

CARDIFF METROPOLITAN UNIVERSITY
CARDIFF SCHOOL OF HEALTH SCIENCES
DEPARTMENT OF HEALTHCARE SCIENCES AND FOOD

BSc (Hons) Human Nutrition and Dietetics

Dissertation Academic Paper

Title: The Rule of 15 in the Treatment of Hypoglycaemia: Are people adhering to this and does structured education make a difference?

[REDACTED]

Student Number: [REDACTED]

2018

Supervisor: [REDACTED]

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.

Dissertation submitted in partial fulfilment of the requirements of Cardiff Metropolitan University for Degree of Bachelor of Science with Honours.

Signed: [REDACTED]

Date: 10th May 2018

Academic Paper

The Rule of 15 in the Treatment of Hypoglycaemia; Are People Adhering to This and Does Structured Education Make a Difference?

Submission Date - Thursday, 10 May 2018



(NHS Choices, 2018; UNC Rex Healthcare, 2018)

Subject: BSc. (Hons) Human Nutrition and Dietetics

Assignment: Academic Paper

Supervisor: [REDACTED]

Student Number: st20082496

Word Count: 5467

Title

The rule of 15 in the treatment of hypoglycaemia: Are people adhering to this and does structured education make a difference?

Abstract

Background - The adherence of people with diabetes and their carers to the rule of 15 (Wiethop and Cryer, 1993) to treat hypoglycaemia and the impact of structured diabetes education has not been fully investigated. Within this research, hypoglycaemia treatment behaviours are explored and compared, between course attendees and non-attendees.

Methods - This cross-sectional study analysed responses from 60 people with diabetes and carers, from an online questionnaire, who had previously experienced and treated hypoglycaemia (n=60). Patients who had attended structured diabetes education (n=29) were compared by their compliance with the rule of 15 (Wiethop and Cryer, 1993) with those who had not attended (n=30) or were unsure (n=1).

Results - Participants who had attended structured diabetes education were 7% more aware (n=15) of the rule of 15 than non-attendees (n=12) (chi-squared, p=0.516, t=3.527, df=4). Blood glucose testing compliance confirmation and re-checking was 17% more common amongst non-attendees (n=18) than attendees (n=13), as was the 15-minute wait time. Males and females were equally likely to attend a course (Chi-squared p=0.520, t=1.307, df=2). People with a diabetes diagnosis duration of 1-5 years (n=5) were least likely and 6-15 years (n=13) most likely to favour attendance. Overall, attendees did not possess improved hba1c levels when compared to non-attendees. Sweets were the most frequently used type of fast-acting carbohydrate (n=15) and mean hypoglycaemia

treatment values were 21g (range 10g-40g) (One-way sample t-test, $t=87.878$, $df=2.42$, $p=0.001$) amongst attendees and 20g (range 9g-75g) for non-attendees (One-way sample t-test, $t=-66.126$, $df=59$, $p=0.001$) which was statistically significant.

Conclusion - The study demonstrated that attendance on structured diabetes education increases awareness of the rule of 15, the use of fast-acting carbohydrate and blood glucose testing confirmation to manage hypoglycaemia amongst people with diabetes and carers. However, adherence, awareness and compliance are still evident amongst non-attendees through the contribution of the diabetes specialist and technology in information provision.

Keywords: *diabetes, hypoglycaemia, carbohydrate, education, dietitian*

Introduction

The Prevalence of Diabetes

The metabolic disorder diabetes mellitus (DM) is characterised by chronic raised blood glucose levels resulting in hyperglycaemia, as a consequence of dysfunctional insulin secretion or action (Wass, *et al.* 2016). It is a prevalent condition, with an estimated 4.5 million people living with a form of diabetes in the UK (Diabetes UK, 2016a). Of these, approximately 90% have type 2 diabetes mellitus (T2DM) (Diabetes UK, 2016a) and 10% type 1 diabetes mellitus (T1DM) (JDRF UK, 2016). Latent autoimmune diabetes in adulthood (LADA) is a further subclass of diabetes, as is maturity-onset diabetes of the young (MODY), which is distinguished by certain genetic mutations (Goff and Dyson, 2016).

Hypoglycaemia Defined

Mild hypoglycaemia is defined as a blood glucose level of 3.9mmol/l or below (Holt, *et al.* 2017), with the patient being conscious and able to self-treat the episode with fast-acting carbohydrate, without external assistance (Walden, *et al.* 2013). Current UK guidelines advise that a person with diabetes experiencing hypoglycaemia should treat the episode with the 'rule of 15' (Wiethop and Cryer, 1993). This involves checking blood glucose levels with a finger prick test to confirm, treating with 15g of fast-acting carbohydrate, waiting 15 minutes and retesting glucose levels to confirm that they have risen and repeating treatment if they have not (DAFNE, 2011).

Hypoglycaemia is a common side-effect of insulin therapy and some sulphonylurea drugs (Stanisstreet, *et al.* 2010) that are used to treat diabetes. A hypoglycaemic episode can be fatal if erroneously managed (Evert, 2014), with research identifying 2-4% of all deaths within the diabetes population (Shafiee, *et al.* 2012) attributable to such events. This, despite modern innovations in diabetes care, including technology such as flash and continuous glucose monitoring (Reddy, *et al.* 2017). Hypoglycaemia is considered a life-limiting consequence of diabetes therapy (Ravnik-Oblak and Lainscak, 2016). It is reported to be experienced by an estimated 90% of patients with the condition (Shafiee, *et al.* 2012), in their pursuit of normal blood glucose levels (Briscoe and Davis, 2006) of between 4 mmol/l and 9 mmol/l (NICE, 2016a).

Patients with both type 1 and type 2 diabetes, LADA and MODY, who are dependent on an insulin therapy or sulphonylurea regimen are all at potential risk of hypoglycaemia (Goff and Dyson, 2016). A recent self-reported study found that the average number of episodes of hypoglycaemia experienced was 2.4 per week for people with T1DM and 0.8 for people with T2DM (Frier, *et al.* 2016). However, hypoglycaemia frequency may have been under-reported by study participants as a result of unawareness or a lack of a blood glucose test confirmation (NIDDK, 2017).

Global Hypoglycaemia Treatment Practice

At present, New Zealand, Canadian and American (Villani, *et al.* 2017) clinicians advocate the same hypoglycaemia treatment and process (McTavish, 2016) as the UK. Whilst in contrast (Villani, *et al.* 2017) to the UK's guidelines of 15g fast-acting carbohydrate treatment (DAFNE, 2011), Australian and European clinicians (McTavish, 2016) follow a rule of up to 30g to treat hypoglycaemia (Villani, *et al.* 2017). Research by Husband, *et al.*

(2010) found that over a span of 5 hypoglycaemic episodes, whereby glucose tablets (glucose), fruit juice (fructose) and Skittles (sucrose) were used comparatively as treatment. Sucrose and glucose were equally as effective, whilst fructose was least effective (Husband *et al.*, 2009) in a 15g quantity. However, limitations of this study were that it was only conducted in children with type 1 diabetes (Husband, *et al.* 2010). A more recent randomised control study also conducted in children, found that the use of sweets in hypoglycaemia treatment resulted in slower symptom alleviation and required repeat treatment in some cases (McTavish and Wiltshire, 2016). Such research highlights the potential for variation in treatment responses amongst patients, creating a challenge for healthcare professionals to recommend a single treatment source.

Fast-Acting Carbohydrate and Government Legislation

In April 2018 the UK government introduced a soft drinks industry levy on beverages with a total sugar content of more than 5 grams of added sugar per 100ml (HM Revenue and Customs, 2016; HM Treasury 2018). This could greatly impact the range of treatment options available to people with diabetes (Alicea and Poole, 2018) for hypoglycaemia management. Whilst recommendations on this should be provided by healthcare professionals at the point of diagnosis to patients (NICE 2016b), the rule of 15 may not be consistently conveyed or adhered to (Wild, *et al.* 2007). With some studies (Sommerfield, *et al.* 2003; Sumner, *et al.* 2000) on hypoglycaemia highlighting under-treatment in relation to appropriate quantity and type of treatment. Therefore, decreased carbohydrate content of beverage preparations could raise safety concerns for people with diabetes (Alicea and Poole, 2018).

Hypoglycaemia Treatment Patient Adherence

Research suggests that adherence by patients to hypoglycaemia treatment guidelines could also be influenced by a fear of hypoglycaemia (FoH). Wild *et al.* (2007) identified that development of this state was multifactorial, but frequently related to the length of time spent on insulin therapy. Alternative findings have proposed that patient education could reduce anxiety and improve disease management (UK Hypoglycaemia Study Group, 2007). Additional studies have shown that structured diabetes education on topics relating to hypoglycaemia management such as carbohydrate counting, food labelling and hypoglycaemia awareness can reduce incidences of emergency treatment by up to 64% (Wong, *et al.* 2015; Elliot, *et al.* 2014).

Previous and Future Research

Variability of hypoglycaemia treatment administered by both people with diabetes and their carers is yet to have been fully investigated (JDRF UK, 2017). Recent research highlights a need for the inclusion of patient reported outcomes (PRO) (Agiostatidou, *et al.* 2017), in the pursuit of clinically meaningful research in this area. This study of self-reported patient practices and behaviours around hypoglycaemia management investigated the potential relationship between adherence to the rule of 15 (Wiethrop and Cryer, 1993) and attendance of structured diabetes education courses. With the aim of identifying key differences and similarities in behaviour between groups. Previous research identified the role of structured diabetes education as instrumental in hypoglycaemia education and management (Choudhary, *et al.* 2015). This aimed to investigate hypoglycaemia and the awareness of people who regularly treat episodes, in addition to an investigation into contributing factors to their behaviour, including; gender, age, hba1c level, reasoning and

duration of diabetes diagnosis (Amiel, *et al.* 2008) with previous studies highlighting greater hypoglycaemia prevalence amongst females (Villani, *et al.* 2017; Kautzky-Willer, *et al.* 2015).

Methods

Study Design

The objectives of the study were to capture data from the diabetes community, through an online questionnaire of cross-sectional design. The study employed this design due to its ability to enable observation of the demographic (Mann, 2003), cost-effectiveness and time-efficient (Brewer, *et al.* 2018) methodology. Research was conducted in July 2017 and aimed to answer the question of adherence to the rule of 15 and the potential influence of structured diabetes education. The questionnaire was created using Qualtrics computer software and the questions were designed to gather qualitative information on attendance of structured diabetes education, awareness of the rule, adherence and reasoning behind behaviour. Quantitative questions were included on amounts of treatments used and estimated to be recommended to provide a standard with which to compare results (Wiethrop and Cryer, 1993).

The questions also sought feedback on the quantitative values associated with age, with much previous research focussed towards newborns, children, older adults or inpatient environment based hypoglycaemia treatment (Rozance and Hay, 2016; Sircar, *et al.* 2016). With the desired outcome that these questions would broadly depict the behaviours of the demographic, adding to the minimal current evidence base of what is known about compliance to the rule of 15. Furthermore, that the questions might highlight how compliance could otherwise be achieved or improved on, dependent on the outcomes.

Alternatively, data could have been captured by face-to-face research, which has been a popular method in qualitative research historically (Opdenakker, 2006). However, the online questionnaire enabled participant anonymity which was paramount to collecting

data that was as unbiased and without perceived judgement by participants as possible, to enable them to answer questions openly and honestly (Brewer, *et al.* 2018). Furthermore, face-to-face interviewing was likely to capture people who were most engaged and forthcoming in sharing information about their diabetes. However, the diabetes online community (DOC) is very active and with isolation and diabetes burnout key challenges of the disease, the chosen method had a greater chance of also capturing data from this particular demographic (Hilliard, *et al.* 2015). Interviews would also have been more time consuming and would have impacted the number of participants able to participate in the study (Brewer, *et al.* 2018).

The potential disadvantages of the online questionnaire style of research are that there is a possible opportunity for dishonesty, as answers are self-reported. However, research suggests that appropriate phrasing is paramount in tackling this, by providing participants opportunity to answer openly, as opposed to asking leading questions they observe to have a right answer (Chesney and Penny, 2013; Brenner and DeLamater, 2016). A consideration of the study design, was the careful wording of the questions, so as to minimise this possibility. Such as in the case of asking participants to estimate UK recommended guidelines for hypoglycaemia treatment, without providing a prescriptive answer. However, a potential disadvantage of the questionnaire being online only, was that it could dissuade older generations from participating or those without access or knowledge of the internet (Kwak and Radler, 2002).

Participants

Research participants were derived from opportunistic sampling of author friends and family, with inclusion criteria that they were known to have diabetes themselves, or to act as a parent, carer or guardian of a person with the condition. Previous studies in diabetes

research have often separated these demographics. However, in paediatric care, diabetes burden falls to parents (Markowitz, *et al.* 2012) who are heavily involved in diabetes management and in the case of adults with complications who require additional care (Jowel, *et al.* 2015). Relevant features possessed by participants were that they had experienced or assisted in treating hypoglycaemia before, so as to be able to answer questions on treatment preparations and behaviours with first-hand experience, which adds authenticity and meaning (Hulland, *et al.* 2018) to the research (Baldie, *et al.* 2018).

