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Association of poverty and social exclusion with Body Mass Index among Special Olympics athletes in Europe

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Abstract

Objectives: To examine the association of a risk of poverty and social exclusion (AROPE), age, and gender with the Body Mass Index (BMI) status of European Special Olympics athletes.

Methods: BMI records were available for 1,905 children and youth and 5,517 adults from the Special Olympics International (SOI) Health Promotion database. AROPE was extracted from EU Eurostat statistics. Logistic regression analyses were used to predict BMI status.

Results: For children/youth and adults respectively, 9.4% and 6.3% were underweight and 25.3% and 44.6% were overweight/obese. Being underweight was significantly associated with higher AROPE rates. Being female, and lower AROPE rates, were significantly associated with overweight/obesity for both children/youth (OR=1.27; 95% CI: 1.07-1.50 and OR=0.97; 95% CI: 0.96-0.98) and adults (OR=1.55; 95% CI: 1.39-1.72 and OR=0.96; 95% CI: 0.95-0.98).

Conclusions: The Europe 2020 "platform against poverty" strategy aims to ensure that those experiencing poverty and social exclusion share the benefits of economic growth. These findings suggest that SOI health promotion efforts to foster healthy BMI is needed and should be tailored to specific social and economic circumstances in Europe.

Keywords: intellectual disability; underweight; overweight; Special Olympics; Body Mass Index; poverty and social exclusion

Introduction

A flagship initiative of the Europe 2020 strategy is the "European platform against poverty" (European Commission 2010, p.6). The initiative aims to reduce the number of people living in poverty by 25% by 2020, and to enable them to “live in dignity and take an active part in society” (European Commission 2010, p.19). To that end, the European Commission annually monitors indicators of poverty and social exclusion (Eurostat 2016a). In 2014, 24.4% of the entire EU population and 27.8% of EU children lived in households experiencing poverty or social exclusion (AROPE) (Eurostat 2016a). AROPE is defined in the Europe 2020 strategy as the proportion of the population experiencing at least one of the following conditions: at risk for monetary poverty, severe material deprivation, or living in a household with a very low work intensity (Eurostat 2016c). What is unknown from these statistics is how European individuals with an intellectual disability (ID) are impacted in terms of their health.

Intellectual disability

Intellectual disability (ID) is a disability characterised by significant limitations in intellectual functioning and adaptive behaviour, with onset occurring in the person’s developmental years (Schalock 2011). ID is a multidimensional state of human functioning and affects a person’s everyday life. Compared with people without an ID, individuals with an ID are socially vulnerable (McGrath et al. 2010), experience lower quality of life (Nota et al. 2007), have high rates of mental health concerns (Bigby 2012), and they are less self-determined (Nota et al. 2007). Overall, the international literature suggests that they are a vulnerable population that exists on the peripheries of society (Emerson 2007).

Poverty and ID are often present concurrently, and Emerson (2007) suggests that this association reflects two distinct processes. First, poverty causes ID because those living in poverty are exposed to environmental and psychosocial hazards such as poor nutrition and housing or environmental toxin. Second, individuals with an ID and their families experience poverty because people with ID are often

54 excluded from the workforce and those caring for individuals with ID often assume additional financial
55 and social responsibilities (Emerson 2007). Emerson also notes that the association between poverty and
56 ID "…accounts in part for the health and social inequalities experienced by people with intellectual
57 disabilities and their families" (Emerson 2007, p.107). Therefore it might be expected that as a result of
58 their increased risk of exposure to poverty, people with ID will have poorer health and greater rates of
59 social exclusion than their peers without ID.
60
61 Overweight and obesity of individuals with ID in Europe
62
63 Adults with ID in countries of the EU generally have high rates of overweight and obesity, particularly
64 among women (Bhaumik et al. 2008; Gazizova et al. 2012; Melville et al. 2008). However, the vast
65 majority of studies showing this trend have been drawn from samples in the United Kingdom (Bhaumik
66 et al. 2008; Gazizova et al. 2012; Melville et al. 2008). Evidence from other EU countries is limited.
67 Smaller samples (n = 38) from Spain (Soler Marín and Xandri Graupera 2011) and (n = 129) from
68 Sweden (Bergström et al. 2013) and a larger sample (n = 945) of older adults with an ID from the
69 Netherlands (de Winter et al. 2012), show rates of obesity that are consistent with the findings from the
70 UK. These trends are a concern, since high BMI levels place individuals with ID at greater risk for
71 hypertension (Bhaumik et al. 2008; Sohler et al. 2009), hypercholesterolemia (Sohler et al. 2009), high
72 serum triglycerides (Gazizova et al. 2012), Type 2 diabetes (Sohler et al. 2009), and the metabolic
73 syndrome in general (Hsu et al. 2012).
74 There is limited research on the rates of obesity in children and youth with ID in the EU. Lloyd
75 et al. (2012) studied worldwide obesity rates in Special Olympics participants, and found in a sample of
76 1,137 children and youth participating in Special Olympics from Europe/Eurasia (n= 749 boys), that
77 21.9% of the boys and 30.9% of the girls were overweight or obese. However, the sample from Lloyd et
78 al.'s study included many Eurasian countries not in the EU; therefore it is difficult to generalize these

