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# Awareness of Obesity and Diabetes: A Survey of a Subset of British Male Drivers

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**Abstract**

Behavior modification necessary to tackle obesity and type 2 diabetes mellitus (T2DM) requires individual awareness of the existing problem. *Objectives:* This study aimed to assess body weight perception, awareness of the relation between adiposity and T2DM, and the relation between adiposity and weight loss attempts. *Methods:* Male drivers were recruited randomly from motorway service stations between May and July 2007, completed a questionnaire and had body mass index (BMI), waist circumference (WC), and body composition. *Results:* Participants included 266 men, median age 52 years, and BMI 28.25 kg/m2. Obesity prevalence was 46% based on BMI and 73% based on WC. Participants underestimated their WC (94.3 ± 10.2 vs. 102.9 ± 11.41 cm, estimated vs. actual, $p < .001$). Of participants with normal BMI, 18% thought they were overweight, whereas 26% of overweight thought they were "just right" and 19% of obese recognized their obesity. Based on WC, 30% of participants with normal WC thought they were obese and 9% of obese realized they were obese. Only 25% and 42% of participants recognized that T2DM is associated with large waist and obesity, respectively. A total of 81% of overweight and 62% of obese participants (based on BMI) believed that they were *not* at increased risk of T2DM. Self-perception of adiposity weakly predicted weight loss attempts ($\lambda = 0.28$, $p = .008$). *Conclusion:* Male drivers significantly underestimate their adiposity and risk of T2DM. Further public education regarding obesity, its associated health risks, and the benefits of weight loss is needed.

**Keywords**

obesity, type 2 diabetes, obesity perception, weight loss

## Introduction

Obesity and type 2 diabetes mellitus (T2DM) are major public health problems in the United Kingdom and worldwide. Obesity is associated with increased risk of T2DM, hypertension, dyslipidemia, obstructive sleep apnea, cardiovascular disease, and certain cancers. In addition, obesity is also associated with increased risk and severity of hypogonadism and erectile dysfunction in men (Kapoor, Clarke, Channer, & Jones, 2007). The role of driving and increased risk of higher waist circumference (WC) and sudden death was first reported in London bus drivers compared with conductors (Morris, 1959). Obesity prevalence has grown by 400% over the past 25 years to the extent that about two thirds of the population in

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England is either obese or overweight with an estimated economic cost of £6.6 to £7.4 billion (House of Commons Health Committee, 2004). Similar trends are observed in the United States where between 1985 and 2007, there has been a dramatic increase in the prevalence of obesity (Centers for Disease Control and Prevention, 2008). In 2007, only one state had an obesity prevalence below 20% and 30 states had a prevalence of obesity more than 25% (Centers for Disease Control and Prevention, 2008). Parallel to the increase in obesity, there has been an increase in the prevalence of T2DM worldwide (International Diabetes Federation [IDF], 2009). In the United Kingdom, it is estimated that the number of patients with T2DM will reach 2.5 million by 2010 (Roberts, 2006).

Lifestyle change, including diet, physical activity, and behavioral modification, is the cornerstone of management of obesity, with the aid of pharmacological and surgical interventions in appropriate patients (Hainer, Toplak, & Mitrakou, 2008). The "Stages of Change Model" highlights the importance of an individual's readiness to change long-term behavior; for which awareness of an existing problem (e.g., obesity) is an important step (Bundy, 2004; Prochaska, 1991). Hence, understanding obesity perception is important when developing health strategies to combat this epidemic (Dorsey, Eberhardt, & Ogden, 2009). The primary aim of this study was therefore to assess the prevalence of obesity/overweight perception and to assess the awareness of the relation between adiposity and T2DM in a subset of British male drivers. We also explored whether there was a relation between adiposity and attempts at weight loss in the study population.