Exclusion criteria was that participants were aged over 18 years with no children completing the questionnaire. Not all participants needed to have attended structured diabetes education previously, however it was important that some of the participants had, in order to reflect both groups and to enable comparison. Previous research has often focussed on comparing treatments (Diabetes UK, 2018a), diet (Sato, *et al.* 2017) or hba1c outcomes post-education (Cooke, *et al.* 2013) therefore this research aimed to add to the existing evidence on the influence of structured diabetes education on these variables. There were no limitations considered to be associated with the participation criteria. Ethics for this study were approved by Cardiff Metropolitan University School of Health Sciences ethics panel prior to data collection (reference 9244), as evidenced in Appendix 1.

Procedure

Prior to the completion of the online questionnaire, the 60 participants were provided with an online information document evidenced in Appendix 2, detailing the background of the study and burden of their participation. Participants were informed within the document that completing the questionnaire would act as their consent to participate, but that prior to completion they could withdraw at any time. They were subsequently sent a link to

complete the anonymous online questionnaire found in Appendix 3, that was hosted on the Qualtrics survey platform. This contained 20 questions relating to their compliance and behaviours regarding the rule of 15 (Wiethop and Cryer, 1993). Each question had to be completed before participants could move onto the next, additional comments were optional. Upon participant completion and submission of the questionnaire, data was captured within the software and compiled as both unidentifiable individual responses and compiled responses represented as single questions that could then be analysed. The questionnaires took a mean time of 10 minutes for the participants to complete, confirming the advantages of this method for a fast turnaround for results and its benefits over slower methods such as postal surveys (Kwak and Radler, 2002).

Participants successfully completed a range of questions on age, gender, relationship with diabetes, treatment and duration of diabetes diagnosis. On questions 12 and 13 regarding blood glucose testing frequency and 15 minute wait-time respectively, the chosen wording could have been clearer. If the questionnaire was to be repeated, the available answers would be quantified by, for example, asking what percentage of times blood glucose is tested. Alternatively, the use of a Likert scale of 0-10 (Ary, *et al.* 2017) would have better enabled quantitative comparison. Question 17 observed some participant responses that they were unsure if they had received structured diabetes education. Therefore, the terminology of structured diabetes education could have been simplified or better explained, as attendance of a series of lessons on diabetes, delivered by the dietitian or diabetes specialist nurse (DSN) in a group or one-to-one environment.

Materials

A pilot study was conducted prior to the dissemination of this study, also through the use of an online questionnaire. This was disseminated to 5 people with diabetes or carers of

those with the condition and feedback was received. Feedback identified that whilst the questions were appropriate for the demographic (Sinkowitz-Cochran, 2013), they needed to be re-ordered to make the questionnaire more fluid and user friendly. The newly edited format was applied to the actual study questionnaire and successfully completed by the 60 participants with no incomplete questionnaires. Results from the pilot study were not included within the current study.

Data Analysis

Qualitative data was analysed using thematic analysis of key themes relating to the rule of 15 and structured diabetes education including; hypoglycaemia treatment choices, attendance on structured diabetes education and awareness of the rule of 15. This method enabled grouping and identification of themes, trends and potential relationships between variables. Theme counts, frequency and percentages were utilised to analyse data captured, to enable comparison between demographics, such as those who did and did not attend structured education. Quantitative data was analysed using Microsoft Excel for Mac 2011 version 14.5.7, to obtain descriptive data including; mean, median, range, standard deviation and frequency values of variables to compare results such as amount of carbohydrate used to treat hypoglycaemia and estimations of UK guidelines. Use of the Statal Package for Social Sciences (SPSS) version 25 and a corresponding code book evidenced in Appendix 4, enabled a tailored approach to inferentially analyse the results of the study, as evidenced in Appendix 5.

Results

Table 1. Study Participant Age and Gender Distribution

Total participants	100% (n=60)
18-25 years	22% (n=13)
26-35 years	28% (n=17)
36-45 years	20% (n=12)
46-55 years	15% (n=9)
56-65 years	15% (n=9)

Of the 70 participants invited to complete the questionnaire, of this the response rate was 86% (n=60). Table 1 identifies that the mean age of participants was 26-35 years (n=17).

Table 2. Study Participant Gender and Diabetes Type

		T1DM	T2DM	MODY	LADA	Carer	Total
Gender	Male	65% (n=18)	4% (n=1)	4% (n=1)	0% (n=0)	29% (n=8)	47% (n=28)
	Female	47%(n=15)	3% (n=1)	0% (n=0)	6% (n=2)	44% (n=14)	53% (n=32)
Total		55% (n=33)	3% (n=2)	1.5% (n=1)	3% (n=2)	37% (n=22)	100% (n=60)

Table 2 highlights that T1DM was most prevalent amongst male (n=18) and female (n=15) participants. Carers of people with T1DM diabetes (n=22) were more likely to be female (n=14) than male (n=8), which was not statistically significant (chi-squared, p=0.324, t=4.663, df=4) and men and women represented similar numbers of participation overall.

Table 3. Study Participant Diabetes Type and Treatment

Diabetes Type	Diabetes Treatment				Total
	Insulin only	Tablets only	Insulin and tablets	Diet and exercise	
T1DM	(n=33)	(n=0)	(n=0)	(n=0)	(n=33)
T2DM	(n=1)	(n=0)	(n=0)	(n=1)	(n=2)
MODY	(n=0)	(n=1)	(n=0)	(n=0)	(n=1)
LADA	(n=2)	(n=0)	(n=0)	(n=0)	(n=2)
Carer	(n=22)	(n=0)	(n=0)	(n=0)	(n=22)
Total	97% (n=58)	1.5% (n=1)	0% (n=0)	1.5% (n=1)	(n=60)

Table 3 identifies insulin therapy as the most frequently used diabetes treatment (n=58). The relationship between diabetes type and treatment was statistically significant (chi-squared, p=0.001, t=89.483, df=8). People with different types of diabetes were equally likely to attend structured diabetes education (Chi-squared, p= 0.297, t=9.564, df=8), which was not statistically significant.

Figure 1. Mean and Standard Deviation Values of Participant Hba1c Results

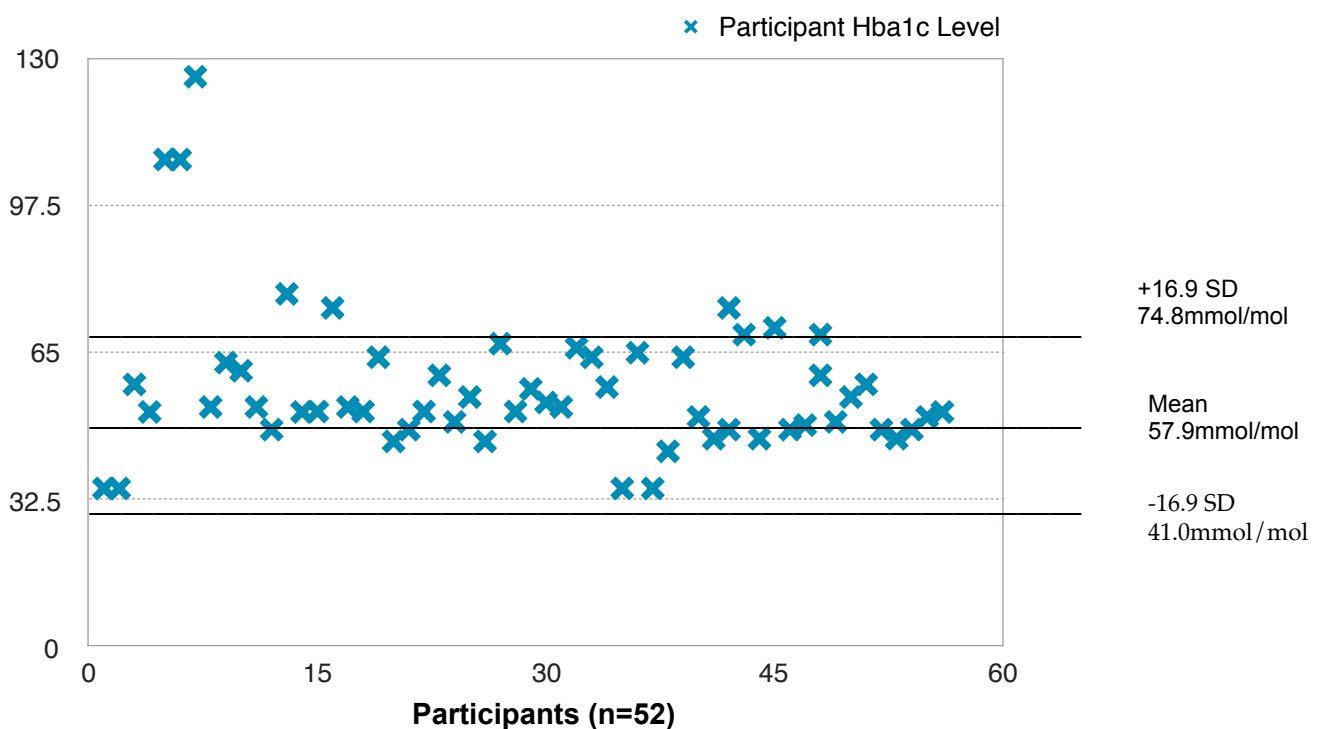


Figure 1 shows mean hba1c levels of participants were 57.9mmol/mol (7.5%), the range was 35mmol/mol-107.7mmol/mol (5.4% - 12.0%), which was statistically significant (One-sample t-test, $t=-26.713$, $df=59$, $p=0.001$) in relation to the recommended guideline of 48mmol/mol (6.5%) (NICE 2016b; NICE 2016c).

Table 4. Comparison of Hba1c Levels and Attendance on a Structured Diabetes Education Course

Total Gender of Participants (n=60)	Females (n=32)		Males (n=28)	
	Hba1c level and Course Attendance Response 92% (n=55)			
	Females (n=30)		Males (n=25)	
Structured Diabetes Education Course Attendance	Attendance 50% (n= 15)	Non Attendance 50% (n=15)	Attendance 52% (n=13)	Non Attendance 48% (n=12)
In range ≤ 48 mmol/mol	20% (n=6)	23% (n=7)	16% (n=4)	8%(n=2)
Above range >48 mmol/mol	30% (n=9)	27% (n=8)	36% (n=9)	40% (n=10)
Unsure of hba1c or course attendance response	(n=2)		(n=3)	

Men and women were both likely to attend structured diabetes education (Chi-squared $p=0.520$, $t=1.307$, $df=2$) and attendance appeared not to influence hba1c, as shown in Table 4, Spearman's coefficient ($+0.016$, $p= 0.904$) was not statistically significant but showed a small positive correlation whereby when hba1c result increases, so does quantity of carbohydrate used to treat hypoglycaemia.

Table 5. Structured Education and Duration of Diagnosis with Diabetes

Duration of Time with Diabetes (n=60)	Attendance on Structured Education Course (n=28)	Non-Attendance on Structured Education Course (n=32)	Unsure of Attendance (n=1)
0-1 years (n=0)	0% (n=0)	0% (n=0)	0% (n=0)
1-5 years (n=17)	24% (n=4)	70% (n=12)	6% (n=1)
6-15 years (n=23)	57% (n=13)	23% (n=10)	0% (n=0)
16-30 years (n=15)	40% (n=6)	60% (n=9)	0% (n=0)
30 years+ (n=5)	80% (n=4)	20% (n=1)	0% (n=0)

Table 5 highlights that participants with living with diabetes 6-15 years (n=23) were most likely to attend a structured education course, with a direct relationship between increased diagnosis time and increasing participant number attendance, with the exception of people with diabetes for 16-30 years. People with diabetes for 1-5 years were least likely to attend a course (n=12).