BMI findings to the EU. Country specific studies have also reported high rates of overweight and obesity; for example a study (n = 1,120) in France demonstrated that 21.7% of the children with an ID were overweight and an additional 10.1% were obese (Begarie et al. 2013). These authors also found that 19% of youth with ID were classified as overweight and a further 7.2% were obese. Despite these data from one high-income country, the general picture of overweight/obesity rates among children and youth with ID in the EU is unclear.

Underweight among individuals with ID in Europe

The rates of underweight (BMI $\leq$ 18.5) among adults with an ID in Europe range widely. In the UK, when measured directly, the rates of underweight appear to range from 5-6% (Melville et al. 2008) to 18.6% (Bhaumik et al. 2008). However, Bhaumik et al. reported that the high rate of underweight was associated with having profound ID, although these authors did not report the proportion of their sample with profound ID. Excluding the very high rates of underweight reported by Bhaumik and colleagues (2008), in general, rates of underweight among individuals with ID seem to be lower in EU countries outside of the UK. In Spain, Soler Marin and Xandri Graupera (2011) found that 0% of women and 4.3% of men with Down syndrome were underweight, and Bergström et al. (2013) found that 2.4% of their sample 63 Swedish adults with ID were underweight. Where studies in the EU have reported the underweight status of men and women separately, men have higher rates of underweight (Bhaumik et al. 2008; Melville et al. 2008; Soler Marín and Xandri Graupera 2011). Although evidence of morbidity and mortality of underweight adults with an ID is not evident in the literature, underweight is associated with an increased risk of respiratory disease and infection (Prospective Studies Collaboration 2009) as well as hospitalization and all-cause mortality (Weitoft et al. 2008) in the general population.

Evidence related to rates of underweight in children and youth with ID is extremely limited. A study from Turkey (n = 70) found 5.4% of children and youth with ID were underweight (Sari and

Bahceci 2012) and another study from Denmark (n = 117) on children and youth with autism spectrum disorder found 31% of males and 12% of females were below the 10th BMI percentile (Mouridsen et al. 2002).

Disability and poverty

Disability, poverty, and social exclusion seem to be causally related, but the extent and significance of the causal links between disability and poverty is expected to vary across disability types and across communities (Braithwaite and Mont 2009). However, very little comparative quantitative research has been undertaken (Braithwaite and Mont 2009). The impact of country economic status, specifically on the BMI amongst individuals with an ID, has been examined in two recent studies using the Special Olympics Healthy Athletes database; one paper focusing on children (Lloyd et al. 2014) and one focusing adults (Temple et al. 2015). These related studies used The World Bank's classification of country economic status to examine BMI among Special Olympics participants from 159 countries. Among almost 20,000 adults, Temple et al. (2015) found that the rate of underweight was high in low-income countries (17.2%), still relatively high in upper-middle income and low middle-income countries (10.8% and 9.6%, respectively), and lowest in high-income countries (4.6%). Whereas obesity rose from 4.2% in low-income countries to 34.1% in high-income countries; however there were significant sex-based differences with women more likely to be obese at every level of economy. Lloyd et al. (2014) found, in a sample of 14,032 children and youth, that the proportion who were underweight was: 10.0% in low-income countries, 2.0% in low-middle income countries, 3.2% in upper-middle income countries, and 2.7% in high income countries. These data indicate that the rates of underweight of children and youth with ID were higher than the rates published for children and youth with non-ID groups in the same economic status (Lloyd et al. 2014). Lloyd and colleagues (2014) found the prevalence of overweight and obesity, respectively were: 14.8% and 3.1% in low income countries, 23.6% and 5.4% in

low-middle income countries; 15.9% and 6.2% in upper-middle income countries, and 21.6% and 18.0% in high income countries. These broad world trends in BMI status of adults and children with an ID based on macro-level indicators have not been examined in regional samples. The aim of the current study was to report the rates of underweight and overweight/obesity of children and youth, and adult Special Olympics participants in the EU. In addition, we investigated the extent to which age, risk of poverty, and social exclusion (measured by AROPE), and gender predicted rates of underweight and overweight/obesity to better understand how personal and socio-economic variables impact on BMI status in this sample of Special Olympics participants from the EU.