## Methods and Participants

We conducted a cross-sectional survey between May and July 2007. A team of four specialist nurses toured motorway service stations at eight different randomly selected sites across England inviting male drivers to take part in free, simple health checks. Moto™ Motorway Services selected the sites on which the survey was conducted. Moto™ has 41 motorway services stations in England distributed across 4 main regions, including North, Midlands, South East, and South West. Of these 41 stations, 20 were deemed appropriate to conduct the research by Moto™ based on the availability of space to host the research team. To provide a wide coverage, sites were chosen from all regions: two from the North, two from the Midlands, one from the South West, and three from the South East. More stations were chosen from the South East because of the larger population living in that area. Stations in each region were randomly selected by Moto™ using Microsoft Excel 2003. Volunteers were selected randomly and were asked to complete a questionnaire that included 10 questions related to obesity and T2DM. The questionnaire was filled out by the participants in the presence of a study team member who clarified any ambiguity raised by the participants. Participants also had a health check including WC, body weight, height, blood pressure (BP), and body composition (bio-impedance). Blood glucose and cholesterol levels were measured in all participants. Bio-impedance data were obtained using Tanita body composition analyzer scales (BC-420MA, Tanita, Middlesex, UK) and included fat mass, other estimated measures of adiposity, and body mass index (BMI).

Obesity was defined according to BMI and WC separately. BMI ($kg/m^2$) was classified into three categories: normal <25 $kg/m^2$, overweight 25 to 29 $kg/m^2$, and obese ≥30 $kg/m^2$ based on World Health Organization criteria (WHO Expert Committee, 1995). WC ≥94 cm was considered as a marker of central obesity as per the IDF (2006) definition of the metabolic syndrome in White Caucasian individuals. Hypertension was defined as a systolic BP ≥130 mmHg or a diastolic BP ≥85 mmHg, in line with the IDF (2006) criteria.

Ethical opinion was sought from the National Research Ethics Service from the National Patient Safety Agency and they deemed that the project did not require ethical approval as the nursing team was working independently and that participants were not recruited via the National Health Service (NHS). This was a nurse-led service initiative, under the name of "Moto Nurse," with the aim of raising men's awareness of obesity and T2DM. No identifiable data were stored on any participant. Only coinvestigators had access to the data. Test results were instant and all medical recommendations were given to the participants at the time of the tests. Any participant who was found to have a health risk was given a letter to take to his own family physician for further investigations. It was the responsibility of the participant to seek further medical help from their family physician if recommended. All participants volunteered to take part in this study.

Data were analyzed using SPSS 15.0 for Windows (LEAD Technologies). Continuous data were presented as mean ± standard deviation (*SD*) or median (interquartile range, IQR), and categorical data were presented as frequencies and percentages. Paired and independent *t* tests were used to compare the means of two continuous variables. Pearson's or Spearman's correlations were used to assess the relation between two continuous variables. Chi-square test was used to detect significant relation between categorical variables. Analysis of variance (ANOVA) and Kruskal–Wallis were used to compare several independent means or medians respectively. Lambda and Somers's *d* statistics were used to detect the

**Table 1.** Participants Characteristics in Relation to BMI Categories

| | BMI Categories | | | | |
|---|---|---|---|---|---|
| | Normal | Overweight | Obese | *p* | Total Sample |
| Age (years) | 56 (41-65) | 52 (43-59) | 50 (41-59) | 0.749 | 52 (42-60) |
| BP systolic (mmHg) | 134 (124-150) | 140 (130-150) | 145 (133-154) | .041 | 141 (130-152) |
| BP diastolic (mmHg) | 80 (77-88) | 90 (80-97) | 92 (82-100) | <.001 | 90 (80-98) |
| Blood glucose (mmol/L) | 5.4 (4.7-6.2) | 5.7 (4.9-6.6) | 5.7 (4.9-6.8) | .487 | 5.7 (4.9-6.6) |
| Cholesterol (mmol/L) | 4.5 (4.0-5.3) | 4.7 (4.1-5.7) | 4.6 (4.2-5.3) | .177 | 4.6 (4.1-5.4) |
| BMI (kg/m$^2$) | N/A | N/A | N/A | N/A | 28.3 (25.6-31.2) |
| Actual waist (cm) | 88.9 (86.4-94.3) | 99.1 (94.0-104.1) | 111.8 (106.7-121.9) | <.001 | 101.6 (94.0-109.2) |
| Estimated waist (cm) | 86.4 (81.3-91.4) | 91.4 (86.4-96.5) | 101.6 (96.5-106.7) | <.001 | 91.4 (86.4-97.2) |
| Fat mass (%) | 19 (16-20) | 24 (22-27) | 31 (29-35) | <.001 | 25.4 (20.8-30.0) |

