consumed outside of set meals times (Llaurado et al, 2016), to O’Connor et al (2015) basing the definition on the type of food rather than timing of consumption. For this study Snacks classed as all ready to eat foods such as those identified in Llaurado et al, (2016), including chocolate, sweets, crisps, Fruit and cereal bars. Similarly, to DeWeese & Ohri-Vachaspati (2017), foods not ready to eat were excluded as the study focus is on snacks purchased to be consumed immediately. All ready to eat food items available on the checkouts, and self-scan area were included. Chewing gum was excluded as it is not designed to be swallowed and digested.

In addition to snacks at checkouts the availability of fruit and vegetables in the shops visited within RW2A were assessed. It is well documented that those living in lower socioeconomic areas consume less fruit and vegetables and are less likely to meet the five-a-day recommendation (Bates et al, 2017).

Ethics

As all stores visited in the study are chain stores and have public access during opening times consent is therefore not necessary. However, if questioned the purpose of the study was explained out of common courtesy. The shops were visited at less busy times to minimize any disruption caused during data collection.

Before any data collection began Cardiff School of Health Sciences Ethics Committee approval was obtained (see appendix 1).

No incentives were offered to shop’s for participating in the study. All data is kept confidentially in a password protected computer used solely for this report. The shops are anonymised in the report to maintain confidentiality and avoid any risk of bad publicity for the shop.

Date collection
Data on snacks available on checkouts was collected from all shops visited including the number of checkouts containing HFSS snacks compared to those containing healthy options. Healthy snacks are based on change-4-life (2016) snack swaps. Any foods that did not fit in the HFSS category or healthy swaps the DoH (2011) nutrient profiling was used where healthy foods are those that score three or less (see appendix 4). A price range for both healthy and HFSS snacks was recorded to identify any cost difference between healthy versus HFSS snacks on checkouts. Similar data was collected for snacks in the area in view of checkouts as consumers will inevitably pass this area to reach checkouts. The availability of fruit and vegetables at in-town shops in the RW2A was recorded regardless of their location within the shop. This was to identify if it is possible to meet the five-a-day recommendation in the RW2A without travelling to a supermarket.

Data was recorded using a checklist (see appendix 3) identifying the number of different healthy and HFSS snacks available at each checkout of the seven shops audited. The use of an audit tool such as this has been successfully used in previous research including Basch et al (2016).

All data was collected during June 2017 to minimise any seasonal variation in product availability between shops. This means results are only valid for one season. Data collected is mainly quantitative; this allows a larger number of checkouts to be audited with the time and resources available. It also makes data quicker to analyse and to identifying similarities or differences between variables. However, quantitative data does not give much information of what snacks were available; a small amount of qualitative data will therefore be included to give more depth to the data.

Analysis

Due to the small sample size of seven shops it is not useful to use statistical analysis to identify significance of the results. The data collected was therefore inputted into excel. Excel was then used to generate graphs and tables to display results.

Results

Seven shops were visited during data collection. Four of these were smaller in-town food shops; three were out of town supermarkets. All shops had checkouts containing snack
foods. The majority of shops had HFSS snacks available with just over half offering healthy options; this is shown in table 1 below.

Table 1 showing shops audited their abbreviations and snacks available.

<table>
<thead>
<tr>
<th>Shop</th>
<th>Abbreviation</th>
<th>Total number of checkouts</th>
<th>Number of checkouts containing healthy snacks</th>
<th>Number of checkouts containing HFSS snacks</th>
<th>Total number of checkouts containing snacks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Discount supermarket 1</td>
<td>DS1</td>
<td>12</td>
<td>12</td>
<td>0</td>
<td>12</td>
</tr>
<tr>
<td>Supermarket 1</td>
<td>SM1</td>
<td>11</td>
<td>11</td>
<td>11</td>
<td>11</td>
</tr>
<tr>
<td>Supermarket 2</td>
<td>SM2</td>
<td>18</td>
<td>4</td>
<td>5</td>
<td>7</td>
</tr>
<tr>
<td>Frozen food retailer 1</td>
<td>FF1</td>
<td>6</td>
<td>2</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Frozen food retailer 2</td>
<td>FF2</td>
<td>3</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Discount retailer 1</td>
<td>DR1</td>
<td>6</td>
<td>0</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Discount retailer 2</td>
<td>DR2</td>
<td>4</td>
<td>0</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