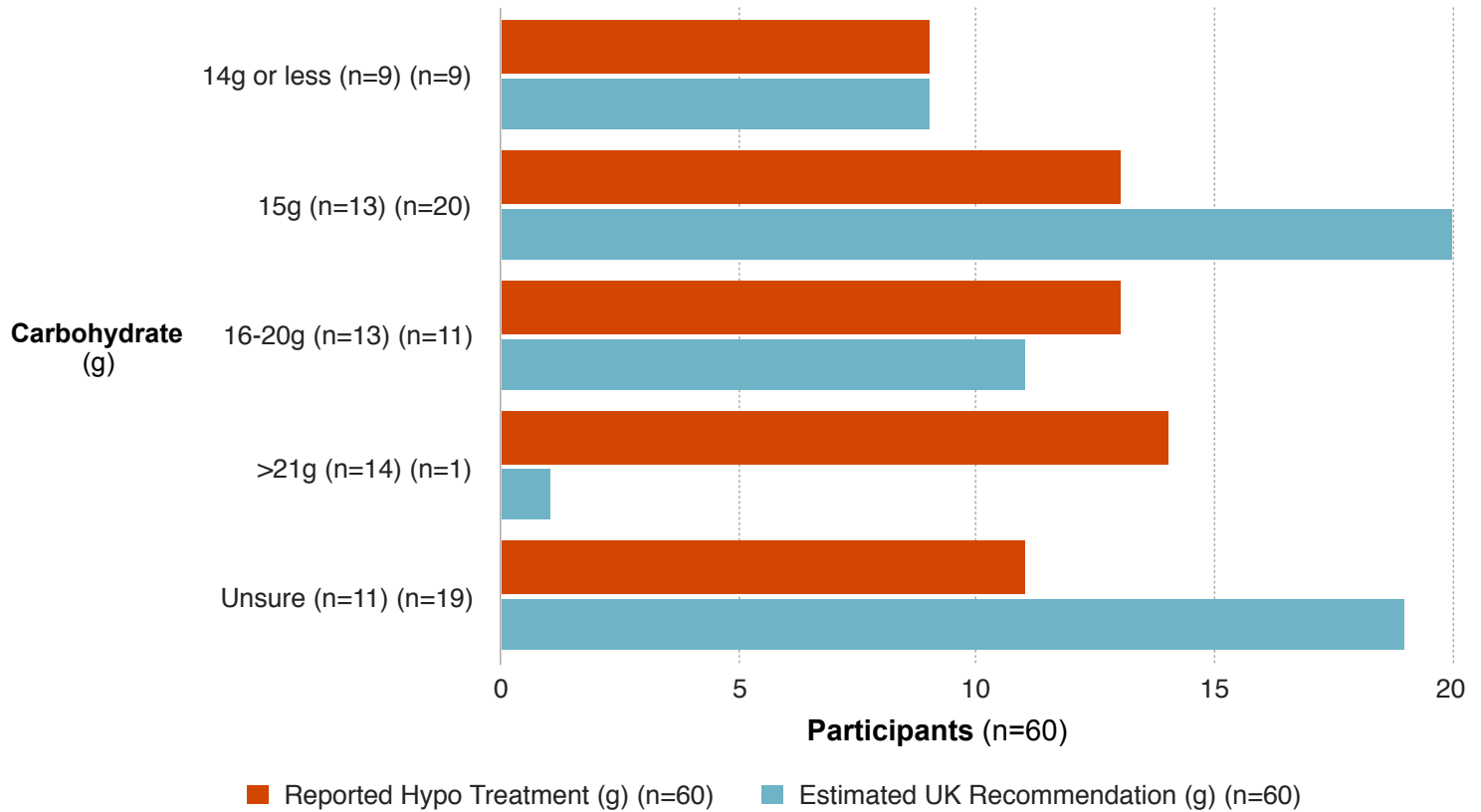


Table 6. Duration of Diabetes and Hypoglycaemia Frequency

Diabetes Duration (n=60)	Mean Hypoglycaemia Frequency	Mean Hypoglycaemia Treatment	Range	Treatment preference	Treatment Selection Reasoning
< 1 year 0% (n=0)	0% (n=0)	0% (n=0)	0% (n=0)	0% (n=0)	0% (n=0)
1-5 years 28% (n=17)	Once daily to 1-3 weekly (n= 15)	20g (n=17)	10-75g = 65g range (n=17)	Lucozade (n=4) Jelly babies/haribo (n =4)	Symptom Severity (n=6)
6-15 years 38% (n=23)	1-3 weekly (n=10)	21g (n=17) Unsure (n=6)	15g-40g = 25g range (n=17)	Jelly babies/haribo (n=8)	Symptom Severity (n=8)
16-30 years 25% (n=15)	3+ weekly (n=6)	21g (n=11) Unsure (n=4)	9g-35g = 26g range (n=11)	Lucozade (n=5)	Medical Recommendation (n=4)
>30 years 8% (n=5)	1-3 weekly (n=2)	20g (n=4) Unsure (n=1)	15-30g = 15g range (n=4)	Jelly babies/haribo (n=2) Fruit (n=2)	Experience, symptom severity, Medical Recommendation, trial and error, habit (n=1)

Table 6 shows greater incidence of hypoglycaemia amongst those who have been diagnosed 1-5 years and the range of carbohydrate quantities used in treatment. Results further show an indirect relationship of decreased hypoglycaemia episodes with increasing time since diagnosis. Spearman's correlation coefficient (-0.058, p=0.685) showed a large negative correlation, which whilst not statistically significant, reflects the indirect relationship of increasing time since diagnosis and decreasing carbohydrate quantity.

Figure 2. A Comparison of Participant Hypoglycaemia Treatment Quantity and their Estimation of UK Recommendations



Comparatively, the relationship between treatment and recommendations was statistically significant (Mann-Whitney, $p=0.001$). Figure 2 also shows that participant treatment overall, was higher than the standard (Wiethop and Cryer, 1993) with the majority of participants using >21g of carbohydrate ($n=14$). Whilst 15g was identified correctly by the most participants ($n=20$) as the UK recommendation value (One-way sample t-test, $t=-87.878$, $df=59$, $p=0.001$) which was statistically significant.

The mean hypoglycaemia treatment used was 20g (One-way sample t-test, $t=-66.126$, $df=59$, $p=0.001$) which was statistically significant in comparison to the standard of 15g (Wiethop and Cryer, 1993), median 17.5g, standard deviation 11.4g and range 7g-75g.

The mean estimated recommendation was 15.5g, median 15g, standard deviation 3.9g and range 4-30g (One-way sample t-test, $t=87.878$, $df=2.42$, $p=0.001$), which also showed statistical significance in relation to UK recommendations of 15g (Wiethop and Cryer, 1993).

Table 7. Type of Hypoglycaemia Treatment and Amount of Carbohydrate Used

Carbohydrate Source	Glycaemic Index (GI)	Participants (n=59)	Mean Amount Used (g)	Unknown Carbohydrate Quantity (g)	Carbohydrate Range (g)
Sweets (Haribo and Jelly babies)	GI = 65	(n= 17)	18g	(n=5)	11g (10.5g-21g)
Lucozade Full Sugar Fizzy Pop	GI = 95 GI = 59	(n=15)	24g	(n=3)	35g (15g-50g)
Glucose Tablets	GI = 100	(n=10)	20g	N/A	21g (9g-30g)
Glucose Gel/ Glucose Juice	GI = 103	(n=5)	17g	(n=1)	5g (15g-20g)
Orange Juice	GI = 50	(n=5)	32g	(n=1)	65g (10g-75g)
Fruit (dates)	GI = 42	(n=2)	15g	(n=1)	N/A
Chocolate	GI = 40	(n=2)	25g	N/A	N/A
Marshmallows	GI = 65	(n=1)	15g	N/A	N/A
Biscuits	GI = 59	(n=1)	7g	N/A	N/A
Anything	N/A	(n=1)	10g	N/A	N/A

(Glycaemic Index Values Adapted from Harvard Medical School, 2018)

Table 7 reports that sweets were the most frequently used carbohydrate source (n=17) by both men and women (Chi-squared, $p=0.564$, $t=7.708$, $df=9$), marshmallows and biscuits were the least (n=1). Participants who used orange juice (32g) consumed the most

carbohydrate and biscuits least (7g). Those who treated hypoglycaemia with dates and marshmallows used the recommended 15g amount (Wiethrop and Cryer, 1993). People who used sweets were least likely to know the value of carbohydrate being used (n=5).

Table 8. A Comparison of Hypoglycaemia Treatment Outcomes Between Attendees and Non-Attendees on Structured Diabetes Education Courses

Attendance	Awareness of Rule of 15 (Wiethrop and Cryer, 1993)	Hypoglycaemia Treatment (g)	Hypoglycaemia Recommendations (g)	Appropriate Treatment Identification (15g)
Attended Structured Diabetes Education 48% (n=29)	Aware= 44% (n=15)	Mean= 21g SD= 7.6g Median= 20g Range= 10g-40g	Mean= 17g SD= 4.2g Median= 15g Range= 12g-30g	15g Treatment Use = 14% (n=4) UK recommendations = 31% (n= 9)
	Unaware= 38% (n=10)			
	Unsure= 12% (n=4)			
Did Not Attend 50% (n=30)	Aware= 37% (n=11)	Mean= 20g SD= 14g Median= 15g Range= 9g-75g	Mean= 15g SD= 3.3g Median= 15g Range= 4-20g	15g Treatment Use = 27% (n=10) UK recommendations = 47% (n= 14)
	Unaware= 40% (n=12)			
	Unsure= 23% (n=7)			
Unsure of Attendance 2% (n=1)	Unaware= 100% (n=1)	15g (n=1) SD =0g	10g SD= 0g	15g Treatment Use = (n=1) UK recommendations = (n= 0)

Table 8 highlights that a similar amount of study participants attended (n=29) as did not attend (n=30) a structured diabetes education course. Awareness of the rule of 15 was greater amongst course attendees (n=15), with non-attendees most unaware (n=12) or unsure (n=7) of the rule, which was not statistically significant (chi-squared, p=0.516, t=3.527, df=4). Mean hypoglycaemia treatments were higher amongst attendees (21g) and contrastingly closer to recommendations amongst those who had not attended (20g).

Those who had not attended also made more accurate judgements on the UK recommendations (NICE, 2016a).

Table 9. Compliance with the Rule of 15 Amongst Structured Education Attendees and Non-Attendees

Attendees	Always	Sometimes	Never
Participants (n=30)	43% (n=13)	50% (n=15)	7% (n=2)
Mean Treatment (g)	15g	21g	28g
Carbohydrate Range (g)	10g-35g	15g-35g	15g-40g
Adherence to 15 minute wait	(n=13)	(n=15)	(n=2)
Non Attendees	Always	Sometimes	Never
Participants (n=30)	60% (n=18)	33% (n=10)	7% (n=2)
Mean Treatment (g)	24g	14g	13g
Carbohydrate Range (g)	12g-75g	7g-20g	10g-15g
Adherence to 15 minute wait	(n=18)	(n=10)	(n=2)

Participants who responded that they always complied with the rule of 15 (n=13), were comparatively more likely to use the recommended amount of carbohydrate for hypoglycaemia treatment. Those who never complied used a mean carbohydrate of 28g as shown in Table 9. Participants who had not attended structured diabetes education frequently answered that they always followed the rule of 15 (n=18). However, their mean carbohydrate treatment was higher than those who sometimes or never followed the rule, as was their range. This did not have statistical significance (chi-squared, $p=0.359$, $t=10.977$ and $df= 10$). Participants who did not attend structured education were most likely to consistently wait 15 minutes and re-test their blood glucose levels (n=18).

Table 10. Carbohydrate Counting Diabetes Management Resources

Diabetes Resources	Primary Use Selection	Secondary Use Selection	Tertiary Use Selection	Quaternary Use Selection
Mobile Applications	51% (n=30)	0% (n=0)	0% (n=0)	0% (n=0)
Carbs and Cals Books	33% (n=19)	57% (n=16)	0% (n=0)	0% (n=0)
Dietitian	0% (n=0)	7% (n=2)	0% (n=0)	0% (n=0)
Diabetes Clinic Resources	2% (n=1)	11% (n=3)	20% (n=2)	0% (n=0)
Online/ Social Media	10% (n=6)	18% (n=5)	70% (n=7)	25% (n=1)
Diabetes Charities	2% (n=1)	3.5% (n=1)	10% (n=1)	50% (n=2)
Food Labels	2% (n=1)	3.5% (n=1)	0% (n=0)	25% (n=1)

Table 10 shows mobile applications (n=30) were the most popular resource used by both male and female participants, which was not statistically significant (chi-squared, p=0.335, t=9.086 and df=8). Carbs and Cals books (n=16) were second, followed by online/ social media (n=70). People with T1DM were most likely to use apps, whilst those with T2DM preferred apps and Carbs and Cals books (Chi-squared, p=0.335, t=9.086 and df=8) which was not statistically significant.

Discussion

The aim of this research was to investigate the compliance of people with diabetes and their carers with the rule of 15 in hypoglycaemia treatment (Wiethrop and Cryer, 1993) in relation to amount and type of treatment used, with finger-prick blood glucose testing followed by 15 minute test confirmation. It aimed to compare the behaviours of people who had and had not attended a structured diabetes education course, to identify if there was a connection between compliance and attendance. Limitations of the study were that it did not identify if cost was a factor in hypoglycaemia treatment, neither did it ascertain the carbohydrate counting capabilities of individuals when providing their treatment amounts for the study. This could be improved upon in future, by asking individuals to identify the carbohydrate value of a given food or drink featured within a questionnaire to ascertain knowledge and accuracy of carbohydrate counting.

Study participants were not typical of the UK diabetes population, as they represented 92% of people or carers of those with T1DM (n=55), subsequently it was statistically significant that 97% (n=58) were on insulin (chi-squared, $p=0.297$, $t=9.564$, $df=8$). The demographic makeup was in contrast to the wider population, which comprises 90% people with T2DM (Diabetes UK, 2016). However, literature suggests that people with T1DM represent those at greatest risk of hypoglycaemia (Frier, *et al.* 2016) and therefore, study findings provide an additional perspective to current research.