Note: BMI = body mass index; BP = blood pressure; N/A = not applicable. Data are presented as median and figures in parentheses denote interquartile range.

**Table 2.** Self-Perception Questionnaire

| Questions | Responses | | | | | |
|---|---|---|---|---|---|---|
| Do you think waist measurement is more or less important than weight with regards to your health? | More, 59% | | | Less, 41% | | |
| Which one of the following would you describe yourself as? | Thin, 1% | Just right, 29% | | Overweight, 64% | Obese, 7% | |
| Do you worry about your weight? | Yes, 60% | | | No, 40% | | |
| Have you ever tried to lose weight? | Yes, 38% | | | No, 62% | | |
| Have you ever been to your doctor to lose weight? | Yes, 6% | | | No, 94% | | |
| Would you ever consider taking medication to help you lose weight? | Yes, 19% | | | No, 81% | | |
| Do you think you may be at risk from type 2 diabetes? | Yes, 24% | | | No, 74% | Known diabetic, 2% | |
| What do you think might cause type 2 diabetes? | High-sugar diet, 67% | Lack of exercise, 40% | Family history, 43% | Large waist, 25% | High blood pressure, 26% | Obesity, 42% |
| Do you think regular services at MOTO and other accessible places are a good idea? | Yes, 99% | | | No, 1% | | |

Note: Results presented as percentages (rounded).

strength of association between nominal and ordinal variables respectively. Statistical significance was set at a $p < .05$.

## Results

Participants' characteristics are summarized in Table 1. Participants were 266 men with a median age of 52 years (IQR: 42-60 years). The results of the questionnaire are summarized in Table 2. The prevalence of overweight and obesity (based on BMI) was 46.0% and 34.6%, similar to the general population (25.1% BMI 30.0-34.9, 8.0% BMI 35.0-39.9, and 1.5% BMI ≥40 kg/m$^2$). The prevalence of central obesity based on WC was 73.1%. In the sample, 1.5% had known diabetes and 10.2% had possible abnormal glycemia (based on a glucose level ≥7.8 mmol/L). The prevalence of systolic and diastolic hypertension was 77.0% and 66.2%, respectively. Hypertension, however, may have been overestimated as blood pressure is likely to be higher than the resting state, having just been on a motorway.

### *Adiposity Measures, Blood Pressure, and Glucose*

BMI, WC, and fat mass had strong and statistically significant correlations (BMI and WC: correlation coefficient, $r = .9$, $p < .001$; BMI and fat mass: $r = .7$, $p < .001$; WC and fat mass: $r = .7$, $p < .001$). BMI and

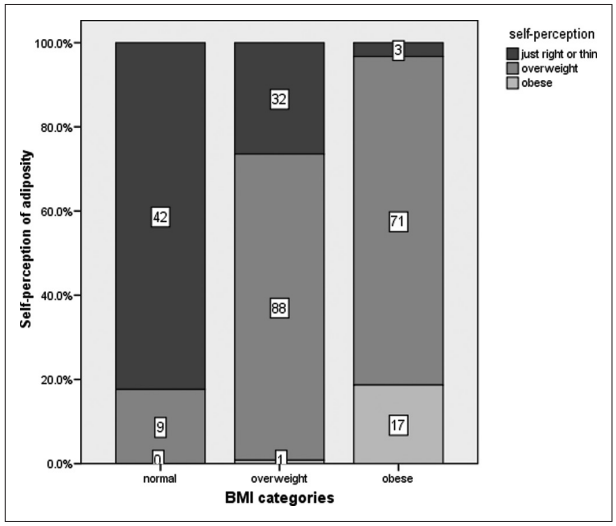


**Figure 1.** The relation between self-perception of adiposity and body mass index (BMI) categories
Note: Data are presented as percentage of each self-perception category. Numbers present the absolute count in each category.

