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Title of the article:

Self-reported weight and predictors of missing response in youth

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Shortened version of the title:

Youth's self-reported weight missing data

Highlights

- Missing self-reported weight is a common problem in youth studies, but such data is rarely analysed

- There was high percentage of missing self-reported weight in the Scottish 2014 HBSC study
- Self-reported weight non-response on this population was missing due to a systemic error.
- Self-reported weight non-response was associated to sociodemographic factors
- Self-reported weight non-response was associated to behavioural factors

Keywords:

Self-reported weight, obesity, missing data, Health Behaviour in School-Aged Children (HBSC) Study

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ABSTRACT

Missing self-reported weight data is a common problem in youth studies, but such data is rarely analysed. The aims of the present manuscript are: to analyse self-reported data on weight, including the missing data, from the 2014 Scottish Health Behaviour in School-Aged Children (HBSC) Study, and to investigate whether behavioural factors related with overweight and obesity, namely dietary habits, physical activity and sedentary behaviour, are associated with weight non-response. 10,839 school-aged children 11-, 13- and 15-year-olds participated at the cross-national 2014 Scottish HBSC Study. Weight missing data was evaluated using Little's Missing Completely at Random (MCAR) test. Afterwards, a fitted multivariate logistic regression model was used to determine all possible multivariate associations between weight response and each of the behavioural factors related with obesity. 58.9% of self-reported weight was missing not at random (MCAR $p<0.001$). Weight was self-reported less frequently by girls (19.2%) than by boys (21.9%). Participants

who reported low physical activity practice (OR 1.2, p<0.001), low vegetables consumption (OR 1.24, p<0.001) and high computer gaming in week days (OR 1.18, p=0.003) were more likely to not report their weight. There are groups of young people in Scotland who are less likely to report their weight. Their weight status may be of the greatest concern because of their poorer health profile, based on key behaviours associated with their non-response. Furthermore, knowing the value of a healthy weight and reinforcing healthy lifestyle messages may help raise youth's awareness of how diet, physical activity and sedentary behaviours can influence weight.

BACKGROUND

Childhood obesity is one of the biggest worldwide public health challenges of the 21st century. It is estimated that one in 10 young people aged 5–17 years are overweight or obese, and such levels have increased rapidly in the last decades [(1)]. Research has pointed dietary practices, decreased physical activity and increased sedentary lifestyles as the main factors contributing to this epidemic [(2-4)].

Recently, the Health Behaviour in School-aged Children (HBSC) World Health Organisation (WHO) collaborative cross-national study released the report regarding adolescent obesity trends and related behaviours in the WHO European Region from 2002–2014 [(1)]. This study has collected international data on health behaviours, health outcomes and social environments of young people aged 11, 13 and 15 years, for over 25 years, allowing the comparison of data across countries and over time [(5)].

The HBSC Study aims to analyse behaviours established during adolescence that can continue into adulthood, affecting issues such as mental health, development of health complaints, tobacco use, diet, physical activity levels, and/or alcohol use. This study, measures obesity using Body Mass Index (BMI) based on self-reported weight and height. This measurement is commonly used in population-based surveys and has been shown to be a useful and cost-effective tool for estimating weight status (e.g. overweight and obesity) in large epidemiological studies [6-11]. However, measurements of this type may be subject to recall or bias, potentially leading to either overestimation or underestimation of the results [12, 13]. Among youth, self-reported weight measurements can be influenced by gender, pubertal status, adiposity, body image concerns, food choices, sociocultural environment influences, awareness of social ideals regarding slimness, and attitudes towards obesity, amongst others [7, 14, 15].

Previous studies have reported a considerable proportion of missing data in population-level surveys of adolescent health and have indicated that weight data are more likely to be missing than height data, particularly for girls [7, 10]. The likelihood of missing self-reported weight data may increase as actual BMI increases, which could indicate that the non-response may be intentional among young people [7]. Although there is no established cut-off in the literature regarding an acceptable percentage of missing data in a dataset for valid statistical inferences, their quality is directly related to the missing data proportion [11, 16]. Consequently, in the latest HBSC obesity report, nine countries were excluded from the analysis due to their high levels of missing

data (>30%): Belgium, Ireland, Israel, Lithuania, Malta, Romania, England, Wales and Scotland [1].