During the audit a total of sixty checkouts were audited, of these 78% contained snack foods and 22% did not. Per shop the percentage of checkouts containing snack food varied from 39% in SM2 to 100% in DS1. Of the checkouts containing snacks, 48% contained healthy snack foods and 58% contained HFSS snacks. On average 39% of checkouts per shop contained healthy snacks compared to 64% containing HFSS snacks showing more checkouts audited contained HFSS foods. However, when adding up the total number of healthy versus HFSS items there were a higher number of healthy snack foods on offer (476 healthy snacks compared to 324 HFSS snacks). This discrepancy in results is due to DS1 containing the highest number of snack foods per checkout and selling exclusively healthy snack items on checkouts. Removing this shop from the study, would show there were a greater number of HFSS snacks on checkouts during the audit (324 HFSS snacks compared to 87 healthy).
Graph 1 shows the average number of healthy versus HFSS snack items available in the shops audited. It shows six of the seven shops contain a higher average number of HFSS snacks per checkout than healthy snacks and only one of seven shops containing a higher average number of healthy snacks per checkout. Three of the seven shops had no healthy snacks available on checkouts this was DR1, DR2 and FF2. Only DS1 had exclusively healthier foods available at its checkouts. All shops to the left of the green line are classed as supermarkets located out of the town center and have the largest number of checkouts (11-18) whereas those on the right are smaller in-town shops with less checkouts (3-6). Only 25% of the in-town supermarkets contained healthy foods at checkout compared to 100% of out of town supermarkets audited. The average percentage of checkouts containing healthy foods is much lower at 8% in the in-town shops compared to 74% in the out of town supermarkets. With an average of 88% of checkouts in the in-town shops containing HFSS snacks compared to 27% in the supermarkets. All seventeen checkouts in the in-town shops that have snacks available contained HFSS snacks. The most widely available snack in the in-town area was chocolate with 94% of checkouts that contained snacks having this available and only one checkout contained fruit or nuts.
Graph 2 shows of the seven shops audited six contained snack foods in view of the checkouts. This was predominantly the end-of-aisle directly facing checkouts. Only two of the seven shops contained healthy snack foods in view of checkouts, each of these shops (SM1 and FF1) had one healthy item each in view of checkouts in addition to many HFSS snacks. It is only possible in one (DS1) of the seven shops audited to go to the checkout area without coming across HFSS snack items. However, in three (DR1, DR1, FF2) of the seven shops it is possible to reach the checkout area and not see any healthy snacks on offer regardless of which checkout is attended, these are all in the in-town area. Chocolate is also the most widely available HFSS item in view of the checkouts, with it being available in this area in five of the total seven shops audited.

The overall availability of HFSS snacks is much greater than healthy snacks both at checkout and in view of checkouts, this is the case is six of the seven shops visited. The cost of HFSS snacks at checkouts is greater than that of healthy snacks. The price of HFSS snacks ranged from 50p to £2.00 per item compared to 32p-£1.49 for the healthier snacks. Where healthier snacks are available they are often on offer at similar or lower cost, when compared to HFSS snacks. Additionally, in all shops except DS1 HFSS snacks were available at a higher cost (see table 1 below).