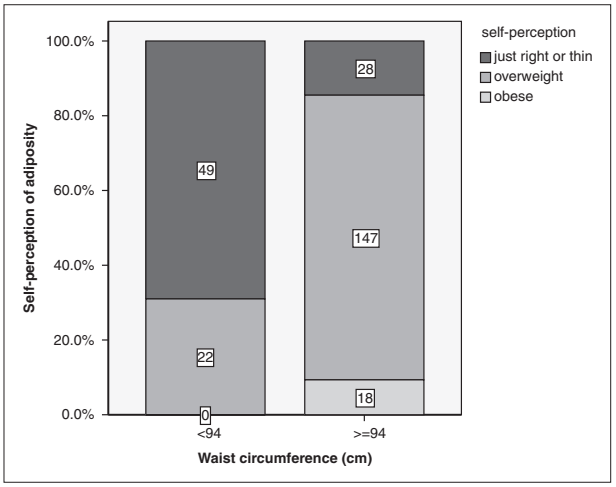


**Figure 2.** The relation between self-perception of adiposity and waist circumference categories
Note: Data are presented as % of each self-perception category. Numbers present the absolute count in each category.

WC correlated significantly with diastolic BP (BMI and diastolic BP: $r = .3$, $p < .001$; WC and diastolic BP: $r = .3$, $p < .001$). There was no significant association between BMI and WC and systolic BP, which is likely to be because of our sample size. WC, but not BMI, correlated with blood glucose (WC and random blood glucose [RBG]: $r = .1$, $p = .03$; BMI and RBG: $r = .1$, $p = .16$).

## *Self-Perception of Adiposity*

Based on the questionnaire, 29.4% of the participants thought they were "thin" or "just right," 63.9% thought they were overweight, and 6.8% thought they were obese. There was no difference in age between the self-perception categories (53 vs. 50 vs. 51 years, for just right, overweight, and obese, respectively, $p = .35$).

There was a statistically and clinically significant difference between estimated and actual WC with a tendency for participants to underestimate their waist measurements (94.3 ± 10.2 vs. 102.9 ± 11.4, for estimated vs. actual WC, $p < .001$). There was a significant difference in adiposity across self-perception categories (WC: 93.1 vs. 105.4 vs. 120.4 cm, for just right vs. overweight vs. obese, $p < .001$ and BMI: 25.1 vs. 29.8 vs. 35.4 kg/m$^2$ for just right vs. overweight vs. obese, $p < .001$).

There was a moderate correlation between participants' self perception and actual degree of adiposity based on BMI (Somers's $d$ value = .65, $p < .001$). Despite that, there was a significant proportion of misperception of adiposity (Figures 1 and 2). Approximately 18% ($n = 9$) of participants with normal BMI thought they were overweight and approximately 26% ($n = 32$) of overweight individuals thought they were "just right." On the other hand, only approximately 19% ($n = 17$) of obese participants realized they were obese (78%, $n = 71$, thought they were overweight and 3%, $n = 3$, thought they were just right; Figure 1).

Similar to BMI, there was a moderate correlation between participants' self-perception and actual central adiposity based on WC (Somers's $d$ value = .45, $p < .001$). Despite that, there was a significant proportion of misperception of adiposity (Figure 2). About 30% ($n = 22$) of participants with normal WC thought they were overweight. On the other hand, only about 9% ($n = 18$) of obese participants recognized that they were obese (76%, $n = 147$, thought they were overweight and 15%, $n = 28$, thought they were just right).