With the purpose of understanding the rationale behind the shortage of weight-response and to prevent this from happening on future studies, the aims of the present manuscript are twofold: first, to analyse if the weight non-response on the Scottish HBSC Study 2014 is either missing at random or due to a systemic error. Second, to investigate whether the non-response of weight data can be associated to behavioural factors related to obesity (namely dietary habits, physical activity and sedentary behaviours).

METHODS

Setting and Participants

The analysis of missing weight response data was taken from the Scottish sample of the 2014 HBSC study [17, 18]. This sample was designed to be nationally representative of Scottish 11-, 13-, and 15-year-olds. The survey was conducted in schools, using classrooms as the primary sampling unit, and all the pupils in the selected classrooms were asked to complete a questionnaire anonymously. The target population was school children in the final year of primary school (average age 11.5 years) and in the second and fourth years of secondary education (average age 13.5 and 15.5 years, respectively). A minimum of 95% of the eligible target population should be within the sample frame. The study was approved by the University of St. Andrews Teaching and Research Ethics Committee [17, 18].

HBSC Survey items

The items from the HBSC Survey relevant to the present study are the following:

Primary Outcome

Self-reported body weight: The participants were asked “How much do you weigh without clothes?”

Behavioural Factors Related with Obesity

The validity and reliability of the following items provided to the participants for the following behavioural factors have been previously verified [19-22].

Dietary Behaviours [19]: The participants were asked “How many times a week do you usually eat or drink ___? (Fruit; Vegetables; Sweets or chocolates; Coke or other soft drinks that contain sugar)”, with possible answers for each item: “Never”, “Less than once a week”, “Once a week”, “2-4 days a week”, “5-6 days a week”, “Once a day every day” and “More than once every day”. For analysis purposes, the responses were categorized into three main groups: “Never” to “Once a week” responses were labelled “Low” consumption, “2-4 days a week” to “5-6 days a week” responses were labelled “Medium” consumption, and “Once a day every day” and “More than once every day” responses were labelled “High” consumption.

Physical activity [20, 21]: The participants were asked “Over the past 7 days, on how many days were you physically active for a total of at least 60 minutes per day?” with possible answers ranging from 0 to 7 days. For analysis purposes, the responses were recoded into three groups: “0 days” to “2 days” were labelled “Low” physical activity practice, “3 days” to “4 days” were labelled

"Medium" physical activity practice, and "5 days" to "7 days" were labelled "High" physical activity practice.

Sedentary behaviours [22]: Screen-time was used as an indicator of sedentary behaviour. The participants were asked: "How many hours a day in your free time do you usually spend (1) watching TV, videos, DVDs, and other screen entertainment, (2) playing games on a computer, and (3) using computers for purposes other than gaming. Considering week days and weekend days separately, the possible answers were "None at all", "About half an hour a day", "About 1 hour a day", "About 2 hours a day", "About 3 hours a day", "About 4 hours a day", "About 5 hours a day", "About 6 hours a day" and "About 7 or more hours a day". For analysis purposes, responses were categorized into three groups: "None at all" to "About 2 hours a day" responses were labelled as "Low" use, "About 3 hours a day" to "About 5 hours a day" responses were labelled as "Medium" use, and "About 6 hours a day" to "About 7 or more hours a day" responses were labelled "High" use.

Sociodemographic determinants: Age, gender and family affluence were included in the analysis to determine their association with weight non-response. The Family Affluence Scale (FAS) is a measure of familial material wealth and is used to describe and explain socioeconomic inequalities in a wide range of health indicators in the HBSC study. This scale categorizes participants into "Low" affluence, "Middle" affluence and "High" affluence groups [23].