Table 2 shows a price comparison of the healthy and less healthy snacks available on checkouts.
<table>
<thead>
<tr>
<th></th>
<th>Cheapest healthy Snack</th>
<th>Cheapest HFSS snack</th>
<th>Most expensive healthy snack</th>
<th>Most expensive HFSS</th>
</tr>
</thead>
<tbody>
<tr>
<td>DS1</td>
<td>32p</td>
<td>N/A</td>
<td>£1.49</td>
<td>N/A</td>
</tr>
<tr>
<td>SM1</td>
<td>54p</td>
<td>50p</td>
<td>£1.00</td>
<td>£2.00</td>
</tr>
<tr>
<td>SM2</td>
<td>32p</td>
<td>50p</td>
<td></td>
<td>£1.00</td>
</tr>
<tr>
<td>FF1</td>
<td>£1.00</td>
<td>£1.00</td>
<td>£1.00</td>
<td>£1.00</td>
</tr>
<tr>
<td>DR1</td>
<td>N/A</td>
<td>50p</td>
<td>N/A</td>
<td>£1.00</td>
</tr>
<tr>
<td>DR2</td>
<td>N/A</td>
<td>£1.00</td>
<td>N/A</td>
<td>99p</td>
</tr>
<tr>
<td>FF2</td>
<td>N/A</td>
<td>50p</td>
<td>N/A</td>
<td>£1.00</td>
</tr>
</tbody>
</table>

**Fruit and vegetable availability in the in-town stores**

All four in-town shops visited stocked fruit and vegetables in some form. All stocked tinned fruit and vegetables with tinned tomatoes and beans being on offer in all shops. Fresh fruit was available in three of the four shops visited with only FF1 storing fruit in the chiller. The fresh fruit available in this shop appeared fresher and more appealing to purchase. Fresh vegetables were available at two of the in-town shops with again only FF1 storing vegetables in a chiller making them appear fresher than in other in-town shops. Frozen vegetables were available at two of the shops visited namely the frozen food retailers, with each of these shops offering a large variety of frozen vegetables. None of the shops stocked frozen fruit; this was the only form of fruit or vegetable not available in any of the in-town shops. Two shops visited stocked dried fruit which along with fresh fruit can be eaten as a snack on the go. The shop with the most variety of fruit and vegetables (FF1) offered 56 varieties when including fresh, frozen, dried and tinned. The shop offering the least provided just 10 varieties (DS2) with an average of 27.7 varieties being on offer in each shop (see figure 1).
The greatest variety of fruit or vegetables was fresh fruit with 33 options available divided between three of the shops (see Graph 3). Other than frozen fruit which was not available in any shops the least available was dried fruit with a total of six options available between two shops. Although all shops had tinned fruit available there were a total of just eight varieties on offer, two from each shop. In every category except dried fruit FF1 had equivalent or more varieties of fruit or vegetables on offer.

Although there is fruit and vegetables on offer in each of the in-town shops there was more chocolate, sweets and crisps available at each of these shops. An average of three times more aisle space was dedicated to these items than fruit and vegetables.
Discussion

The aims of this study were to assess how realistic it is for those living the RW2A to swap HFSS snacks for change-for-life (2016) health snacks at checkouts and to meet the five-a-day recommendation.

Limitations

One limitation of the study is the small sample size having just seven shops. A larger number of shops from a variety of socioeconomic areas would allow a comparison based on the economic status of the area. A power calculation was not completed. A power calculation and increasing the number of shops involved would have enabled statistical testing to be carried out, identifying any significant differences in the availability, price and quality of healthy snacks on offer between social classes.

Supermarket checkouts

The RW2A has better access to convenient stores than supermarkets; this is consistent with findings by Macdonald et al (2011). The convenient shops within the RW2A also have greater availability of HFSS than healthy snacks at checkouts. This may provide some explanation as to why Macdonald et al (2011), found those living close to convenient stores have higher rates of obesity.