## *Self-Perception of Type 2 Diabetes Mellitus Risk*

The relation between self-perception risk of T2DM, self-perception and actual adiposity is summarized in Figures 3, 4, and 5. Based on self-perception of adiposity, 74% ($n = 125$) of overweight and 28% ($n = 5$) of obese individuals considered themselves not to be at risk of developing T2DM. Based on BMI, 81% ($n = 98$) of overweight and 62% ($n = 56$) of obese men believed that they were not at increased risk of having T2DM. Based on WC, 71% ($n = 136$) of participants with central obesity believed that they were not at increased risk of T2DM.

Despite the observation that a significant proportion of our sample underestimated their risk of T2DM,

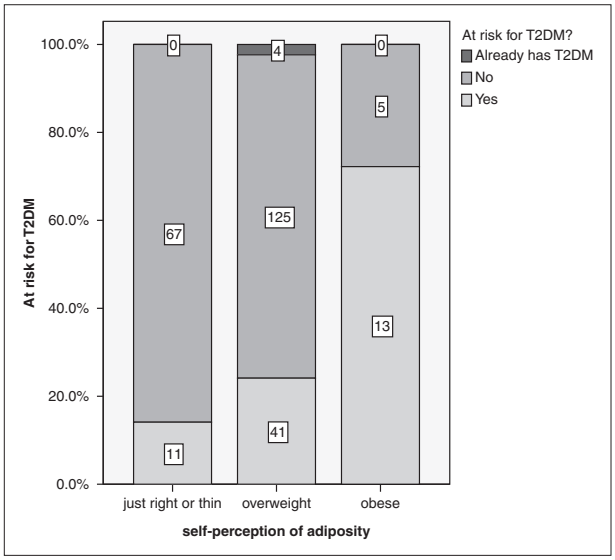


**Figure 3.** The relation between self-perception of adiposity and self-perception of type 2 diabetes mellitus (T2DM) risk
Note: Data are presented as percentage of each self-perception category. Numbers present the absolute count in each category.

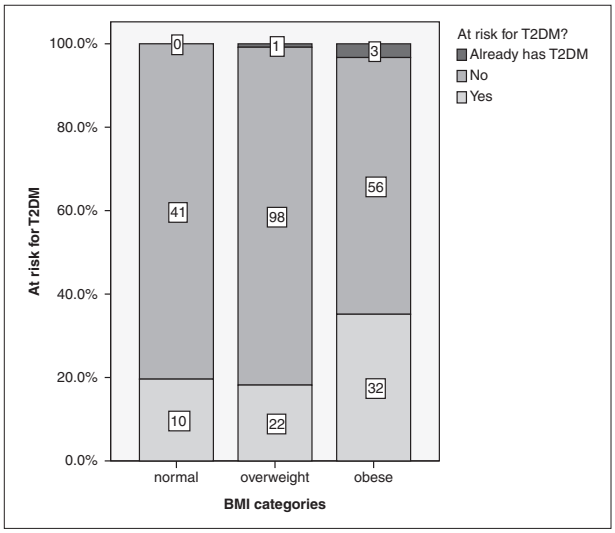


**Figure 4.** The relation between body mass index (BMI) and self-perception of type 2 diabetes mellitus (T2DM) risk
Note: Data are presented as percentage of each BMI category. Numbers present the absolute count in each category.

those who considered themselves to be at increased risk were more obese (BMI: 30.3 ± 5.0 vs. 28.3 ± 4.0 kg/m$^2$, $p = .001$; WC: 107 ± 12.8 vs. 101.3 ± 10.5 cm, $p < .001$). Individuals who do not consider themselves to be at increased risk of T2DM had an average BMI (28.3 ± 4.0 kg/m$^2$) and WC (101.3 ± 10.5 cm) that are in the overweight/obese range. Furthermore, only 42% and 25% of our participants considered obesity and large waist,