This was further reinforced by people with all types of diabetes were represented in the study, including the rarer forms of MODY and LADA, adding to the meaningful outcomes of the study. The majority of participants had an hba1c result greater than the target range of 48 mmol/mol or 6.5% (n=36) (NICE 2016b; NICE 2016c). The mean hba1c value was

7.5% (57.9 mmol/mol) (One-sample t-test, $t=-26.713$, $df=59$, $p=0.001$), which was statistically significant. In relation to recommendations this may be indicative of the change in hba1c parameters in 2015 (NICE, 2015) from 7% to 6.5% and the arguable achievability of the guideline.

All participants ($n=60$) reported having previously experienced hypoglycaemia, a finding which is in contrast to the literature, that suggests only 90% experience such events (Shafiee, *et al.* 2012; Elwin, *et al.* 2015). Overall, mean hypoglycaemia treatment was 20g, which was statistically significant (One-way sample t-test, $t=-66.126$, $df=59$, $p=0.001$), as was the mean 15.5g estimated UK recommendation (One-way sample t-test, $t=87.878$, $df=2.42$, $p=0.001$) in relation to the 15g standard (Wiethrop and Cryer, 1993). Participant ability to identify the standard was also statistically significant (One-way sample t-test, $t=-87.878$, $df=59$, $p=0.001$). Cumulatively this suggests participants are aware, but do not consistently comply with recommended standards. Research by Frier, *et al.* (2016) identified that mean hypoglycaemia frequency was 2.4 episodes/ week amongst T1DM patients and 0.8 episodes/ week for T2DM. However, findings from this research revealed greater prevalence, with mean episodes reported as 1-3 times/ week ($n=19$) and 3+ times/ week ($n=16$) (Spearman's correlation coefficient, -0.058 , $p=0.685$). Higher frequency shows the scale hypoglycaemic events and underpins the requirement for accurate and efficacious hypoglycaemia treatment and education.

Sweets were identified as the most commonly used hypoglycaemia treatment ($n=17$) amongst men and women (Chi-squared, $p=0.564$, $t=7.708$, $df=9$), which negates a relationship between gender and treatment option. Furthermore, this reflects previous research findings suggesting that treatments containing glucose and sucrose were deemed most efficacious (Husband, *et al.* 2009). Lucozade might have been expected to

be the most popular preparation (Alicea and Poole, 2018), however, this was the second most frequently used (n=15), which may be indicative of the recent reformulation of the product (Alicea and Poole, 2018). In contrast to research suggesting the associated slow blood glucose rise rate of fructose containing treatment, orange juice and dates (n=7) were used (Husband, *et al.* 2009) by participants. However, people who used orange juice were most likely to over treat hypoglycaemia than in comparison to all other preparations, with one participant using 75g of carbohydrate, 60g over recommendations (Wiethrop and Cryer, 1993). Evidence underpinned by the comparatively lower GI values of these carbohydrate preparations (Harvard Medical School, 2018).

Study participants reflected both those who had and had not attended structured diabetes education. Men and women were equally as likely to attend a course (p= 0.520), hba1c values were comparably similar in relation to NICE guidelines (NICE 2016b; NICE 2016c), suggesting attendance did not directly positively impact long-term blood glucose levels. Attendance in relation to diagnosis time with diabetes contradicted the guidelines advising it be offered to the newly diagnosed (NICE, 2015), as people diagnosed 1-5 years (n=12), were least likely to attend, with those with diabetes 6-15 years (n=23) most likely to attend. Further research being this occurrence could look at geographical availability and attitudes of newly diagnosed patients.

People who attended structured diabetes education were more aware (n=15) of the rule of 15 (Wiethrop and Cryer, 1993) than those who did not (n=11) (chi-squared, p=0.516, t=3.527, df=4). However, treated hypoglycaemia with a greater mean value of 21g than non-attendees 20g, but the range was 9g-75g, suggesting treatment was greatly variable. Contrastingly, non-attendees were more aware of UK recommendation for hypoglycaemia, identifying the mean suggestion of 15g correctly (n=14) and more people amongst this

demographic actually used 15g as a treatment (n=10). This could suggest that awareness of the rule 15 is not exclusive to those who attend structured education. Alternatively, it could indicate that whilst people who did attend were aware of the rule and the additional skills on carbohydrate counting they have acquired led to increased confidence and freedom with diabetes and nutritional management (Mansell, 2012). This hypothesis correlates with the result that mobile applications (n=30) were the most frequently used diabetes resources, which by nature can be utilised and accessed anywhere.

The comparative results of reported hypoglycaemia treatments and estimated recommendations showed incidences of under-treatment of <15g of carbohydrate (n=9) and corresponding estimations of the same value estimation (n=9). More participants knew the amount of carbohydrate to use as a recommendation (n=20) than who reported using it (n=13). This highlights juxtaposition between theory and practice because whilst the recommendation suggests 15g (Wiethrop and Cryer, 1993), there are variables which impact the alleviation of symptoms, such as glycemic index of the preparation used (Harvard Medical School, 2018). Furthermore, results showed participants were more likely to over-treat hypoglycaemia than under-treat, which could be attributable to fear as identified in Appendix 4, contribute to the mean overall hba1c of participants of 58mmol/mol (7.5%), 7mmol/mol (1%) higher than recommendations. A future follow-up study could be utilised to ascertain if participants developed complications as a result of higher hypoglycaemia treatments and hba1c levels, due to the additional risk of rebound hyperglycaemia from such over-treatment (Goff and Dyson, 2016).

Compliance with the rule of 15 also requires blood glucose test confirmation, waiting 15 minutes and retesting (Wiethrop and Cryer, 1993). Participants who did not attend structured education were most likely to conduct an initial confirmation blood glucose test

and used more carbohydrate to treat the episode. Whilst attendees tested less, but were more controlled in the quantity of carbohydrate they used (chi-squared, $p=0.359$, $t=10.977$ and $df=10$). Across both demographics there was a trend of higher carbohydrate values amongst those who tested and less amongst those who did not, suggesting caution despite non-compliance with testing. Non-attendees were also most likely to wait 15 minutes and retest their glucose levels, suggesting that awareness and education from an alternative source to the course, such as a diabetes specialist ($n=39$) as was reported in the study concerning information sources, evidenced in Appendix 6.

This is significant because the International Diabetes Federation (IDF) (2011) report their findings that hypoglycaemia treatment is often founded on their clinical judgement and subsequently influences patient decisions. Such correlation between study findings and the report highlight a requirement for a consistent multi-disciplinary (MDT) approach to hypoglycaemia information. This could identify an opportunity for members of the MDT to receive structured diabetes education on nutrition to achieve this, which holds potential for further research on how patient hypoglycaemia might change if regularly followed-up by consistent professional input on the rule of 15.

In conclusion, people who attended structured diabetes education were more likely than those who did not, to be aware of the rule of 15. Whilst mean amount of carbohydrate treatment used was similar between demographics, the range of preparations used is greater amongst non-attendees, suggesting a requirement for education to promote consistency amongst patients. Non-attendees were more aware of UK recommendations for hypoglycaemia treatment and more likely to follow the rule of 15 consistently.

Structured diabetes education did not appear to impact hba1c results, however, attendees

were more influenced by fear, symptom severity and potentially sense of freedom which could account for higher blood glucose levels from rebound hyperglycaemia episodes.

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Appendices



Appendix 1

Ethical Approval Letter



Thursday, 29 June 2017

cshs/ethics /approved

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

Dear Applicant

Re: Application for Ethical Approval: The rule of 15 in the treatment of hypoglycaemia: Are people adhering to this and does structured diabetes education make a difference?

Project Reference Number : 9244

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

[Redacted signature]

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 : [Redacted]

Cc: [Redacted]

PLEASE RETAIN THIS LETTER FOR REFERENCE

Appendix 2

Participant Information Sheet

Project Title: The Rule of 15 in the Treatment of Hypoglycaemia: Are people adhering to this and does structured education make a difference?

Participant Information Sheet for People with Diabetes, Spouses, Carers and Guardians

Background

Hypoglycaemia is a serious medical condition caused by too little glucose in the blood. Individuals with diabetes who take certain medications can be at risk and need to understand the correct treatment of hypoglycaemia.

This research will explore participant's treatment of hypoglycaemia, and whether structured diabetes education aimed at people with diabetes has an impact on knowledge and adherence to guidelines for treatment.

- This is an invitation for you to join the study and to let you know what it would involve. The study is being undertaken by a final year BSc(Hons) Human Nutrition and Dietetics student Melanie Gray, at Cardiff Metropolitan University, under the supervision of Vicky Gould of Cardiff Metropolitan University.

Your participation in the research project

Why you have been asked?

You have been invited to take part in this research project because you have diabetes yourself, are a carer, guardian or spouse of a person with diabetes.

What would happen if you agree to participate in the research project?

If you agree to join the study you will be asked to complete a short online questionnaire, by following a link on this information sheet. The questionnaire should take 10-15minutes to complete. All questionnaires remain anonymous.

What happens if you want to change your mind?

If you decide that you do not want to complete the questionnaire you can stop at any time by simply not submitting your questionnaire. By completing the questionnaire it is assumed that you give your consent to participate in the study.

Are there any risks?

We do not think there are any significant risks if you take part in the study.

What happens to the results of the questionnaire?

Melanie Gray is responsible for putting all the information from the study into a computer programme. We will then look to see if people are adhering to the correct treatment for hypoglycemia and whether access to structured diabetes education makes a difference to this.

Are there any benefits from taking part?

Yes, you will receive an information leaflet on hypoglycaemia for yourself as a person with diabetes or the carer, guardian or spouse of a person with the condition. There is no cost to you for this.

What happens next?

If you consent to being involved in this research study, please respond to the invitation email and you will be sent a link to complete the questionnaire.

How is your privacy protected?

All the information we get from you is strictly confidential and everyone working on the study will protect your privacy. All questionnaires are anonymous and we will not require your name or any personal details from you. There is no information on the questionnaire that could let anyone work out who you are.

At the end of the evaluation study we will destroy the information we gathered

Further information

If you have any questions about the research or how we intend to conduct the study, please contact us.



Appendix 3

Sample - Participant Administered Questionnaire

Please answer each question below;

1. What is your relationship with diabetes?

- I have type 1 diabetes
- I have type 2 diabetes
- I have MODY (maturity onset of diabetes in the young)
- I am a carer or guardian for a person with diabetes

Other.....

2. How do you, or the person you care for with diabetes treat the condition? (*Please indicate all that apply*)

- Insulin (pump or injections)
- Tablets (which increase insulin activity)
- Insulin and tablets
- Diet and exercise only

Other.....

3. How long have you/ the person you care for, had diabetes?

Please indicate in years and months below;

.....yearsmonths

4. What was your last hba1c result ?

Please indicate if answer given is in % or mmol/l

5. Have you, or the person you care for, ever experienced hypoglycaemia (defined as a blood glucose level of 4.0mmol or below)?

Yes

No

If YES, how frequently do you, or the person you care for with diabetes, experience hypoglycaemia?

- Less than 1 per week
- 1-5 per week
- 7 per week (daily)
- More than 1 per day

6. What is your preferred initial hypoglycaemia treatment? (Choose ONE option)

- Glucose tablets
- Lucozade energy
- Full sugar fizzy pop
- Orange juice
- Jelly babies
- Chocolate

Other.....

7. How many total grams of carbohydrate, do you use to treat one episode of hypoglycaemia?

Please comment.....g

8. How much do you think the recommended amount of carbohydrate to treat hypoglycaemia is in accordance with UK guidelines?

Please comment.....g

9. Do you test your blood glucose levels before treating hypoglycaemia, to confirm that you are hypoglycaemic?

- Always
- Mostly, but not always
- Sometimes
- Rarely
- Never



10. What is the amount of carbohydrate you consume to treat hypoglycaemia primarily based on?

Please comment.....

11. From whom did you first learn about how much carbohydrate to use to treat hypoglycaemia?

Specialist healthcare professional (Consultant, diabetes nurse)

GP

Dietitian

A friend or relative with diabetes

A diabetes website

Social media

A diabetes charity

12. Was the rule of 15 mentioned to you by this person?

Yes

Maybe, I cannot remember

No

13. Have you ever attended a carbohydrate counting structured education course? (E.g- DAFNE, DESMOND, XPERT, or structured education with the dietitian etc.)

Yes, please state which course you attended

No, please indicate why not

14. Do you read the label when deciding on a food or drink to use to treat hypoglycaemia?

Yes, I read the label and **do** understand the information on carbohydrate and sugar content

Yes, I read the label, but **do not** understand the information on carbohydrate and sugar content

I sometimes read the label

No, I do not read the label

No, please state reason for not reading the label

15. Do you use any resources to help you find out the carbohydrate content of food and drink?

Yes

No



If yes, please indicate which you use most frequently (Choose ONE option);

Apps

Carbs and Cals books

I ask the dietitian

Resources from the specialist diabetes clinic

The internet

Posts on social media

Other.....