Methods

Data source

Special Olympics is a global not-for-profit sporting organization serving approximately 5 million people with ID around the world (Special Olympics 2016). Special Olympics has programs in over 170 countries and offers free health screenings at local, State/Provincial, National, and World Games. Data from the health screenings are entered into Special Olympics databases. Before participation in all Special Olympics events, athletes and/or their guardians sign a medical release/consent form to participate in their respective event(s). As part of this document, separate consent is given for the participation in Healthy Athletes screenings which includes consent for the de-identified data to be used to report on the health of Special Olympics athletes. Currently Special Olympics is the largest single source of international health surveillance data and health services for people with ID in the world (Special Olympics 2016). For the present study, Special Olympics provided access to the following variables from their Health Promotion database: gender, age, event, location, delegation (specifically 28 EU-countries and three European Free Trade Association (EFTA) countries), height, and weight. The AROPE rate for each of these EU-28 and EFTA countries was obtained from Eurostat (Eurostat 2016a). The AROPE rate represents the proportion of the population experiencing monetary poverty, severe

material deprivation, or very low work intensity (Eurostat 2016b). Height and weight were assessed directly by trained personnel at Special Olympics events using protocols developed by Special Olympics (2007). Weight was measured to 0.1kg using digital scales and height was measured to the nearest 0.1cm using portable stadiometers. Ethics approval for this secondary analysis was provided by the institutional ethics review committee of each author's university.

Data cleaning and analyses

The initial data of 8,506 available entries for both children/youth aged 8-17 years old and adults aged 18-65 years old from 2006-2013 were examined and filtered to remove extreme or missing values. This methodology for data cleaning was based off previous studies using the Special Olympics database (Temple et al. 2015). The values for inclusion of adults were height between 121.9cm and 238.8cm and weight between 30.0kg and 317.5kg as identified in previous work (ALSWH 2007). For children/youth, height and weight values between +/-5 z score as identified using the ZANTHRO macro for Stata were retained (Vidmar et al. 2004).

Listwise deletions were used when anthropometric, gender, age, or country data were missing or determined to be extreme; total number of cases excluded were 1099 (13%). Data from the EU-28 and EFTA countries in the Eurostat database were extracted on February 16, 2016. The AROPE rate data for each of the participant's home country were matched to the participants' event year (year in which the SO event took place) that the healthy athlete data was collected. To increase the sensitivity of the analysis, subgroup values from Eurostat were used. These subgroup data provide a specific AROPE rate value for gender and the following age groups: <16y, 16-24y, 25-54y, and >54y.

The International Obesity Task Force (IOTF) cut points were used to determine overweight and obese weight status for children (Cole et al. 2000) and the World Health Organization grade 1 thinness value (an age-adjusted BMI of < 18.5) was used to compute underweight (Cole et al. 2007). For adults

179 World Health Organization (1995) cut-points: Underweight <18.5, Normal range 18.5-24.9, Overweight
180 25.0–29.9, and Obese ≥30 were applied.
181 A series of multiple logistic regressions were run to examine how the following model with three
182 predictor variables: gender (as a dichotomous variable; male = 0, female =1), age (as a continuous
183 variable), and AROPE rate (as a continuous variable) were associated with the likelihood (i.e. Odds
184 Ratio, OR) of being in a given weight status (underweight – not underweight or overweight/obese – not
185 overweight/obese). An OR is an indicator of the probability of a condition such as overweight/obesity
186 resulting from a unit change in a predictor e.g. age (Persoskie and Ferrer 2017). As such, and as an
187 example, a significant association between age and rate of overweight/obesity (e.g. OR = 1.04) means
188 that for every 1 year increase in age the odds of being overweight are increased by approximately 4%.
189 To adjust for the lack of independence associated with clustering by country a robust estimator
190 of variance was used with a clustering option. These analyses were performed for children and adults
191 separately. Data were analyzed using STATA/MP Version 12 for windows (StataCorp LP, College
192 Station, TX).
193
194 **Results**
195 A total of 7,422 (1,905 children/youth and 5,517 adults) Special Olympics participant BMI records were
196 available. Of the child/youth sample 173 were children < 12 years of age and 1,732 were 12 – 18 years of
197 age. Mean age, height, and weight as well as the proportion of children/youth and adults in each BMI
198 category are presented in Table 1. Table 2 shows that a higher AROPE rate (higher risk of poverty and
199 social exclusion) was significantly associated with higher rates of underweight for children/youth and
200 adults (OR = 1.03 and OR = 1.04, respectively). In addition, being older (OR = 1.06) and male (OR =
201 0.82) was associated with higher rates of underweight among children/youth; and being younger was
202 associated with higher rates of underweight among adults (OR = 0.94). Lower AROPE rates and being