Statistical Methods

The statistical study is performed in two steps. First, to evaluate if data from the outcome is missing at random or due to a systemic error, the Little's Missing

Completely at Random (MCAR) test was implemented. This test verifies the significance of the difference between the means of missing-value patterns, thus comparing the distribution of fully observed predictor variables for respondents and non-respondents. The MCAR test takes into consideration that missing data from the outcome is independent of both observed and unobserved information [24, 25], and does not assume the reasons for the absence of the data itself.

If a systemic error was found, the second step was performed through a chi-square (χ^2) test which examined whether there was an association between weight response and each of the behavioural factors related with obesity (dietary patterns, physical activity, sedentary behaviours or sociodemographic information). Given the sample size, Bonferroni corrections where implemented on the data. Following this test, only the factors with an associated statistical significance were included in a multivariate logistic regression model to determine all possible multivariate associations between the predictors and the outcome variable. After analysing the significance of each behavioural factor, the model was fitted accordingly by excluding the non-significant predictors. Thus, a second multivariate logistic regression model was run using only the significant predictors. This procedure generated adjusted odds ratios (OR ± 95% Confidence Interval (CI)) which were used to determine the association with weight response. In the multivariate logistic regression model, results where the p-value was smaller than 0.05 were considered statistically significant.

SPSS v. 22.0 (Chicago, Illinois) was used for data management and statistical analysis.

RESULTS

In total, 10,839 school children aged 11, 13 and 15 years participated in the Scottish 2014 HBSC study. A low percentage of self-reported weight data (41.1%) was present in this sample, resulting in a 58.9% of missing data, as shown in **Table 1**. Weight was self-reported less frequently by girls than by boys (19.2% and 21.9%, respectively), and despite that the rate of self-reported weight responses variates through the different age groups, it remained lower for girls than for boys for all age groups. According to the Little's MCAR test, the missing self-reported weight data were not missing at random ($p<0.001$).

Once that the missing of weight data was attributed to a systemic error, items evaluating behavioural factors were assessed using a χ^2 test for univariate association in relation to the weight data availability. Given the large data sample size, Bonferroni corrections were used when calculating the p-value of all the categories of each behavioural factor, resulting in an α value of 0.006. **Table 2** shows the frequencies of the selected behaviours with respect to the weight-response and weight non-response together with the p-values obtained for each category of the behavioural factors. Results lead to the exclusion of the following items from the multivariate logistic regression models: Fruit Consumption (medium), Vegetable Consumption (medium), Sweet and Chocolate Consumption (all categories), Sugary Drinks Consumption (medium), Physical Activity (medium), Time Spent Watching Entertainment Screen on Week Days (medium), Time Spent Watching Entertainment Screen on Weekend Days (all categories), Time Spent Playing Games on a Computer on Week Days (medium), Playing Games on a Computer on Weekend Days

(medium), and Time Spent Using Computers for Purposes other than Gaming on Week and Weekend Days (all categories).

Afterwards, a first multivariate logistic regression was applied, and the low and high categories for the following variables were excluded from the final model given the lack of statistical significance: Fruit Consumption, Sugary Drinks Consumption, Time Spent Watching Entertainment Screen on Week Days, and Time Spent Playing Games on a Computer on Week days.

The values of the final multivariate logistic regression model for predicting an individual's odds of self-reporting weight are shown in **Table 3**. Participants who reported a high (OR 0.76, p<0.001) or medium (OR 0.83, p<0.001) FAS score were less likely to have missing weight data than those that reported a low FAS score. Age also influenced on weight response, with 11-year-old adolescents less likely to report their weight compared to 13-year-olds (OR 0.69, p<0.001) and 15-year-olds (OR 0.49, p<0.001). Regarding gender, females (OR 1.24, p<0.001) were less likely to report their weight than males.

The behavioural factors included in the final multivariate logistic regression model also denoted an influence on weight data response. Regarding physical activity, those reporting low physical activity practice (OR 1.2, p<0.001) were more likely to not report their weight compared to those who reported a higher practice (OR 0.8, p<0.001). A similar pattern was found for vegetable consumption, whereby those who reported low consumption (OR 1.24, p<0.001) were more likely to not report their weight than those who reported high consumption (OR 0.84, p<0.001). Finally, those who reported low computer gaming in week days (OR 0.84, p<0.001) were more likely to report

their weight than those who reported a higher computer gaming frequency on week days (OR 1.18, p=0.003).