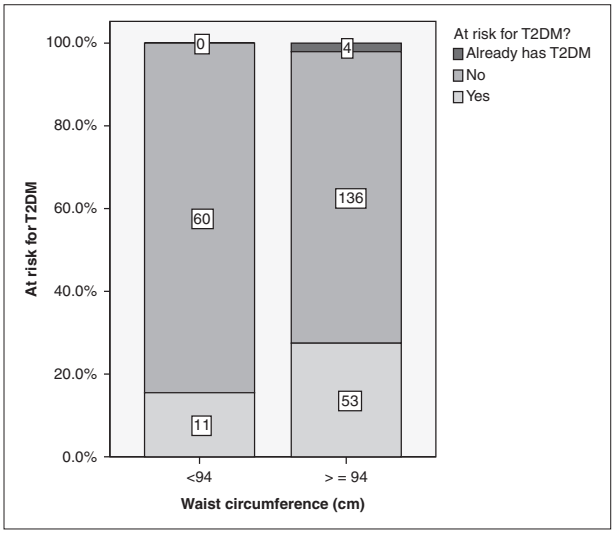


**Figure 5.** The relation between waist circumference (WC) and self-perception of type 2 diabetes mellitus (T2DM) risk
Note: Data are presented as percentage of each WC category. Numbers present the absolute count in each category.

respectively, as contributing factors to the development of T2DM.

## *Who Is Trying to Lose Weight?*

Participants self-perception of adiposity weakly, but significantly, predicted attempt to lose weight ($\lambda = 0.28$, $p = .008$). A total of 32% ($n = 25$) of participants who thought their weight was "just right" or "thin" attempted to lose weight. On the other hand, only 27% ($n = 45$) of people who perceived themselves to be overweight and 11% ($n = 2$) of people who perceived themselves to be obese had not attempted to lose weight.

Participants BMI did not predict attempts to lose weight ($\lambda = 0.11$, $p = .12$). About 39% of participants with normal BMI had attempted to lose weight whereas 43% ($n = 51$) of overweight and 18% ($n = 16$) of obese participants did not attempt to lose weight. Based on WC, 51% ($n = 36$) of participants with normal WC attempted to lose weight whereas 33% ($n = 63$) of patients with high WC did not attempt to lose weight.

Based on WC, there was no relation between central adiposity and seeking medical advice regarding weight loss ($p = .225$). The majority (92%) of participants with central obesity had never been to their doctor regarding weight management. Similarly, 97% of overweight and 87% of obese participants (based on BMI) have never sought medical advice regarding weight management.

Our data suggest that an individual's attempt to lose weight is based on his self-perception rather than actual adiposity. The majority of individuals who think their

weight is normal but who are overweight/obese based on BMI and/or WC did not attempt to lose weight. In contrast, individuals who perceived themselves to be overweight/obese have attempted to lose weight even though they fall into the normal range based on BMI/WC.

## Discussion

Our data show that obesity and overweight are prevalent, with the majority of a sample of middle-aged male drivers being either overweight or obese and having a WC above the threshold for the definition of the metabolic syndrome. This high prevalence of excess adiposity in our sample was associated with a high prevalence of hypertension and dysglycemia. The high prevalence of overweight and obesity in our study is consistent with that of other countries (Vahratian, 2009).

Also, our data show that despite recent government and media interest in obesity and T2DM, a significant proportion of men did not appreciate the degree of their adiposity, underestimating their risk of T2DM and their WC by 8 cm on average. Furthermore, our study shows that only about a quarter of our population is aware that increased WC is a risk for developing T2DM. Furthermore, with the exception of dietary contribution, which was recognized by two thirds of our sample, less than half the participants related physical activity, large WC, and obesity to T2DM. We are thus still failing to get the message across regarding the importance of maintaining a healthy weight and the subsequent risks associated with being overweight or obese in this population. This is further supported in our study by the significant proportion of the overweight/obese subjects who were not worried about their adiposity. Furthermore, the data suggest that despite the diabetes epidemic, public knowledge regarding its causes and the relation to lifestyle factors is still grossly inadequate.