female were significant predictors of overweight/obesity for both children/youth and adults (see Table 2). Further, among adults, rates of overweight/obesity were higher with increasing age (OR = 1.04).

Discussion

The aim of this study was was to report the rates of underweight and overweight/obesity of children and youth, and adult Special Olympics participants in the EU, and to examine the association of AROPE rate with the BMI status of European Special Olympics participants. Results indicate that the rates of underweight, overweight and obesity in European Special Olympics participants were higher than would be expected in the general population. Our findings also indicate that the risk of poverty and social exclusion (high AROPE rate) is associated with the BMI status (underweight and overweight/obese) of both children and adults with ID who participate in Special Olympics in the EU.

Prevalence of underweight

Among the adults, rates of underweight were relatively consistent between males and females. This rate of approximately 6% was higher than previously found among adult Special Olympics athletes from Europe/Eurasia (i.e. around 4.5%); but similar to other studies of adults with ID in European countries where BMI has been directly measured (Gazizova et al. 2012; Melville et al. 2008). In our data there was that 82% of the adults who were underweight came from four countries, and more than half of those came from one country. That particular country had one of the highest AROPE rates in 2010 indicating an extreme risk of poverty and social exclusion for the entire country (Antufermo and Di Meglio 2012). Our results indicate that individuals with ID are at high risk of being underweight when the AROPE rate is high; and being underweight is a significant predictor of health. Although an overall underweight prevalence of 6% at the population level is a relatively low prevalence from a public health perspective (World Health Organization 1995), there were countries with higher overall rates of underweight, which

suggests closer monitoring is needed. At an individual level, Special Olympics suggests that athletes considered underweight should be referred to a health professional, however the extent to which this referral is followed up by the individual, their family, or care-providers is unknown.

The underweight rate for children/youth was quite high at 9.4% in our study. Although many of the underweight children/youth in this study were from countries with high rates of poverty and social exclusion, this was not universally the case. Underweight was also evident in countries with low poverty rates. Being underweight is a significant indicator of poor health in children and in adults (Black et al. 2003; Prospective Studies Collaboration 2009; Weitoft et al. 2008); and therefore, further surveillance is needed to verify these findings and health promotion efforts are needed to identify the aetiology of the underweight status in children and how to prevent it.

Prevalence of overweight and obesity

The proportion of overweight/obese adults in the present study was very similar to the proportion identified as being overweight/obese in a Special Olympics sample from Europe/Eurasia (Temple et al. 2013). However, the rates of overweight/obesity in our study were lower than rates of overweight/obesity among adults with ID in Sweden (69.9%) (Bergström et al. 2013), older adults with ID in the Netherlands (males = 52.9%; females =75.1%) (de Winter et al. 2012), and adults with ID in the United Kingdom (Melville et al. 2008). It is perhaps not surprising that our rates were lower than for individuals with ID in the United Kingdom, since in the general population, the United Kingdom has the third highest rate of excess weight in Western Europe (Ng et al. 2014). Furthermore, our sample was considerably younger than the de Winter et al. sample, and as the odds of being overweight/obese increase with age (Temple et al., 2014), lower rates of overweight and obesity seem sensible. However, as the living circumstances of participants in this study are not known, it is unclear why the rate of overweight/obesity was lower in the present study than the rate reported for those living semi-

253 independently in Sweden (Bergström et al. 2013). Even though the rates of overweight/obesity in this
254 study were lower than in many previous studies, these rates were still high which is indicative of poor
255 health.