DISCUSSION

In the Scottish 2014 HBSC study, a high percentage of missing data was observed for self-reported weight among 11-, 13- and 15-year-olds. The present manuscript shows that weight non-response on this population was missing due to a systemic error. Moreover, this weight non-response was associated to predictors such as sociodemographic determinants (i.e. age, gender, family affluence) and behavioural factors such as vegetable consumption, physical activity practice and computer usage for gaming on week days, which have been previously associated with obesity [(2-4)].

Among national surveys, the proportion of missing data (unknown/unusable) for weight self-reported values ranges from 14% to 37% [(26,27)]. Notably, in the Scottish 2014 HBSC sample this proportion was much higher than the previously described upper limit (58.9%). Imputation methods to assign values on missing data were not reasonable because they require more data than the available, which tends to increase result bias. Consequently, valid weight data was available from only 41.1% of the participants.

The higher levels of missing data for self-reported weight, particularly in girls, were comparable to the results found on previous studies [(7, 10)]. Moreover, the fact that younger age and low FAS were associated with not self-reporting weight has been shown in other studies that reported effects of sociocultural environment influences, gender and age over weight self-response [(7, 14)].

Scotland was the country with the second-highest prevalence of missing data (after Ireland) regarding BMI (70% for 11-year-olds, 72% for 13-year-olds and 61% for 15-year-olds) according to the 2013/2014 HBSC international report [(5)]. This rate has increased from the one reported on the previous 2009/2010 international report (71% for 11-year-olds, 64% for 13-year-olds and 52% for 15-year-olds) [(28)]. Missing data seems not to be the only issue in weight data analysis on this sample, since according to self-reported weight in the 2014 HBSC study, 74% of 15-year-olds in Scotland have a normal BMI; 14% are overweight/obese, and 12% are underweight [(5)]. These numbers differ from the latest data from the Scottish Health Survey (2014), in which height and weight were objectively measured (using a stadiometer and a scale), and reported that 37% of Scottish children aged 12-15 years old are at risk of overweight/obesity [(29)]. This shows that Scottish young people is not only unaware of their weight or unwilling to report it, but also those who report a value may underestimate it. Moreover, a similar pattern was found on the Welsh population, compared to the Scottish sample in the 2009/10 HBSC international report [(5)]. Wales was one of five countries reporting highest proportions of missing BMI data, and a previous study in the Welsh adolescent population found that self-reported BMI significantly underestimated overweight prevalence, since it was 6.4 percent points lower when based on self-reported data (based on International Obesity Task Force (IOTF) cut-offs) [(6)].

In contrast, within the HBSC Study, Portugal is the country with the second lowest prevalence of missing BMI-self reported measurements data (3% of 11-year-olds, 2% of 13-year-olds and 1% of 15-year-olds), after Republic of Moldova [(5)]. A recent analysis of Portugal's HBSC weight data reported that the

Portuguese adolescents are aware of their weight because they perform a physical fitness test several times a year and because physical education teachers provide them with information about their measurements [30]. Furthermore, Portugal BMI data and the prevalence of overweight and obesity among the Portuguese HBSC sample did not differ significantly when based on self-reports versus direct measurements of weight (based on IOTF cut-offs) [9]. Thus, implementing a universal programme that provides adolescents with their height and weight might not only increase the response rate, but also might help make this self-measurement more accurate.

Currently, all National Health Service (NHS) Boards in Scotland provide a child health programme that offers health promotion services and routine reviews at different stages of a child's life. Height and weight measurements are collected in the first year of primary school, but there is no universal programme in place for subsequent measurements. Therefore, it is possible that many adolescents in Scotland are unaware of their weight, which may contribute to the high levels of non-response. Also, such universal health program should address the improvement of healthy lifestyles, since our findings show that behaviours such as physical activity levels, vegetable consumption and computer gaming on week days are associated with weight self-reporting. This lends support to the idea that non-responders may be have a poorer health profile and are more likely to engage in behaviours associated with overweight and obesity.