Our data show that the benefits of weight loss are not widely appreciated. Seeking medical advice for weight loss was very limited with only a small minority of obese people having attempted to lose weight. This lack of interest in seeking help could be because of many factors, including lack of motivation. However, other factors could also be contributing, such as lack of knowledge about what help is available to the overweight/obese patient. Obese individuals might fear seeking medical advice where they might be "punished" or "told off" (National Task Force on the Prevention and Treatment of Obesity, 2002). Furthermore, some drivers might have difficulties accessing health services because of the nature of their jobs. However, a "health check," such as the one described in this study, might be helpful in increasing public awareness particularly as 99% of the participants felt that such a "health check" was a "good idea."

The misperception and lack of knowledge about obesity and its complications might represent a barrier to programs and health policies that aim to fight obesity and its complications, and need to be considered when designing and implementing health policies. This is even more important considering that our data show that self-perception (and not actual adiposity) is associated with attempts to lose weight. Other studies have shown that weight misperception is a predictor of future weight gain and is associated with psychological distress (Atlantis & Ball, 2008; Herring et al., 2008).

Our results are consistent with previous studies, mainly from the United States, that showed misperception of weight and obesity to be common among overweight/obese adults (Bennett & Wolin, 2006; Burroughs et al., 2008; Dorsey et al., 2009; Gregory, Blanck, Gillespie, Maynard, & Serdula, 2008; Kuchler & Variyam, 2003; Okosun, Bhatt, Boltri, & Ndirangu, 2008; Paeratakul, White, Williamson, Ryan, & Bray, 2002; Ver Ploeg, Chang, & Lin, 2008). These studies have shown that gender, income, ethnicity, and social backgrounds are among the factors that affect the extent of such misperception (Bennett & Wolin, 2006; Dorsey et al., 2009; Gregory et al., 2008; Kuchler & Variyam, 2003; Okosun et al., 2008; Paeratakul et al., 2002; Ver Ploeg et al., 2008).

There were several limitations to this study. First, the results cannot be generalized. The nature of our study design means the results of our study apply to British male drivers who stop at motorway stations. Second, we did not collect any information regarding the socioeconomic background of study participants, although as the participants were recruited randomly from different areas of the United Kingdom, we are likely to have a range of social, educational, and vocational categories included. Third, we did not have data about the family history of T2DM; this could affect the participants' awareness of the risk factors for T2DM. Fourth, there is a possibility of enrollment bias in our study, as people who think that they have a health problem are more likely to be involved in a "health check." We cannot rule out this bias completely, but our survey suggests that a significant proportion of our participants were not worried about their weight or diabetes risk. A further limitation of our study is the lack of drug and past medical history. Finally, our questionnaire has been used in a small cohort of truck drivers the year before the study but has not been formally validated. Nonetheless, there was a member of the research team present while the participants filled the questionnaires to clarify any confusion. Interestingly, the high prevalence of overweight/obesity indicates that our study population is at high risk of developing obstructive sleep apnea, which is related to excessive daytime sleepiness. This is a particularly relevant issue in this study as the participants

are all drivers, which may have implications for road safety.

Our study has several strengths. It provides U.K. data describing obesity perception. Unlike most studies in the United Kingdom, our sample was randomly selected from different areas of the United Kingdom and participants were not recruited from health-related institutions, whereas other U.K. studies have recruited participants from health-related institutions such as hospital or family practices. Hence, our sample may be more representative of "real life."

In summary, our study shows a high prevalence of overweight/obesity in male British drivers. Waist circumference is significantly underestimated by individuals and a large proportion of overweight/obese individuals do not appreciate the extent of their adiposity. A significant proportion of overweight/obese participants had never attempted to lose weight and were not worried about their weight. Only a minority of participants had sought medical advice to lose weight. Male British drivers underestimated their own risk of T2DM and a significant proportion was not aware of the association between adiposity and diabetes. There is a need for further public education regarding obesity and its associated risks. Future studies examining the barriers for not seeking medical advice for weight issues need to be explored and addressed. Also, health services that are available to individuals with weight problems needs to be better publicized.

## Authors' Note

The views expressed in this publication are those of the authors and not necessarily those of the National Health Service (NHS), the National Institute for Health Research (NIHR), or the Department of Health. The funders had no involvement in the design of the study, data interpretation or manuscript writing.

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