16. When did you last visit the dietitian? (Please indicate in days, weeks, months or years OR note NEVER if applicable)

.....



Appendix 4

Statistical Package for Social Sciences (SPSS) Code Book

Variable name in full	Variable name, shortened for SPSS	Coding instructions	Type of data
Q1. Gender	Gender	1= male, 2 = female, 3= Prefer not to say	Nominal
Q2. Age	Age	1=18-25 years, 2= 26-35 years, 3=36-45 years, 4= 46-55 years, 5= 56-65 years, 6=66+ years	Scale
Q3. Diabetes Type	D_type	1- type 1 diabetes, 2= type 2 diabetes, 3= MODY, 4= LADA, 5= carer/ parents	Nominal
Q4. Therapy	Trtmnt	1= Insulin only, 2= Tablets only, 3= Insulin and tablets, 4= diet and exercise only	Nominal
Q5. Diabetes years	Dx_yrs	1= <1 year, 2= 1-5 years, 3= 6-15 years, 4= 16-30 years, 5= >30 years	Scale
Q6. Last hba1c	Hba1c	1= Not sure, 2= less than or equal to 6.5%, 3= 6.6-7.4%, 4= 7.5%+ (mmol)	Scale
Q7. Hypoglycaemia experienced	Hypo_exp	1= Yes, 2=No, 3= Unsure	Ordinal
Q8. Hypo frequency	Hypo_freq	1= One daily, 2= 2+ daily, 3= 1-3 weekly, 4= 3+ weekly, 5= 1-3 monthly, 6= 3+ month, 7= None	Ordinal
Q9. Initial hypo treatment	Initial_t	1= Glucose tablets, 2= Lucozade energy, 3= fizzy drink, 4=Glucose shots/gels, 5= Jelly babies/ sweets, 6= Orange juice, 7=Chocolate/ marshmallows, 8= Biscuits, 9= dates, 10= Anything	Nominal
Q10. Treatment (grams)	HypoT_g	1= Don't know, 2=< 15g, 3= 15g, 4= 16-30g, 5= 31g-40g, 6= 41g-50g, 7= 51-60g, 8= 61g-70g, 9= >71g	Scale
Q11. UK recommendations	UK_recs	1= Don't know, 2=< 15g, 3= 15g, 4= 16-30g, 5= 31g-40g, 6= 41g-50g, 7= 51-60g, 8= 61g-70g, 9= >71g	Scale
Q12. BG test before	Pre_BG	1= Yes always, 2= Mostly, 3= Half the time, 4= Sometimes, 5= Never	Ordinal
Q13. 15 minute wait	Wait_15	1= Yes always, 2= 15 mins+, 3= Sometimes, 4= Do not test, 5= Definitely not	Ordinal
Q14. CHO basis	CHO_base	1= Hunger, 2= Fear, 3= Guess work, 4= Medical advice, 5= Symptom severity, 6=Habit, 7= Trial and error, 8= Experience, 9= CGM, 10= BG levels,	Nominal

Q15. Hypo education	Hypo_edu	1= Diabetes specialist, 2= GP, 3=Dietitian, 4= Friend/relative, 5= Diabetes charity, 6= Social media/ Online, 7= Trial and error, 8= DAFNE, 00= blank	Nominal
Q16. Rule of 15 awareness	Aware15	1= Yes, 2= No, 3= Unsure	Ordinal
Q17. Structured edu. attendance	Edu_Atnd	1= Yes, 2= No, 3= Unsure	Ordinal
Q18. Food label read	F_label	1= Yes, I understand, 2= Read but not understood, 3= Sometimes, 4= No	Ordinal
Q19. Most used resources	Resource	1= Yes, 2= No	Ordinal

Gender	Age	D_type	Trtmnt	Dx_yrs	Hba1c	Hypo_exp	Hypo_freq	Initial_t	HypoT_g
2	4	5	1	3	1	1	2	2	3
2	3	4	1	2	2	1	2	6	2
1	4	5	1	2	2	1	5	6	8
1	2	5	1	2	4	1	3	1	2
2	1	1	1	3	3	1	2	4	3
2	1	1	1	2	4	1	1	2	2
1	1	5	1	2	4	1	1	2	2
2	5	2	1	3	4	1	3	5	1
1	5	5	1	3	3	1	4	4	1
2	3	5	1	2	4	1	4	4	2
1	3	1	1	4	4	1	4	3	5
2	4	5	1	4	4	1	3	1	2
2	3	1	1	4	2	1	3	1	2
2	2	5	1	2	4	1	1	5	3
2	4	5	1	3	3	1	2	4	4
2	3	5	1	2	3	1	2	4	4
1	5	5	1	4	1	1	4	2	1
2	1	1	1	3	4	1	4	5	3
2	1	1	1	3	3	1	2	2	5
1	3	1	1	5	3	1	4	9	3

2	2	1	1	3	4	1	3	6	4
1	2	1	1	2	2	1	1	5	4
2	3	5	1	5	1	1	5	9	1
2	2	5	1	2	2	1	2	2	5
1	4	1	1	3	3	1	4	2	3
2	3	5	1	3	4	1	1	5	3
2	5	1	1	5	3	1	2	5	3
2	1	5	1	3	3	1	4	5	1
1	5	1	1	5	2	1	3	5	4
2	1	5	1	2	4	1	4	5	4
2	3	1	1	5	4	1	3	1	4
2	5	5	1	3	1	1	4	5	4
1	3	5	1	3	3	1	4	5	4
1	2	5	1	2	4	1	4	5	3
2	2	5	1	2	3	1	3	2	3
1	1	3	2	4	4	1	5	1	4
2	4	1	1	4	4	1	5	7	4
2	5	5	1	4	3	1	4	2	1
1	4	1	1	3	2	1	3	2	4
1	1	1	1	3	4	1	3	5	1
1	4	2	4	2	2	1	6	4	3

1	3	1	1	2	2	1	3	6	4
1	1	1	1	2	4	1	3	8	2
2	2	1	1	3	3	1	2	1	4
1	2	1	1	4	2	1	6	1	4
1	3	1	1	4	2	1	1	10	2
2	2	1	1	4	4	1	6	5	4
2	2	1	1	3	4	1	3	7	3
1	5	1	1	4	2	1	4	5	1
1	5	1	1	4	4	1	5	6	4
2	1	4	1	2	2	1	4	5	2
1	1	1	1	3	3	1	3	2	5
1	2	1	1	3	4	1	3	7	4
1	5	5	1	3	4	1	3	6	1
1	2	1	1	3	3	1	1	1	4
1	2	1	1	3	1	1	3	1	4
1	1	1	1	3	3	1	3	3	4
2	2	1	1	4	4	1	3	2	3
2	4	1	1	3	1	1	6	5	1

UK_recs	Pre_BG	Wait_15	CHO_base	Hypo_edu	Aware15	Edu_Atnd	F_label	Resource	Which_Re
3	2	1	5	1	1	2	1	1	1
3	2	5	10	6	1	2	1	1	1
1	1	1	5	6	2	2	1	1	5
2	2	1	4	3	1	1	1	1	2
1	1	4	1	1	2	1	1	1	1
2	1	1	5	1	2	1	1	1	2
1	1	1	5	1	1	2	1	1	2
1	1	1	3	1	3	1	4	1	2
1	2	1	5	1	2	1	1	1	1
3	1	1	4	1	2	2	1	1	1
1	2	3	4	7	1	1	1	1	1
4	1	3	5	1	1	2	1	1	1
3	2	3	6	1	1	2	1	1	7
1	1	1	4	1	3	2	1	1	2
3	1	1	4	1	2	1	1	1	1
3	2	3	9	8	3	2	1	1	1
1	1	3	5	3	3	2	3	1	2
3	2	3	4	1	1	2	1	1	1
3	2	5	4	4	1	1	1	1	1
4	3	3	7	7	1	1	3	1	1

4	1	1	4	1	1	1	4	1	2
3	1	3	5	1	3	1	3	1	1
1	1	1	6	4	2	2	4	2	6
1	1	1	7	1	2	2	1	2	2
3	2	3	5	1	1	1	1	1	1
3	1	1	5	1	3	2	3	1	2
3	2	3	4	1	1	1	1	1	2
1	2	3	7	1	2	1	1	2	5
4	2	3	8	8	2	1	1	1	2
4	1	1	4	1	1	2	1	1	2
3	2	3	5	1	1	1	4	1	1
4	2	3	6	1	1	1	1	1	2
3	1	1	5	1	3	2	1	1	2
2	1	1	2	1	2	3	4	1	1
1	1	1	2	1	2	2	1	1	1
1	1	1	3	6	2	2	3	2	5
3	1	2	4	1	2	2	1	1	2
1	1	1	4	1	1	1	1	1	1
3	1	3	3	1	2	2	1	1	1
1	2	3	6	1	3	2	3	1	1
3	3	1	6	4	1	2	4	1	1

3	2	1	5	4	1	1	1	1	1
2	2	3	5	3	2	2	4	1	1
3	1	3	4	1	3	1	1	1	2
2	2	1	4	1	1	1	1	1	1
2	2	3	7	6	2	2	3	2	9
4	1	1	4	1	1	1	1	1	2
3	2	3	5	1	2	1	1	1	5
1	1	1	7	6	2	2	4	2	5
4	3	3	6	3	2	1	3	1	1
3	1	3	6	7	2	2	1	1	2
4	2	1	5	1	2	1	1	1	1
3	2	3	1	1	1	1	1	1	2
1	3	3	8	1	3	1	4	2	4
4	1	1	10	3	1	2	1	1	1
1	2	3	4	1	2	1	1	1	1
3	2	3	5	1	1	2	1	1	1
3	1	1	8	9	1	2	1	1	8
1	1	1	5	1	3	2	3	2	10

Appendix 5

Inferential Tests

Variable 1		Variable 2		Appropriate Inferential Test
Name	Type of Data	Name	Type of Data	
Gender	Nominal	D-type	Nominal	Chi-squared
D-type	Nominal	Trtmnt	Nominal	Chi-squared
HypoT_g	Scale	15g Standard	-	One-way sample t-test
UK_recs	Scale	15g Standard	-	One-way sample t-test
HypoT_g	Scale	UK_recs	Scale	Mann-Whitney
Aware15	Ordinal	Edu_Atnd	Ordinal	Chi-squared
Gender	Nominal	Which_Re	Nominal	Chi-squared
Which_Re	Nominal	D-type	Nominal	Chi-squared
Hba1c	Scale	6.5% standard	-	One-way sample t-test
Dx_yrs	Scale	HypoT_g	Scale	Spearmans
HypoT_g	Scale	Gender	Nominal	Chi-squared
Gender	Nominal	Edu_Atnd	Ordinal	Chi-squared
HypoT_g	Scale	Edu_Atnd	Ordinal	Chi-squared

Appendix 6

Additional Results

Table 12. Hypoglycaemia Experience

Experience of an Episode of Hypoglycaemia	
Yes	100% (n=60)
No	0% (n=0)

All participants had experienced or observed an episode of hypoglycaemia (n=60), as shown in Table 12.