One limitation of this study is that behavioural factors (i.e. dietary behaviours, physical activity and sedentary behaviours) used as predictors in the present study are also self-reported data. However, the HBSC study is involved in a continuous process of developing and validating their research instrument as

part of the quality assurance to permit robust research conclusions [18]. Also, data of lifestyle choices in similar populations are needed to compare the present results.

Missing data is commonly reported, but rarely analysed in youth studies. Analysing missing data regarding self-reported items can build evidence and contribute to a better understanding for large-scale surveys, programmes, interventions and/or public health efforts that use self-reported measurements of adolescents. Thus, this analysis could also help to assess bias in large epidemiological youth studies. The present results indicate that many Scottish young people are either unaware of or unwilling to provide information on their weight. Unfortunately, with the available HBSC data it is not possible to quantify how many adolescents are either unaware or unwilling to share this information. The results presented in this manuscript become a prelude of a needed analysis that attempts to examine more deeply the heterogeneity of missing data in weight-response across HBSC surveys in Europe and North America.

CONCLUSIONS

This study found that there are groups of young people in Scotland who are less likely to report their weight. These young people's weight status may be of the greatest concern because of their poorer health profile, based on key behaviours associated with their non-response. Rising levels of overweight and obesity among children and adolescents in recent years have important implications for both current and future health outcomes. Monitoring overweight and obesity within the adolescent population is essential to highlight need, identify priority groups and evaluate the impact of national policies and

programmes. BMI, based on self-reported height and weight, is one of the most cost-effective means of measuring overweight and obesity within large-scale population based surveys. High levels of missing data, however, can bias results and lead to inaccurate estimates of prevalence. Furthermore, knowing the value of a healthy weight in youth and reinforcing healthy lifestyle messages, such as daily consumption of vegetables and fruits, regular participation in physical activity and reduced time spent in sedentary behaviours, may help raise young people's awareness of how diet, physical activity and sedentary behaviours can influence weight.

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CONFLICT OF INTEREST

No competing financial interests exist.

Authorship

MA-M and RW analysed the data. All authors formulated the research questions, wrote and review the article.

ABBREVIATIONS

Health Behaviour in School-aged Children (HBSC)

World Health Organisation (WHO)

Body Mass Index (BMI)

International Obesity Task Force (IOTF)

Family Affluence Scale (FAS)

Little's Missing Completely at Random (MCAR)

Odds Ratio (OR)

Confidence Interval (CI)

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REFERENCES

1. Inchley J, Currie D, Jewell J, *et. al*. (Eds.) (2017) Adolescent obesity and related behaviours: trends and inequalities in the WHO European Region, 2002–2014. Observations from the Health Behaviour in School-aged Children (HBSC) WHO collaborative cross-national study. Copenhagen, Denmark, WHO Regional Office for Europe: WHO.

2. Sahoo K, Sahoo B, Choudhury AK, *et. al*. (2015) Childhood obesity: causes and consequences. *J Family Med Prim Care*; **4**(2): 187–192., doi: 10.4103/2249-4863.154628.

3. Gurnani M, Birken C, Hamilton J. (2015) Childhood Obesity: Causes, Consequences, and Management. *Pediatr Clin North Am*. **62**(4):821-40. doi: 10.1016/j.pcl.2015.04.001.

4. Spruijt-Metz D. (2011) Etiology, Treatment and Prevention of Obesity in Childhood and Adolescence: A Decade in Review. *J Res Adolesc*. **21**(1):129-152.

5. Inchley J, Currie D, Younf T, *et. al*. (eds). (2016) Growing up unequal: gender and socioeconomic differences in young people's health and well-being. Health Behaviour in School-aged Children (HBSC) study: international report from the 2013/2014 survey. Copenhagen, Denmark, WHO Regional Office for Europe (Health Policy for Children and Adolescents, No. 7): WHO.