Similarly, to Sustain in 2012, and Bach et al 2016 the majority of the checkouts visited contain more HFSS snacks such as chocolate and confectionary than healthy snacks. However, in contrast to sustain (2012), all three supermarkets had healthy snack options on offer at some checkouts showing an improvement, making it possible to make healthy snack swaps at checkouts as suggested by change-for-life (2016). This increase in availability is likely to have increased sales as shown by Winkler et al (2016) especially as healthy snacks are on offer at lower cost than HFSS snacks. This increase in healthy snack consumption may have contributed to the reduction in obesity in Wales which has recently been reported as 23% (Welsh government, 2017) down from 24% reported in 2015 (Welsh Health Survey, 2015). This is consistent with O’Connor et al (2015), finding waist circumference is inversely related to healthy snack consumption.

There was a lower percentage of checkouts per shop in supermarkets offering HFSS snacks than Sustain (2012) of 42% compared to 55%. This reduction could be attributed to the
Sustain campaign in 2012 which named and shamed shops with a high number of HFSS food on their checkouts. Other influences may include public opinion and the change-for-life (2016) campaign. There are however many differences between the two studies which affect their comparability such as the current study being much smaller in size and visiting different shops in different cultural areas. Skidmore et al (2010) found snack food availability varies between rural and urban areas suggesting any differences may be attributed to the Sustain (2012) study being conducted in an urban area and this study being conducted in a rural area. Additionally Sustain (2012,) study included drinks as well as snack items. This study focused exclusively on snack foods at checkouts.

**In town shop checkouts**

There was a higher percentage (79%) of checkouts in the in-town shops containing HFSS snacks than supermarkets as well as convenient shops visited by Sustain (2012) which had 22% of checkouts containing HFSS snacks. Additionally, only FF1 contained any healthy snack available at checkouts. These findings support Horsley et al (2014) research showing in-town convenient shops offer great availability of HFSS snacks. It is hypothesized that these shops have a great availability of these products due to their profitability (Masterfoods, 2010). These findings show at the majority of checkouts audited in the RW2A it is not possible to make change-for-life health snack swaps. Supermarkets have plenty of room to stock HFSS snacks in other areas are likely to show no loss of profit by removing them from checkouts, as shown by Winkler et al (2016), This may be why supermarkets have greater healthy snack availability at checkouts.

**Cost**

The cost of healthy snacks available at the checkouts was lower than HFSS options. This contrasts with Rao and colleagues (2013) meta-analysis finding HFSS snacks were slightly more expensive than healthy options suggesting retailers may have adapted prices to address this issue. The barrier of cost to eating healthy reported by Cassady et al (2007) may therefore be reduced for snacks at checkouts in the RW2A. This increases the chance individuals will choose healthier snacks swaps to replace HFSS snacks as suggested by change-for-life (2016). It also shows the main barrier for choosing these snack swaps at checkouts may be availability and variety, particularly in shopping in the RW2A. Any
intervention regarding snacks at checkouts should therefore focus on availability of healthy snack as this was much lower in the RW2A.

**In view of checkouts**

All shops visited, except DS1 had less healthy food available in view of the checkouts. This meant in most shops audited HFSS snacks will have a high footfall as customers pass on the way to the checkouts. This viewing of less healthy snack foods is likely to prompt temptation to buy and prompt children to request them as shown by (Horsley et al, 2014). Many shops particularly the supermarkets appear to have reduced HFSS snacks from checkouts since Sustain (2012). This may be due to much of the media attention such as the BDA (2016) ‘junk free checkouts campaign and Sustain (2012) focusing on checkouts, however more needs to be done to remove HFSS items from other high footfall areas to reduce children pestering for these items.