Figure 3. Distribution of Participant Hypoglycaemia Treatments

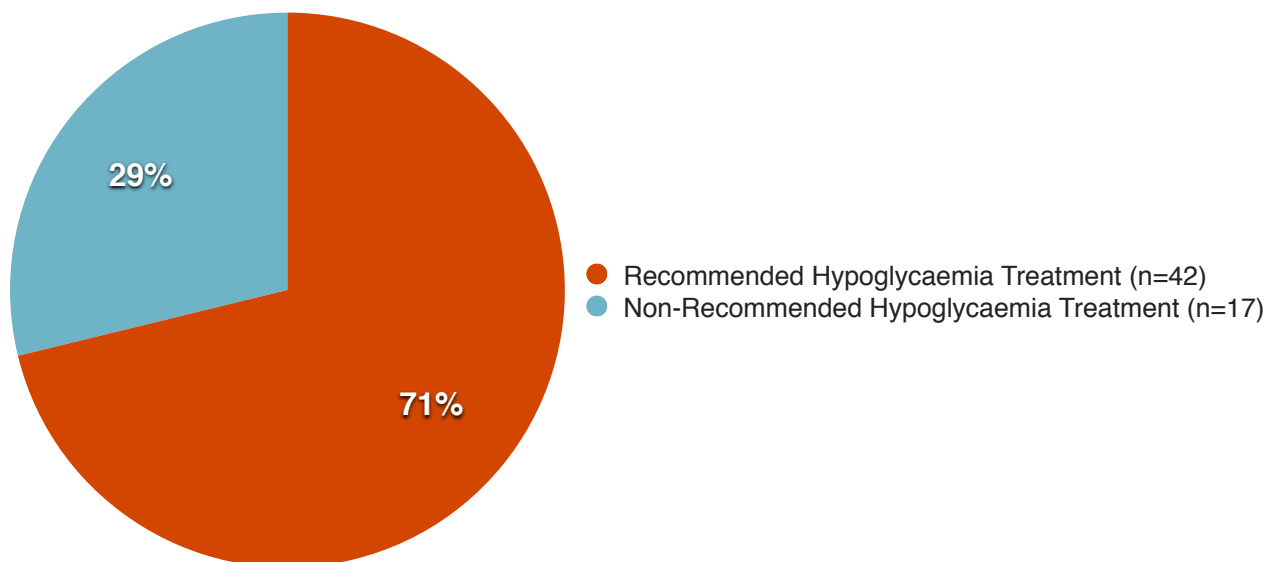


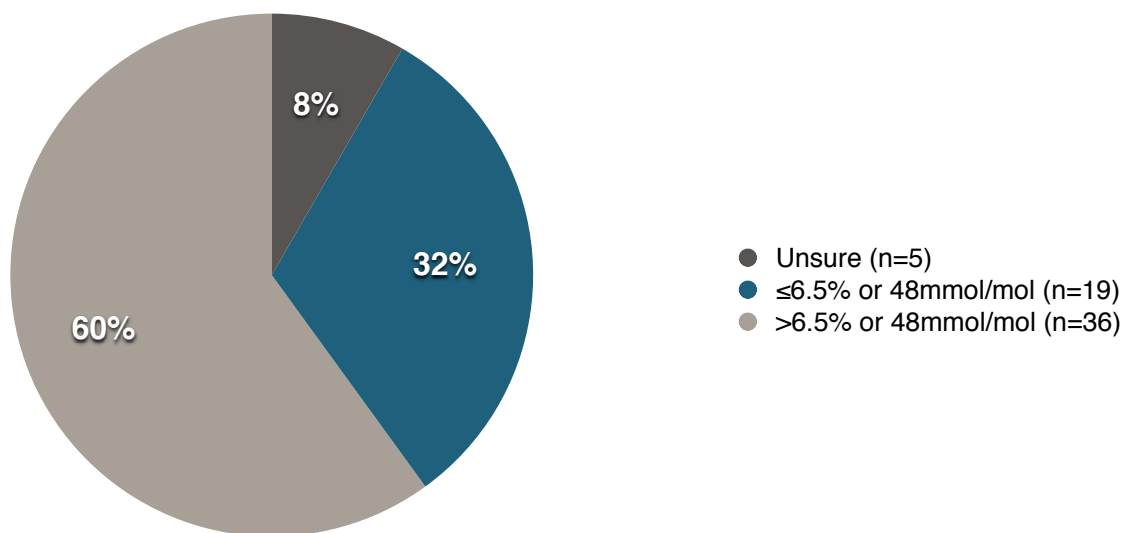
Figure 3 shows that of the responses (n=59), 71% of participants reported using an appropriately recommended source of fast-acting glucose (Jelly babies/ sweets n=17, fizzy sugary drinks n=15, glucose tablets n=9). 29% reported using a non-recommended initial treatment (orange juice n=6, sports gel n=4, chocolate n=2, fruit n=2, marshmallows n=1, biscuits n=1 and anything to hand n=1) (Diabetes UK, 2018b).

Table 13. Duration of Time with Diabetes Diagnosis

Duration of Diagnosis	Number of Respondents
<1 year	0% (n=0)
1-5 years	28.3% (n=17)
6-15 years	38.3% (n=23)
16-30 years	25.0% (n=15)
30+ years	8.3% (n=5)

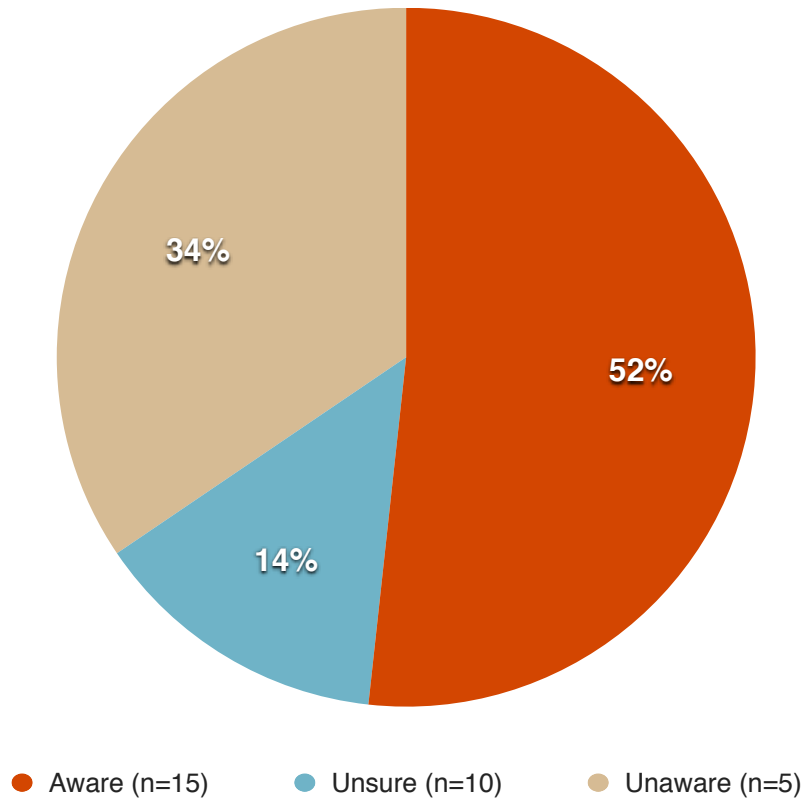
Table 13 identifies that participants with diabetes for 6-15 years were most represented and that there were no responses from newly diagnosed patients.

Figure 4. Distribution of Participant Hba1c Results with Reference to Clinical Guidelines



The majority of participants had an hba1c result greater than the target range of 48 mmol/mol or 6.5% (n=36) as shown in Figure 1 (NICE 2016b; NICE 2016c). The mean hba1c value was 7.5% (57.9 mmol/mol), the range was 5.4%-13.7% (35mmol/mol - 126mmol/mol) and standard deviation 2.5% (16.9 mmol/mol).

Figure 5. Awareness of the rule of 15 amongst structured education attendees



Course attendees were more aware of the rule of 15 in Figure 5, than non course attendees in Figure 6.