6. Elgar FJ, Roberts C, Tudor-Smith C, *et. al*. (2005) Validity of self-reported height and weight and predictors of bias in adolescents. *J Adolesc Health*. **37**(5):371-5.

7. Brener ND, Mcmanus T, Galuska DA, *et. al*. (2003) Reliability and validity of self-reported height and weight among high school students. *J Adolesc Health*. **32**(4):281-7.

8. Spencer EA, Appleby PN, Davey GK, *et. al*. (2002) Validity of selfreported height and weight in 4808 EPIC-Oxford participants. *Public Health Nutr*. **5**:561–5.

9. Fonseca H, Silva AM, Matos MG, *et. al*. (2010) Validity of BMI based on self-reported weight and height in adolescents. *Acta Paediatr*. **99**(1):83-8. doi: 10.1111/j.1651-2227.2009.01518.x.

10. Béghin L, Huybrechts I, Ortega FB, *et. al*. (2013) Nutritional and pubertal status influences accuracy of self-reported weight and height in adolescents: the HELENA Study. *Ann Nutr Metab*. 62(3):189-200. doi: 10.1159/000343096.

11. Fonseca H, Gaspar de Matos M. (2005) Perception of overweight and obesity among Portuguese adolescents: an overview of associated factors. *Eur J Public Health*. **15**(3):323-8.

12. Elgar FJ, Stewart JM. (2008) Validity of self-report screening for overweight and obesity. Evidence from the Canadian Community Health Survey. *Can J Pub Health*. **99**(5):423–7.

13. Stommel M, Schoenborn CA. (2009) Accuracy and usefulness of BMI measures based on self-reported weight and height: findings from the NHANES & NHIS 2001–2006. *BMC Public Health*. **9**: 421. doi: 10.1186/1471-2458-9-421.

14. Morrison TG, Kalin R, Morrison MA. (2004) Body image evaluation and body-image investment among adolescents: a test of sociocultural and social comparison theories. *Adolescence.* **39**: 571–592.

15. Wardle J, Griffith J. (2011) Socioeconomic status and weight control practices in British adults. *J Epidemiol Community Health*. **55**:185–190.

16. Jackson SE, Johnson F, Croker H, *et. al*. (2015) Weight perceptions in a population sample of English adolescents: cause for celebration or concern? *Int J Obes (Lond).* **39**(10):1488-93. doi: 10.1038/ijo.2015.126.

17. Currie C, Whitehead R, Van der Sluijs W, *et. al.* (Eds.) (2015) Health Behaviour in School-aged Children: World Health Organization Collaborative Cross-National Study (HBSC): findings from the 2014 HBSC survey in Scotland. St. Andrews, Scotland. Child and Adolescent Health Research Unit (CAHRU), University of St Andrews.

18. Currie C, Inchley J, Molcho M, *et. al*. (Eds.) (2014) Health Behaviour in School-aged Children (HBSC) Study Protocol: Background, Methodology and Mandatory items for the 2013/14 Survey. St Andrews: CAHRU. St. Andrews, Scotland. Child and Adolescent Health Research Unit (CAHRU), University of St Andrews.

19. Vereecken CA, Maes L. (2003) A Belgian study on the reliability and relative validity of the Health Behaviour in School-Aged Children food-frequency questionnaire. *Public Health Nutr*. **6**(6):581-8.

20. Prochaska JJ, Sallis JF, Long B. (2001) A physical activity screening measure for use with adolescents in primary care. *Arch Pediatr Adolesc Med*. **155**: 554-559.

21. Ridgers ND, Timperio A, Crawford D, *et. al*. (2012) Validity of a brief self-report instrument for assessing compliance with PA guidelines amongst adolescents. *J Sci Med Sport.* **15**(2), 136-141. doi: 10.1016/j.jsams.2011.09.003.