**Fruit and vegetables on offer**

Despite the low fruit and vegetable consumption reported in North Wales (Welsh Government, 2017), all in-town shops had fruit and vegetables available. This supports Millichamp et al (2013) reporting good availability of fruit and vegetables in low socioeconomic areas. However, contrasts with Horsley et al (2008). Many previous studies looked exclusively at fresh fruit and vegetable availability. This study included all forms (fresh, frozen, tinned and dried) of fruit and vegetables as they all provide health benefits and contribute to the government’s 5-a-day target for public health (Public Health England, 2016). As availability is good however consumption is the lowest in Wales (Welsh government, 2017) availability alone does not appear increase consumption. An intervention study showed increasing the availability and appearance of fresh fruit and vegetables in convenience shops in deprived areas increased purchase and consumption without affecting sales of other items (DOH, 2010). These finding may encourage other retailers to do the same which may explain a potential increase in fresh fruit and vegetable availability since 2010. Showing to improve consumption it may be more important to focus on quality.
Only FF1 had fresh fruit or vegetables on sale in the fridge therefore in the other shops the fruit did not appear as fresh and as appealing. This supports Milichamp et al, (2013) finding fresh fruit and vegetables on offer in low socioeconomic areas were cheaper but lower quality. This will affect the likelihood of purchase and consume these products (DOH, 2010). The majority of the HFSS items are prepackaged and can be stored for a longer period at room temperature and therefore quality does not vary between shops, along with the great profitability of these items (Masterfoods, 2010) may explain why a greater shop area is dedicated to these items in the smaller in-town shops.

Within the RW2A there is a good availability of fruit and vegetables however limited availability of high quality fresh fruit and vegetables. Improving this similarly to that reported by DOH (2010) may improve the health of the local population. As consumption of fruit and vegetables increases vitamin, mineral and fiber content of the diet which can help reduce the risk of all-cause mortality (Oyebode et al, 2014) and help maintain cognitive health (Miller et al, 2017).

At the time of data collection there was a good amount of fruit and vegetables available in the in-town shops increasing the likelihood of achieving the 5-a-day target. Over 50% of the fruit and vegetables on offer were in FF1. Since data collection this shop has moved to an area outside of the town-center. This move of shops to out of town centers with better car access has been well documented in a number of countries including the UK (Padilla et al, 2017). Although this may improve overall access and support Macdonald et al (2011) finding no difference in access to fruit and vegetables between different socioeconomic areas when distance is measured via motorized transport, for those of lower income who do not have car access fruit and vegetable availability is likely to be decreased.

**Conclusion**

The availability of healthier foods at checkouts seems to be improving as well of the cost of these items often being cheaper or comparable to HFSS snacks. However, more needs to be done to get to a point where healthier snacks are available in comparable or greater variety as HFSS snacks. If this occurs it will be more achievable to make healthy snack swaps as suggested by the 2016 change for life campaign.
There is also good availability of fruit and vegetables in the in-town area, however where fresh and ready to eat options were available they often appeared poor in quality. Based on these results it would be possible to meet the 5-a-day targets shopping the RW2A, however in most of the shops variety and quality would be reduced.

Future studies could compare the sales of healthy and HFSS snacks in shops with ‘junk free checkouts’ compared to those who have HFSS snacks on offer at the checkouts. They could then identify if change in availability at checkouts affects the overall sales of these products, and help predict consumption. Another option could be looking at consumer opinions and if they feel there had been any change in the checkout availability since the Sustain, 2012 campaign and what their thoughts on this are.

**Word count 5481.**

**References**


Supermarkets.” *Public Health Nutrition.*


Skidmore. P., Welch, A., Van Sluijs, E., Jones, A. (2010). Impact of neighbourhood food...


Tovey, M. (2017). Obesity and the public purse weighing up the true cost to the tax payer. *Institution of economics and affairs*


Appendix

Appendix 1 Ethics approval

BSc (Hons) Human Nutrition & Dietetics  
Cardiff School of Health Sciences

Dear Applicant

Re: Application for Ethical Approval: Availability of HFSS items in food shops in the communities first area of central Rhyl; what is on offer at checkouts and promotional area and how does it compare with healthy eating guidelines?

Project Reference Number: 9202
Your ethics application, as shown above, was considered by the Health Care and Food Ethics Panel on 28/06/2017.