Figure 6. Awareness of the rule of 15 amongst structured education non-attendees

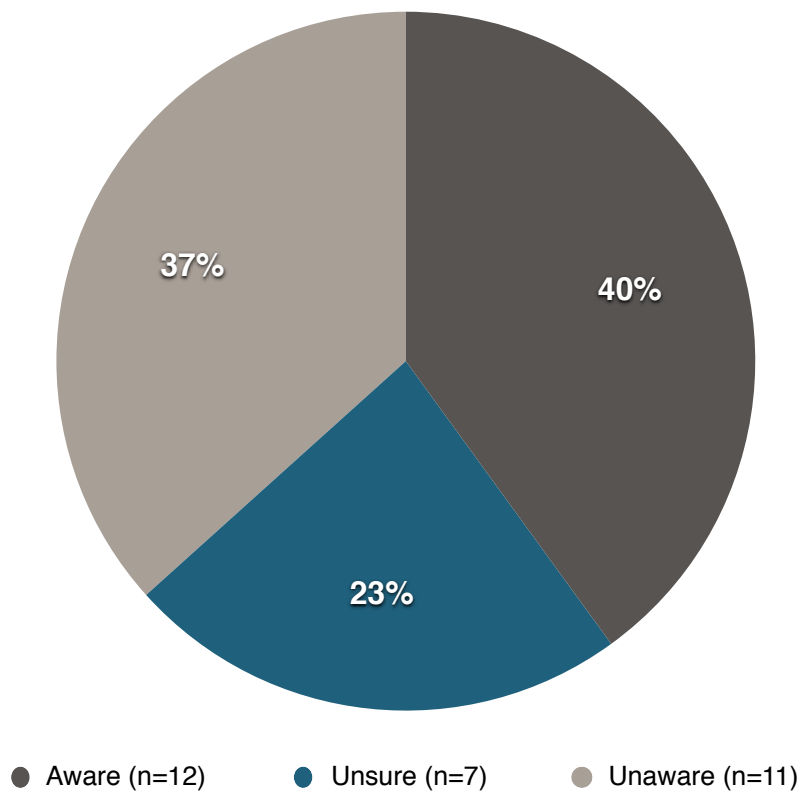


Figure 7. Sources of Hypoglycaemia Treatment Information

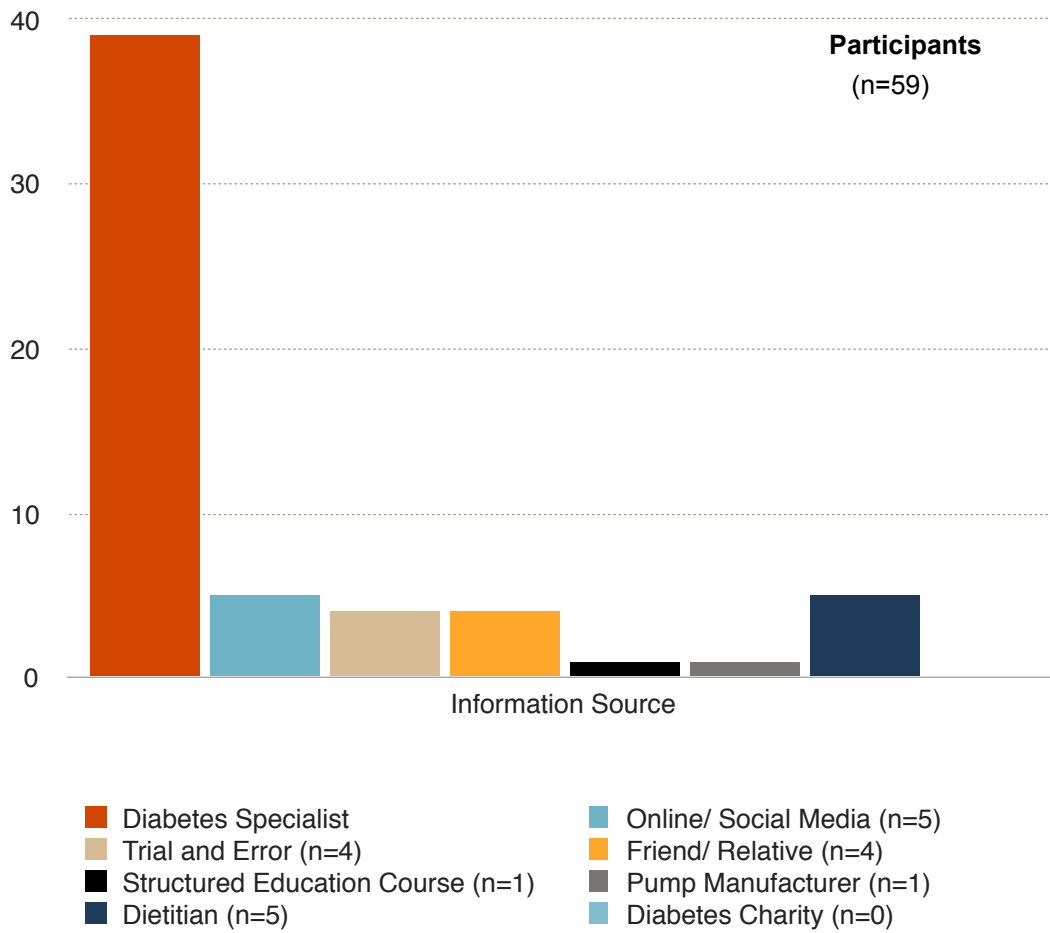


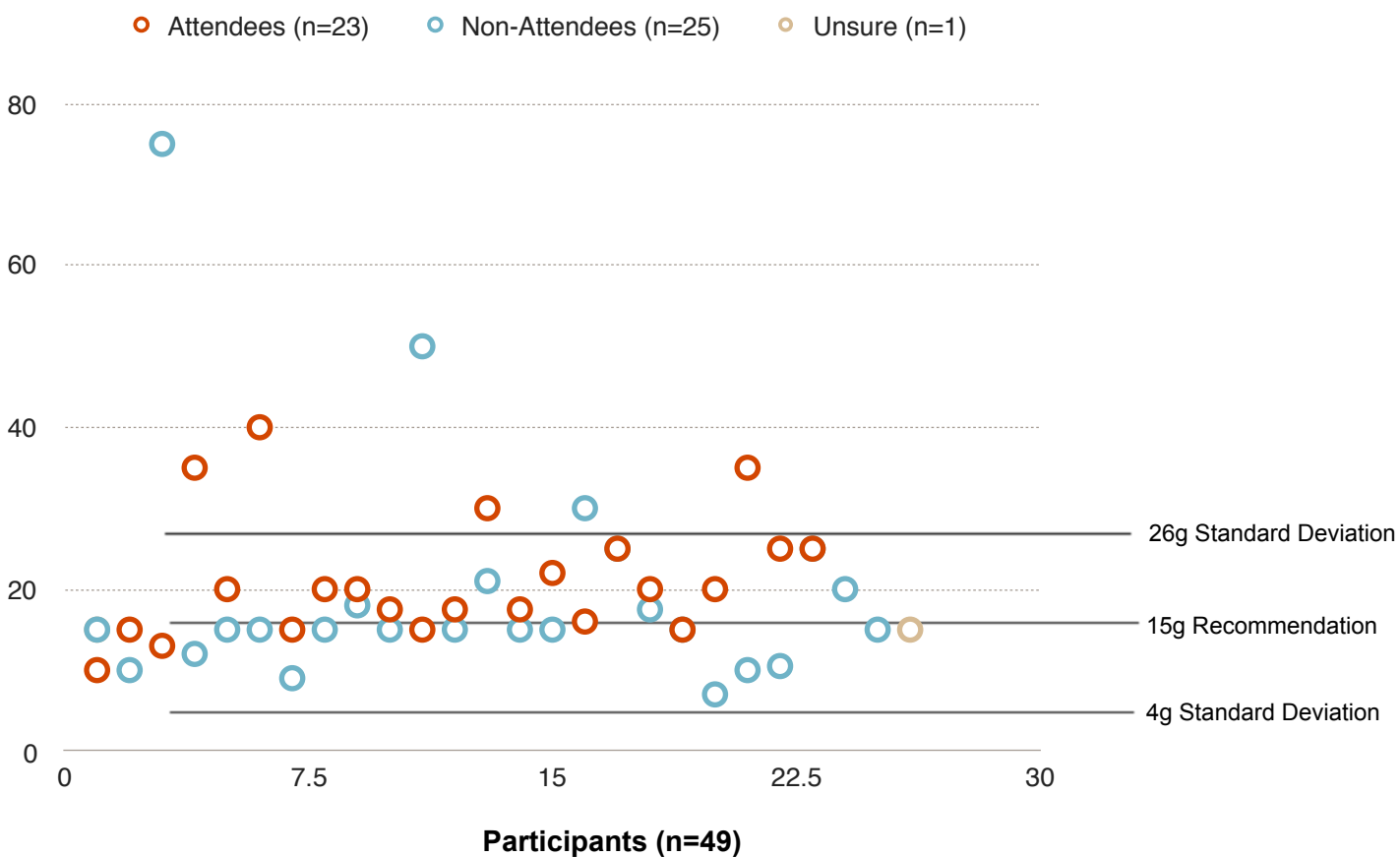
Figure 7 shows that the diabetes specialist is overwhelmingly the primary source of diabetes education.

Table 14. Hypoglycaemia Frequency

Frequency of Hypoglycaemia	All participants - 100% (n=60)
of which; No episodes of hypoglycaemia	0% (n=0)
Once Daily	12% (n=7)
2+ Daily	15% (n=9)
1-3 weekly	32% (n=19)
3+ weekly	27% (n=16)
1-3 monthly	8% (n=5)
3+ per month	7% (n=4)

100% of respondents had experienced a hypo within a 3 monthly period, whilst the majority experienced them between 1-3 times per week, as shown in Table 14.

Figure 8. Mean Hypoglycaemia Treatment of Participants who Have and Have Not Attended Structured Diabetes Education



Non-course attendees were more likely to use hypoglycaemia treatments outside of the recommended range.

Appendix 7

Raw Data Summary



Q2	Q3	Q1	Q1_6_TEXT	Q4	Q4_5_TEXT	Q5
Q1. What is y	Q2. Which a	Q3. What is y	Q3. What is y	Q4. Which di	Q4. Which di	Q5. How mar
{"ImportId":	{"ImportId":	{"ImportId":	{"ImportId":	{"ImportId":	{"ImportId":	{"ImportId":
Female	46-55 years	I am a Carer/ Guardian/ S	Insulin only			6-15 years
Female	36-45 years	I have LADA (latent autoir	Insulin only			1-5 years
Male	46-55 years	I am a Carer/ Guardian/ S	Insulin only			1-5 years
Male	26-35 years	I am a Carer/ Guardian/ S	Insulin only			1-5 years
Female	18-25 years	I have type 1 diabetes	Insulin only			6-15 years
Female	18-25 years	I have type 1 diabetes	Insulin only			1-5 years
Male	18-25 years	I am a Carer/ Guardian/ S	Insulin only			1-5 years
Female	56-65 years	I have type 2 diabetes	Insulin and tablets			6-15 years
Male	56-65 years	Other (pleas	Parent of	Insulin only		6-15 years
Female	36-45 years	I am a Carer/ Guardian/ S	Insulin only			1-5 years
Male	36-45 years	I have type 1 diabetes	Insulin only			16-30 years
Female	46-55 years	I am a Carer/ Guardian/ S	Insulin only			16-30 years
Female	36-45 years	I have type 1 diabetes	Insulin only			16-30 years
Female	26-35 years	I am a Carer/ Guardian/ S	Insulin only			1-5 years
Female	46-55 years	I am a Carer/ Guardian/ S	Insulin only			6-15 years
Female	36-45 years	I am a Carer/ Guardian/ S	Insulin only			1-5 years
Male	56-65 years	Other (pleas	Parent	Insulin only		16-30 years
Female	18-25 years	I have type 1 diabetes	Insulin only			6-15 years
Female	18-25 years	I have type 1 diabetes	Insulin only			6-15 years
Male	36-45 years	I have type 1 diabetes	Insulin only			30+ years
Female	26-35 years	I have type 1 diabetes	Insulin only			6-15 years
Male	26-35 years	I have type 1 diabetes	Insulin only			1-5 years
Female	36-45 years	I am a Carer/ Guardian/ S	Insulin only			30+ years
Female	26-35 years	I am a Carer/ Guardian/ S	Insulin only			1-5 years
Male	46-55 years	I have type 1 diabetes	Insulin only			16-30 years
Female	36-45 years	I am a Carer/ Guardian/ S	Insulin only			6-15 years
Female	56-65 years	I have type 1 diabetes	Insulin only			30+ years
Female	18-25 years	I am a Carer/ Guardian/ S	Insulin and tablets			6-15 years
Male	56-65 years	I have type 1 diabetes	Insulin only			30+ years
Female	18-25 years	I am a Carer/ Guardian/ S	Insulin only			1-5 years
Female	36-45 years	I have type 1 diabetes	Insulin only			30+ years
Female	56-65 years	I am a Carer/ Guardian/ S	Insulin only			6-15 years
Male	36-45 years	I am a Carer/ Guardian/ S	Insulin only			6-15 years
Male	26-35 years	I am a Carer/ Guardian/ S	Insulin only			1-5 years
Female	26-35 years	I am a Carer/ Guardian/ S	Insulin only			1-5 years
Male	26-35 years	I have MODY (maturity on	Tablets only			16-30 years
Female	46-55 years	I have type 1 diabetes	Insulin only			16-30 years
Female	56-65 years	I am a Carer/ Guardian/ S	Insulin only			16-30 years
Male	46-55 years	I have type 1 diabetes	Insulin only			6-15 years
Male	18-25 years	I have type 1 diabetes	Insulin only			6-15 years
Male	46-55 years	I have type 2 diabetes	Diet and exercise only			1-5 years
Male	36-45 years	I have type 1 diabetes	Insulin only			1-5 years
Male	18-25 years	I have type 1 diabetes	Insulin only			1-5 years

Female	26-35 years	I have type 1 diabetes	Insulin only	6-15 years
Male	26-35 years	I have type 1 diabetes	Insulin only	16-30 years
Male	36-45 years	I have type 1 diabetes	Insulin only	16-30 years
Female	26-35 years	I have type 1 diabetes	Insulin only	16-30 years
Female	26-35 years	I have type 1 diabetes	Insulin only	6-15 years
Male	56-65 years	I have type 1 diabetes	Insulin only	16-30 years
Male	26-35 years	I have type 1 diabetes	Insulin only	16-30 years
Female	18-25 years	I have LADA (latent autoim	Insulin only	1-5 years
Male	18-25 years	I have type 1 diabetes	Insulin only	6-15 years
Male	26-35 years	I have type 1 diabetes	Insulin only	6-15 years
Male	56-65 years	Other (please My son has t	Insulin only	6-15 years
Male	26-35 years	I have type 1 diabetes	Insulin only	6-15 years
Male	26-35 years	I have type 1 diabetes	Insulin only	6-15 years
Male	18-25 years	I have type 1 diabetes	Insulin only	6-15 years
Female	26-35 years	I have type 1 diabetes	Insulin only	16-30 years
Female	46-55 years	I have type 1 diabetes	Insulin only	6-15 years
Female	18-25 years	I have type 1 diabetes	Insulin only	16-30 years

Q6	Q7	Q8	Q9	Q9_7_TEXT	Q10	Q10_1_TEXT
Q6. What wa	Q7. Have yo	Q8. How ma	Q9. What is y	Q9. What is y	Q10. How m	Q10. How m
{"ImportId":	{"ImportId":	{"ImportId":	{"ImportId":	{"ImportId":	{"ImportId":	{"ImportId":
Don't know	Yes	2+ daily	Lucozade energy (non-red	Please comr		15
5.4% (pregna	Yes	2+ daily	Orange juice	Please comr		10
5.4	Yes	1-3 monthly	Orange juice	Please comr	50-100	
58	Yes	1-3 weekly	Glucose tablets (E.g- Dextr	Please comr	10g	
6.9mmol	Yes	2+ daily	Other (pleas	GSF syrup	Please comr	15
12 mmol	Yes	Once daily	Lucozade energy (non-red	Please comr		13
12mmol	Yes	Once daily	Lucozade energy (non-red	Please comr		12
126	Yes	1-3 weekly	Jelly babies	I do not know		
7	Yes	3+ weekly	Other (pleas	glucogel	I do not know	
7.90%	Yes	3+ weekly	Other (pleas	Gluc juice	Please comr	15
77%	Yes	3+ weekly	Full sugar fizzy drink (E.g-	Please comr		35
7%	Yes	1-3 weekly	Glucose tablets (E.g- Dextr	Please comr		Oct-15
6.50%	Yes	1-3 weekly	Glucose tablets (E.g- Dextr	Please comr	9g	
78mmol	Yes	Once daily	Jelly babies	Please comr	15g	
6.9	Yes	2+ daily	Other (pleas	Gluck gel	Please comr	20
52	Yes	2+ daily	Other (pleas	Gluc juice	Please comr	18
n/a	Yes	3+ weekly	Lucozade energy (non-red	I do not know		
9.5 mmol	Yes	3+ weekly	Other (pleas	Haribos	Please comr	15
7.00%	Yes	2+ daily	Lucozade energy (non-red	Please comr	~40	
6.90%	Yes	3+ weekly	Other (pleas	Medjool Dat	Please comr	15g
8	Yes	1-3 weekly	Orange juice	Please comr	20g	
6.30%	Yes	Once daily	Jelly babies	Please comr		20
Unknown	Yes	1-3 monthly	Other (pleas	Dates	I do not know	
48%	Yes	2+ daily	Lucozade energy (non-red	Please comr	50g	
52mmol/mol	Yes	3+ weekly	Other (pleas	Lucozade if a	Please comr	15-20
60	Yes	Once daily	Jelly babies	Please comr		15
6.70%	Yes	2+ daily	Jelly babies	Please comr	15g	
7.2	Yes	3+ weekly	Other (pleas	haribo sweet	I do not know	
6.3	Yes	1-3 weekly	Jelly babies	Please comr	15 to 21	
67	Yes	3+ weekly	Jelly babies	Please comr		21
6.9	Yes	1-3 weekly	Glucose tablets (E.g- Dextr	Please comr		30
Don't know	Yes	3+ weekly	Jelly babies	Please comr	15-20	
57	Yes	3+ weekly	Jelly babies	Please comr		15
54	Yes	3+ weekly	Other (pleas	Haribos	Please comr	15g
53	Yes	1-3 weekly	Lucozade energy (non-red	Please comr		15
8.2	Yes	1-3 monthly	Glucose tablets (E.g- Dextr	Please comr		30
8%	Yes	1-3 monthly	Chocolate	Please comr		25
7.4	Yes	3+ weekly	Lucozade energy (non-red	I do not know		
5.4mmol/L	Yes	1-3 weekly	Lucozade energy (non-red	Please comr	15-20grams	
65	Yes	1-3 weekly	Other (pleas	Haribo Tangf	I do not know	
35	Yes	3+ month	Other (pleas	Sports gel	Please comr	15
6.10%	Yes	1-3 weekly	Orange juice	Please comr		22
64%	Yes	1-3 weekly	Other (pleas	Biscuits	Please comr	7