22. Bobakova D, Hamrik Z, Badura P, *et. al*. (2015) Test-retest reliability of selected physical activity and sedentary behaviour HBSC items in the Czech Republic, Slovakia and Poland. *Int J Public Health.* **60**(1):59-67. doi: 10.1007/s00038-014-0628-9.

23. Currie C, Molcho M, Boyce W, *et. al*. (2008) Researching health inequalities in adolescents: the development of the Health Behaviour in School-Aged Children (HBSC) family affluence scale. *Soc Sci Med.;* **66**(6):1429-36. doi: 10.1016/j.socscimed.2007.

24. Little, Roderick JA. (1988) A test of missing completely at random for multivariate data with missing values. *Journal of the American Statistical Association*. **83**,404:1198-1202.

25. Li, C. (2013) Little's test of missing completely at random. *The Stata Journal*.**13** (4):795-809.

26. Bennett DA. (2001) How can I deal with missing data in my study? *Aust N Z J Public Health*. **25**(5):464-9.

27. Chau N, Chau K, Mayet A, *et. al*. (2013) Self-reporting and measurement of body mass index in adolescents: refusals and validity, and the possible role of socioeconomic and health-related factors. *BMC Public Health*. 13, 815. doi: 10.1186/1471-2458-13-815.

28. Currie C, Zanotti C, Morgan A*, et. al.* (Eds.) (2012) Social determinants of health and well-being among young people. Health Behaviour in School-aged

Children (HBSC) study: international report from the 2009/2010 survey. Copenhagen (Denmark), WHO Regional Office for Europe, (Health Policy for Children and Adolescents, No. 6): WHO.

29. The Scottish government (2014). Obesity Indicators 2014: Monitoring Progress for the Prevention of Obesity Route Map. http://www.gov.scot/Topics/Statistics/Browse/Health/TrendObesity (Accessed 12 Apr, 2017).

30. Marques A, de Matos MG. (2016) Trends in prevalence of overweight and obesity: are Portuguese adolescents still increasing weight? *Int J Public Health.* **61**(1):49-56.

Table 1 Total HBSC Scottish sample size and weight response by age and gender.

	Boys		**Girls**		**Total**	
	n	%	n	%	n	%
Total	5461	50.4	5378	49.6	10839	100
11-year-old	2009	18.5	1944	17.9	3953	36.4
13-year-old	1836	16.9	1873	17.3	3709	34.2
15-year-old	1466	13.5	1453	13.4	2919	26.9
Missing age	150	1.4	108	1.1	258	2.5
	Boys		**Girls**		**Total**	
	n	%	n	%	n	%
Participants reporting weight	2368	21.9	2084	19.2	4452	**41.1**
	Boys		**Girls**		**Total**	
	n*	%	n*	%	n*	%
11-year-old	713	35.5	679	34.9	1392	35.2
13-year-old	817	44.5	731	39	1548	41.7
15-year-old	801	54.6	649	44.7	1450	49.7
Missing age	37	24.6	25	23.1	62	24.03

n=total sample. For the total sample, results are presented within the whole Scottish HBSC sample. n =proportional sample from the participants reporting weight. For the weight response, results are presented as the proportion within each age/gender group*

Table 2 Behavioural factors differences among Weight respondents and non-respondents from the Scottish HBSC 2014 study