I am pleased to inform you that your application for ethical approval was APPROVED.

Minor issues may still need addressing before you commence any work – if so these will be listed below.

N/A

Where changes to the information sheet, consent form and/or procedures are deemed necessary you must submit revised versions to the relevant ethics inbox. If you are a student – your supervisor must do this on your behalf.

Note: Failure to comply with any issues listed above will nullify this approval.

Standard Conditions of Approval

1. Your Ethics Application has been given a Project Reference number as above. This MUST be quoted on all documentation relating to the project (E.g. consent forms, information sheets), together with the full project title. 2. All documents must also have the approved University Logo and the Version number in addition to the reference and project title as above 3. A full Risk Assessment must be undertaken for this proposal, as appropriate, and be made available to the Committee if requested. 4. Any changes in connection to the proposal as approved, must be referred to the Panel/Committee for consideration without delay quoting your Project Reference Number. Changes to the proposed project may have ethical implications so must be approved. 5. Any untoward incident which occurs in connection with this proposal must be reported back to the Panel without delay.

6. If your project involves the use of human samples, your approval is given on the condition that you or your supervisor notify the HTA Designated Individual of your intention to work with such material by completing the form entitled “Notification of Intention to Work with Human Samples”. The form must be submitted to the PD (Sean Duggan), BEFORE any activity on this project is undertaken

This approval expires on 28/06/2018. It is your responsibility to reapply / request extension if necessary.

Yours sincerely

Prof. [Redacted]

Chair of Department of Healthcare and Food Ethics Panel Cardiff School of Health Sciences Llandaf Campus Western Avenue, Cardiff CF5 2YB Tel: [Redacted] E-mail: atatham@cardiffmet.ac.uk
Appendix 2 classification of shops involve in study

8 shops identified

1 excluded due to having less than one full aisle dedicated to food

Three shops identified as out of town supermarkets using Sustain (2012) classification of mainly selling food items and having more than six checkouts. One of the supermarkets was identified as a discount supermarket (Carroll, 2016b). the other two are part of the 'big four'

These shops will be identified as SM1, SM2 and DS1

Two in town shops were identified as Frozen food retailers having selling mainly frozen food and having less than six checkouts

These shops will be identified as FF1 and FF2

Two in town-shops were identified as discount retailers.

These shops will be identified as DR1 and DR2

Appendix three, Checklist for checkouts

<table>
<thead>
<tr>
<th>Checkout number</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>price range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Snacks available</td>
<td>Y/N</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fresh fruit</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unsalted nuts</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baked crisps</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vegetables</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dried fruit</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Seeds</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>low fat pop corn</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Product Category</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>------------------</td>
<td>-----</td>
<td>-----</td>
<td>-----</td>
<td>-----</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>rice cakes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>chocolate bar</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chocolate</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Confectionary</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cakes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crisps excluding baked</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>oat cakes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Healthy cereal bars</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>less healthy cereal bars</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other (please specify)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Appendix 4 DOH (2011) nutrient profiling
1. Application of the Agency’s Nutrient Profiling Model

There are 3 steps to working out the overall score of a food or drink.

1. Work out total ‘A’ points

A maximum of ten points can be awarded for each nutrient.
Total ‘A’ points = (points for energy) + (points for saturated fat) + (points for sugars) + (points for sodium)
The following table indicates the points scored, depending on the amount of each nutrient in 100g of the food or drink:

<table>
<thead>
<tr>
<th>Points</th>
<th>Energy (kJ)</th>
<th>Sat Fat (g)</th>
<th>Total Sugar (g)</th>
<th>Sodium (mg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>≤ 335</td>
<td>≤ 1</td>
<td>≤ 4.5</td>
<td>≤ 90</td>
</tr>
<tr>
<td>1</td>
<td>&gt;335</td>
<td>&gt;1</td>
<td>&gt;4.5</td>
<td>&gt;90</td>
</tr>
<tr>
<td>2</td>
<td>&gt;670</td>
<td>&gt;2</td>
<td>&gt;9</td>
<td>&gt;180</td>
</tr>
<tr>
<td>3</td>
<td>&gt;1005</td>
<td>&gt;3</td>
<td>&gt;13.5</td>
<td>&gt;270</td>
</tr>
<tr>
<td>4</td>
<td>&gt;1540</td>
<td>&gt;4</td>
<td>&gt;18</td>
<td>&gt;360</td>
</tr>
<tr>
<td>5</td>
<td>&gt;1675</td>
<td>&gt;5</td>
<td>&gt;22.5</td>
<td>&gt;450</td>
</tr>
<tr>
<td>6</td>
<td>&gt;2010</td>
<td>&gt;6</td>
<td>&gt;27</td>
<td>&gt;540</td>
</tr>
<tr>
<td>7</td>
<td>&gt;2245</td>
<td>&gt;7</td>
<td>&gt;31</td>
<td>&gt;630</td>
</tr>
<tr>
<td>8</td>
<td>&gt;2660</td>
<td>&gt;8</td>
<td>&gt;36</td>
<td>&gt;720</td>
</tr>
<tr>
<td>9</td>
<td>&gt;3015</td>
<td>&gt;9</td>
<td>&gt;40</td>
<td>&gt;810</td>
</tr>
<tr>
<td>10</td>
<td>&gt;3350</td>
<td>&gt;10</td>
<td>&gt;45</td>
<td>&gt;900</td>
</tr>
</tbody>
</table>

If a food or drink scores 11 or more ‘A’ points then it cannot score points for protein unless it also scores 5 points for fruit, vegetables and nuts.

2. Work out total ‘C’ points

A maximum of five points can be awarded for each nutrient/food component.
Total ‘C’ points = (points for % fruit, vegetable & nut content) + (points for fibre (either NSP or AOAC)) + (points for protein)
The following table indicates the points scored, depending on the amount of each nutrient/food component in 100g of the food or drink:

<table>
<thead>
<tr>
<th>Points</th>
<th>Fruit, Veg &amp; Nuts (%)</th>
<th>NSP Fibre *(g)</th>
<th>Or AOAC Fibre *(g)</th>
<th>Protein (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>≤ 40</td>
<td>≤ 0.7</td>
<td>≤ 0.9</td>
<td>≤ 1.8</td>
</tr>
<tr>
<td>1</td>
<td>&gt;40</td>
<td>&gt;0.7</td>
<td>&gt;0.9</td>
<td>&gt;1.6</td>
</tr>
<tr>
<td>2</td>
<td>&gt;60</td>
<td>&gt;1.4</td>
<td>&gt;1.9</td>
<td>&gt;3.2</td>
</tr>
<tr>
<td>3</td>
<td>-</td>
<td>&gt;2.1</td>
<td>&gt;2.8</td>
<td>&gt;4.8</td>
</tr>
<tr>
<td>4</td>
<td>-</td>
<td>&gt;2.8</td>
<td>&gt;3.7</td>
<td>&gt;8.4</td>
</tr>
<tr>
<td>5*</td>
<td>&gt;60</td>
<td>&gt;3.5</td>
<td>&gt;4.7</td>
<td>&gt;9.0</td>
</tr>
</tbody>
</table>
3. Work out overall score

- If a food scores less than 11 ‘A’ points then the overall score is calculated as follows:
  Total ‘A’ points (energy + saturated fat + sugars + sodium)
  Minus
  Total ‘C’ points (fruit, veg and nuts + fibre + protein)

- If a food scores 11 or more ‘A’ points but scores 5 points for fruit, vegetables and nuts then the overall score is calculated as follows:
  Total ‘A’ points (energy + saturated fat + sugars + sodium)
  Minus
  Total ‘C’ points (fruit, veg and nuts + fibre + protein)