6.8mmol	Yes	2+ daily	Glucose tablets (E.g- Dextr Please comrr 16g	
6.4	Yes	3+ month	Glucose tablets (E.g- Dextr Please comrr	25
6.5	Yes	Once daily	Other (pleasε Anything tha Please comrr	10-Dec
9%	Yes	3+ month	Jelly babies	Please comrr 20
69	Yes	1-3 weekly	Other (pleasε marshmallow Please comrr 15g	
46	Yes	3+ weekly	Jelly babies	I do not know
8.6	Yes	1-3 monthly	Orange juice	Please comrr 20
48 mmol	Yes	3+ weekly	Jelly babies	Please comrr 10.5
49mmol/l	Yes	1-3 weekly	Lucozade energy (non-red Please comrr	35
7.6	Yes	1-3 weekly	Chocolate	Please comrr 25
8.5	Yes	1-3 weekly	Other (pleasε Varies, juice, I do not know	
6,7	Yes	Once daily	Glucose tablets (E.g- Dextr Please comrr	25
N/A	Yes	1-3 weekly	Glucose tablets (E.g- Dextr Please comrr	25
7.2	Yes	1-3 weekly	Full sugar fizzy drink (E.g- ε Please comrr	20
58	Yes	1-3 weekly	Lucozade energy (non-red Please comrr	15
Not to sure	Yes	3+ month	Jelly babies	I do not know
48mmol	Yes	3+ weekly	Lucozade energy (non-red I do not know	

Q21	Q21_1_TEXT	Q12	Q13	Q14	Q14_8_TEXT	Q15
Q11. How many times per week do you exercise?	Q11. How many times per week do you exercise?	Q12. Do you have any symptoms of hypoglycemia?	Q13. Do you have any symptoms of hypoglycemia?	Q14. What is your primary source of information about diabetes?	Q14. What is your primary source of information about diabetes?	Q15. Where do you get your diabetes supplies?
Please comment	15	Mostly, but rarely	Yes, always	Very	Symptom severity	Diabetes specialist
Please comment	15	Mostly, but rarely	Definitely not	Other (please specify)	Working out	Social media
		Yes, always	Yes, always	Very	Symptom severity	Social media
Please comment 10-15g	10-15g	Mostly, but rarely	Yes, always	Very	Medical recommendation	Dietitian
		Yes, always	I do not test	Hunger		Diabetes specialist
Please comment	13	Yes, always	Yes, always	Very	Symptom severity	Diabetes specialist
		Yes, always	Yes, always	Very	Symptom severity	Diabetes specialist
		Yes, always	Yes, always	Very	Other (please specify)	I don't know
		Mostly, but rarely	Yes, always	Very	Symptom severity	Diabetes specialist
Please comment	15	Yes, always	Yes, always	Very	Medical recommendation	Diabetes specialist
Please comment Varies	Varies	Mostly, but rarely	I sometimes	Other (please specify)	Use a weight scale	Other (please specify)
Please comment Oct-20	Oct-20	Yes, always	I sometimes	Symptom severity		Diabetes specialist
Please comment 15g	15g	Mostly, but rarely	I sometimes	Habit		Other (please specify)
		Yes, always	Yes, always	Very	Medical recommendation	Diabetes specialist
Please comment	15	Yes, always	Yes, I wait until	Medical recommendation		Diabetes specialist
Please comment	15	Mostly, but rarely	I sometimes	Other (please specify)	Dexcom cgm	Other (please specify)
		Yes, always	I sometimes	Symptom severity		Dietitian
Please comment	15	Mostly, but rarely	I sometimes	Medical recommendation		Diabetes specialist
Please comment	15	Mostly, but rarely	Definitely not	Medical recommendation		A friend or relative
Please comment 20g	20g	Sometimes	I sometimes	Trial and error		Other (please specify)
Please comment 20g	20g	Yes, always	Yes, always	Very	Medical recommendation	Diabetes specialist
Please comment Oct-15	Oct-15	Yes, always	I sometimes	Symptom severity		Diabetes specialist
		Yes, always	Yes, always	Very	Habit	A friend or relative
		Yes, always	Yes, always	Very	Trial and error	Diabetes specialist
Please comment	15	Mostly, but rarely	I sometimes	Symptom severity		Diabetes specialist
Please comment Oct-15	Oct-15	Yes, always	Yes, always	Very	Symptom severity	Other (please specify)
Please comment 15g	15g	Mostly, but rarely	I sometimes	Medical recommendation		Diabetes specialist
		Mostly, but rarely	I sometimes	Trial and error		Diabetes specialist
Please comment 15 to 20	15 to 20	Mostly, but rarely	I sometimes	Other (please specify)	Experience	Other (please specify)
Please comment	20	Yes, always	Yes, always	Very	Medical recommendation	Diabetes specialist
Please comment	15	Mostly, but rarely	I sometimes	Symptom severity		Diabetes specialist
Please comment 15-20	15-20	Mostly, but rarely	I sometimes	Habit		Diabetes specialist
Please comment	15	Yes, always	Yes, always	Very	Symptom severity	Diabetes specialist
Please comment 10g	10g	Yes, always	Yes, always	Very	Fear	Diabetes specialist
		Yes, always	Yes, always	Very	Fear	Diabetes specialist
		Yes, always	Yes, always	Very	Guess work	Social media
Please comment	15	Yes, always	Yes, I wait until	Medical recommendation		Diabetes specialist
		Yes, always	Yes, always	Very	Medical recommendation	Diabetes specialist
Please comment 15grams	15grams	Yes, always	I sometimes	Guess work		Diabetes specialist
		Mostly, but rarely	I sometimes	Habit		Diabetes specialist
Please comment	15	Sometimes	Yes, always	Very	Habit	A friend or relative
Please comment	15	Mostly, but rarely	Yes, always	Very	Symptom severity	A friend or relative
Please comment	4	Mostly, but rarely	I sometimes	Symptom severity		Dietitian

Please comm	16	Yes, always	I sometimes	Medical recommendation	Diabetes spe
Please comm	25	Mostly, but r	Yes, always v	Medical recommendation	Diabetes spe
Please comm	10	Mostly, but r	I sometimes	Trial and error	Other (pleas
Please comm	15-20 grams	Yes, always	Yes, always v	Medical recommendation	Diabetes spe
Please comm	15	Mostly, but r	I sometimes	Symptom severity	Diabetes spe
		Yes, always	Yes, always v	Trial and error	Social media
Please comm	20	About half th	I sometimes	Habit	Dietitian
Please comm	15	Yes, always	I sometimes	Habit	Other (pleas
Please comm	30	Mostly, but r	Yes, always v	Symptom severity	Diabetes spe
Please comm	15	Mostly, but r	I sometimes	Hunger	Diabetes spe
		Sometimes	I sometimes	Other (pleas	Experience... Diabetes spe
Please comm	15-20	Yes, always	Yes, always v	Other (pleas	Blood sugar I Dietitian
		Mostly, but r	I sometimes	Medical recommendation	Diabetes spe
Please comm	15	Mostly, but r	I sometimes	Symptom severity	Diabetes spe
Please comm	Oct-15	Yes, always	Yes, always v	Other (pleas	I measure ou Other (pleas
		Yes, always	Yes, always v	Symptom severity	Diabetes spe
Please comm	12g	About half th	I sometimes	Habit	Diabetes spe

Q15_7_TEXT	Q16	Q17	Q17_1_TEXT	Q18	Q19	Q20
Q15. Where	Q16. Are you	Q17. Have yc	Q17. Have yc	Q18. Do you	Q19. Do you	Q20. Which c
{"ImportId":	{"ImportId":	{"ImportId":	{"ImportId":	{"ImportId":	{"ImportId":	{"ImportId":
cialist healthc	Yes	No		Yes, I read th	Yes	Apps,Carbs a
	Yes	No		Yes, I read th	Yes	Apps,Carbs a
	No	No		Yes, I read th	Yes	Social media
	Yes	Yes (please comment wha		Yes, I read th	Yes	Carbs and Ca
cialist healthc	No	Yes (please c DAFYDD		Yes, I read th	Yes	Apps,Carbs a
cialist healthc	No	Yes (please c Dafydd		Yes, I read th	Yes	Carbs and Ca
cialist healthc	Yes	No		Yes, I read th	Yes	Carbs and Ca
cialist healthc	Unsure	Yes (please c desmond		No, I do not r	Yes	Carbs and Ca
cialist healthc	No	Yes (please comment wha		Yes, I read th	Yes	Apps,Carbs a
cialist healthc	No	No		Yes, I read th	Yes	Apps,Carbs a
Using Insulin	Yes	Yes (please c DaFNE retros		Yes, I read th	Yes	Apps,Social n
cialist healthc	Yes	No		Yes, I read th	Yes	Apps,Carbs a
Trial and errc	Yes	No		Yes, I read th	Yes	Other (pleas
cialist healthc	Unsure	No		Yes, I read th	Yes	Carbs and Ca
cialist healthc	No	Yes (please comment wha		Yes, I read th	Yes	Apps,Carbs a
Trial and errc	Unsure	No		Yes, I read th	Yes	Apps,Carbs a
	Unsure	No		I sometimes	Yes	Carbs and Ca
cialist healthc	Yes	No		Yes, I read th	Yes	Apps,Social n
lative with di	Yes	Yes (please c DAFNE		Yes, I read th	Yes	Apps,Carbs a
Trial & Error	Yes	Yes (please c DAFNE		I sometimes	Yes	Apps
cialist healthc	Yes	Yes (please c Dafne		No, I do not r	Yes	Carbs and Ca
cialist healthc	Unsure	Yes (please comment wha		I sometimes	Yes	Apps,Carbs a
lative with di	No	No		No, I do not r	No	Diabetes cha
cialist healthc	No	No		Yes, I read th	No	Carbs and Ca
cialist healthc	Yes	Yes (please c BERTIE online		Yes, I read th	Yes	Apps,Other (
Initially it wa	Unsure	No		I sometimes	Yes	Carbs and Ca
cialist healthc	Yes	Yes (please c DAFNE & HA		Yes, I read th	Yes	Carbs and Ca
cialist healthc	No	Yes (please c dafne		Yes, I read th	No	Social media
Dafne	No	Yes (please c DAFNE		Yes, I read th	Yes	Carbs and Ca
cialist healthc	Yes	No		Yes, I read th	Yes	Carbs and Ca
cialist healthc	Yes	Yes (please c Bertie		No, I do not r	Yes	Apps
cialist healthc	Yes	Yes (please c DAFNE		Yes, I read th	Yes	Carbs and Ca
cialist healthc	Unsure	No		Yes, I read th	Yes	Carbs and Ca
cialist healthc	No	Unsure		No, I do not r	Yes	Apps,Carbs a
cialist healthc	No	No		Yes, I read th	Yes	Apps,Carbs a
	No	No		I sometimes	No	Social media
cialist healthc	No	No		Yes, I read th	Yes	Carbs and Ca
cialist healthc	Yes	Yes (please c Daphne		Yes, I read th	Yes	Apps
cialist healthc	No	No		Yes, I read th	Yes	Apps
cialist healthc	Unsure	No		I sometimes	Yes	Apps
lative with di	Yes	No		No, I do not r	Yes	Apps,Carbs a
lative with di	Yes	Yes (please c DAFNE		Yes, I read th	Yes	Apps,Social n
	No	No		No, I do not r	Yes	Apps,Resourc

Specialist healthc	Unsure	Yes (please c Dafne	Yes, I read th	Yes	Carbs and Ca
Specialist healthc	Yes	Yes (please c DAFNE	Yes, I read th	Yes	Apps
Online	No	No	I sometimes	No	Other (please
Specialist healthc	Yes	Yes (please c DAFNE	Yes, I read th	Yes	Carbs and Ca
Specialist healthc	No	Yes (please c DAFNE	Yes, I read th	Yes	Social media
	No	No	No, I do not r	No	Social media,
	No	Yes (please c BERTIE	I sometimes	Yes	Apps,Carbs a
Trial and errc	No	No	Yes, I read th	Yes	Carbs and Ca
Specialist healthc	No	Yes (please c Have attende	Yes, I read th	Yes	Apps
Specialist healthc	Yes	Yes (please c DAFNE	I sometimes	Yes	Carbs and Ca
Specialist healthc	Unsure	Yes (please c Gateau (st T	No, I do not r	No	Resources pr
	Yes	No	Yes, I read th	Yes	Apps,Carbs a
Specialist healthc	No	Yes (please c DAFNE	Yes, I read th	Yes	Apps
Specialist healthc	Yes	No	Yes, I read th	Yes	Apps
Specialist healthc	Yes	No	Yes, I read th	Yes	Other (please
Specialist healthc	Unsure	No	I sometimes	No	
Specialist healthc	Yes	Yes (please c DAFYDD	I sometimes	Yes	Apps,Carbs a

Q20_7_TEXT Q9_7_TEXT - Topics

Q20. Which c Q9_7_TEXT - Topics

{"ImportId": {"ImportId": "QID9_7_TEXT_31774b593438420ab51f7488Topics"}}

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Appendix 8

Statistical Package for Social Sciences (SPSS) Output