	Total Population		*Weight respondents*		*Weight non-respondents*		*X^2 Bonferroni Correction**
	n	%	n	%	n	%	
Fruit Consumption							**<0.001**
Low	2191	20.2	825	18.5	1366	21.4	**<0.001**
Medium	4503	41.5	1820	40.6	2683	42.0	0.241
High	4072	37.6	1788	40.2	2284	35.8	**<0.001**
Vegetables Consumption							**<0.001**
Low	2470	22.8	828	18.6	1642	25.7	**<0.001**
Medium	4139	38.2	1709	38.4	2430	38.0	0.719
High	4151	38.3	1897	42.6	2254	35.3	**<0.001**
Sweet and Chocolate Consumption							0.145
Low	2071	19.1	829	18.6	1242	19.4	0.282
Medium	5125	47.3	2162	48.6	2963	46.4	0.025
High	3557	32.8	1442	32.4	2115	33.1	0.429
Sugary Drinks Consumption							**0.001**
Low	5122	47.3	2176	48.9	2946	46.1	**0.004**
Medium	3293	30.4	1367	30.7	1926	30.2	0.539
High	2351	21.7	893	20.1	1458	22.8	**<0.001**
Physical Activity							**<0.001**
Low	2168	20.0	751	16.1	1417	22.2	**<0.001**
Medium	3451	31.8	1406	31.6	2045	32.0	0.6310
High	4949	45.7	2222	49.9	2727	42.7	**<0.001**
Time Spent Watching Entertainment Screen on Week days							**<0.001**
Low	6258	57.7	2704	60.7	3554	55.6	**<0.001**
Medium	3261	30.1	1299	29.2	1962	30.7	0.085
High	814	7.5	273	6.1	541	8.5	**<0.001**
Time Spent Watching Entertainment Screen on Weekend days							0.016
Low	4161	38.4	1771	39.8	2390	37.4	0.012
Medium	4353	40.2	1809	40.6	2544	39.8	0.401
High	1791	16.5	691	15.5	1100	17.2	0.018
Time Spent Playing Games on a Computer on Week days							**<0.001**
Low	6490	59.9	2821	63.4	3669	57.4	**<0.001**
Medium	2686	24.8	1070	24.0	1616	25.3	0.132
High	1098	10.1	368	8.3	730	11.4	**<0.001**
Time Spent Playing Games on a Computer on weekend days							**<0.001**
Low	4848	44.7	2138	48.0	2710	42.4	**<0.001**
Medium	3350	30.9	1348	30.3	2002	31.3	0.237
High	2065	19.1	769	17.3	1269	20.3	**<0.001**
Time Spent Using Computers for Purposes other than Gaming on week days							0.044
Low	5815	53.6	2442	54.9	3373	52.8	0.036
Medium	2911	26.9	1227	27.6	1684	26.4	0.167
High	1572	14.5	608	13.7	964	15.1	0.036
Time Spent Using Computers for Purposes other than Gaming on weekend days							0.225
Low	4654	42.9	1934	43.4	2770	42.6	0.376
Medium	3283	30.3	1397	31.4	1886	29.5	0.039
High	2319	21.4	936	21.0	1383	21.7	0.432

n= number of participants that report the behaviours in the Scottish HBSC 2014 sample. %: percentage of the whole Scottish HBSC 2014 sample. X^2 Bonferroni Correction= chi square tests results corrected by Bonferroni adjustment considering <0.006 results as statistical significant among weight respondents and weight non-respondents.*

Table 3. Weight response predictors

	B	SE	Sig.	OR	OR 95% CI	
					Lower	Upper
FAS Classification			<0.001			
Low (ref)						
Medium	-0.26	0.05	<0.001	0.83	0.75	0.91
High	-0.26	0.05	<0.001	0.76	0.69	0.84
Gender			<0.001			
Boys (ref)						
Girls	0.22	0.04	<0.001	1.24	1.15	1.35
Age			<0.001			
11 years (ref)						
13 years	-0.35	0.05	<0.001	0.69	0.63	0.77
15 years	-0.71	0.05	<0.001	0.49	0.44	0.54
Physical Activity			<0.001			
Low	0.186	0.05	0.001	1.20	1.07	1.35
High	-0.215	0.04	<0.001	0.80	0.73	0.88
Vegetables Consumption			<0.001			
Low	0.22	0.55	<0.001	1.24	1.12	1.39
High	-0.17	0.04	<0.001	0.84	0.76	0.91
Computer Gaming (week days)			<0.001			
Low	-1.66	0.04	<0.001	0.84	0.77	0.92
High	0.16	0.07	.0032	1.18	1.01	1.37

Ref=reference group. FAS: Family Affluence Scale; SE: Standard Error; OR: Odds Ratio; CI: Confidence Interval; Sig: Statistical significance was considered p <0.05.