- If a food scores 11 or more ‘A’ points, and less than 5 points for fruit, vegetables and nuts, then the overall score is calculated as follows:
  Total ‘A’ points (energy + saturated fat + sugars + sodium)
  Minus
  Points for fibre + points for fruit, vegetables and nuts (not allowed to score for protein)

A **food** is classified as 'less healthy' where it scores **4 points or more**.
A **drink** is classified as 'less healthy' where it scores **1 point or more**.
<table>
<thead>
<tr>
<th>Shop code</th>
<th>Total checkouts</th>
<th>with snack food</th>
<th>% containing snack foods</th>
<th>healthy</th>
<th>% healthy snacks</th>
<th>PRIS</th>
<th>%PRIS</th>
<th>price range</th>
<th>PR</th>
<th>H</th>
<th>%RH</th>
<th>snacks in view</th>
<th>No in view</th>
<th>No healthy</th>
<th>% healthy</th>
<th>No less healthy</th>
<th>% less healthy</th>
</tr>
</thead>
<tbody>
<tr>
<td>D1L</td>
<td>12</td>
<td>12</td>
<td>100</td>
<td>11</td>
<td>0</td>
<td>0/0-149</td>
<td>N/A</td>
<td>50-149</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>Y</td>
<td>16</td>
<td>0</td>
<td>0</td>
<td>16</td>
<td>100</td>
</tr>
<tr>
<td>S11</td>
<td>18</td>
<td>7</td>
<td>99</td>
<td>4</td>
<td>10</td>
<td>18/30-100</td>
<td>50-100</td>
<td>50-100 Y</td>
<td>0</td>
<td>0</td>
<td>100</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>D1H</td>
<td>6</td>
<td>6</td>
<td>100</td>
<td>0</td>
<td>0</td>
<td>6</td>
<td>100</td>
<td>100</td>
<td>N/A</td>
<td>N/A</td>
<td>Y</td>
<td>18</td>
<td>0</td>
<td>0</td>
<td>16</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>F11</td>
<td>6</td>
<td>4</td>
<td>67</td>
<td>2</td>
<td>38</td>
<td>67</td>
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<td>100</td>
<td>Y</td>
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<td>90%</td>
<td></td>
</tr>
<tr>
<td>S11</td>
<td>11</td>
<td>11</td>
<td>100</td>
<td>11</td>
<td>11</td>
<td>100/12-100</td>
<td>50-100</td>
<td>50</td>
<td>43</td>
<td>Y</td>
<td>54</td>
<td>1</td>
<td>2</td>
<td>53</td>
<td>96</td>
<td>96</td>
<td></td>
</tr>
<tr>
<td>F11</td>
<td>3</td>
<td>3</td>
<td>100</td>
<td>0</td>
<td>3</td>
<td>100/50-99</td>
<td>50-99</td>
<td>N/A</td>
<td>Y</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>100</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>D12</td>
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<td>0</td>
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<td>50</td>
<td>100</td>
<td>100</td>
<td>N/A</td>
<td>Y</td>
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<td>0</td>
<td>0</td>
<td>8</td>
<td>100</td>
<td>100</td>
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<td>79</td>
<td>31</td>
<td>10</td>
<td>4</td>
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<td>12</td>
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<td>207</td>
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</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Shop</th>
<th>Fresh fruit</th>
<th>Fresh vegetables</th>
<th>Tinned vegetables</th>
<th>Tinned fruit</th>
<th>Dried fruit</th>
<th>Frozen fruit</th>
<th>Frozen vegetables</th>
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<tbody>
<tr>
<td>D1L</td>
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<td>5</td>
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<td>3</td>
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<td>0</td>
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<tr>
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<td>2</td>
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<td>2</td>
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<td>0</td>
<td>10</td>
</tr>
<tr>
<td>F11</td>
<td>13</td>
<td>14</td>
<td>5</td>
<td>2</td>
<td>0</td>
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<td>16</td>
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</table>