256 The combined overweight/obesity rate of children/youth in this study was 25.3%, with females
257 having significantly higher rates than males. Given that 90% of the children/youth in the present study
258 were 12 years of age or older, our findings suggest that more than a quarter of adolescents with ID
259 participating in Special Olympics in the EU are overweight/obese. This is particularly troubling since
260 childhood obesity status moderately predicts adult obesity status, and the persistence of obesity from
261 adolescence to adulthood is high (Simmonds et al. 2015). Research to elucidate factors contributing to
262 these high rates of obesity in young people with ID is urgently needed. This research needs to extend
263 beyond calorie input and output to include other known contributing factors such as the adequacy of
264 sleep, the impact of medications, syndrome specific factors, as well as key aspects of the child/youth's
265 social and cultural environment, for example: food as rewards, family socio-economic status, and foods
266 available at home and at school (Harrison et al. 2011).
267
268 Risk for poverty and limitations of the study
269
270 Higher rates of AROPE, defined in this study as higher risk of monetary poverty, material deprivation,
271 or low work-intensity (Eurostat 2016c), was significantly associated with higher rates of underweight for
272 children and adults. This means that for individuals with ID who are at high risk of poverty and social
273 exclusion, the risk of being underweight is also elevated. These findings are consistent with findings for
274 children (Lloyd et al. 2014) and adults (Temple et al. 2015) with ID in global samples stratified by
275 country economic status. For adult European Special Olympics participants, being younger and from a
276 country with higher rates of AROPE were associated with higher rates of underweight. However,
277 underweight was a more pervasive problem among children than adults in this sample, particularly

among boys. These underweight rates are higher than previously reported rates for children and youth with ID in the region (Mouridsen et al. 2002; Sari and Bahceci 2012). Lower AROPE, defined in this study as lower risk of monetary poverty, material deprivation, or low work-intensity, was significantly associated with overweight/obesity for both children and adult Special Olympics participants. In other words, the lower the risk of poverty and social exclusion, the higher the rates of overweight and obesity in this sample. Again, these findings are consistent with data derived from global samples by Lloyd et al. (2014) for children and Temple et al. (2015) for adults, where the high-income countries had the highest proportion of overweight/obese participants and the low-income countries had the lowest proportion. In addition to lower risk of poverty and social exclusion predicting overweight/obesity, being a female Special Olympics athlete in our study was significantly associated with higher rates of overweight/obesity; especially for adult athletes. This is also consistent with previous evidence that children and adult female Special Olympics athletes from Europe/Eurasia (Lloyd et al. 2012; Temple et al. 2013) and from high-income countries (Lloyd et al. 2014; Temple et al. 2015), have higher rates of overweight/obesity than males.

The results of the present study show that higher poverty and social exclusion scores were associated with high rates of underweight, while conversely, lower poverty and social exclusion scores were associated with high rates of overweight/obesity among child and adult Special Olympics athletes in Europe. As there are adverse health outcomes associated with both high rates of underweight and with high rates of overweight/obesity (Prospective Studies Collaboration 2009), our findings reveal that Special Olympics athletes living in European countries with both high and low rates of poverty and social exclusion are at risk of poor health based on adverse BMI profiles. Further investigation into the living circumstance of Special Olympics athletes in Europe is warranted, including the availability of, and access to: appropriate nutrition, health promotion efforts, as well as health care and surveillance. Special Olympics could also play a role in promoting healthy body weight among

athletes by increasing their health promotion efforts and support, particularly in countries with high AROPE rates to mitigate the adverse effects of poverty and social exclusion on BMI status.

A limitation of our study is that we know the AROPE rate of each athlete's country but we do not know the personal economic status of each individual. It is possible that individuals with ID in low AROPE rate countries are also at risk of living in poverty and being socially excluded. In addition, although we mention that several countries have especially high AROPE rates and associated high levels of underweight and overweight/obesity, based on our data sharing agreement with SOI we are not allowed to name the specific country/ies. Further, we do not know the etiology of ID, medication use, athletes' living arrangements, associated health conditions and the like, because these are not part of the database, and therefore association/s to AROPE could not be examined. However, this does not detract from the general trends we found showing that high levels of poverty and social exclusion were associated with poorer BMI status and by extension increased risk of poor health.

A final limitation of this study is the fact that all the participants were Special Olympics participants limiting the generalizability of the results. It is possible that because all the participants in this sample were competing at local, national and international sporting events that they were more physically active than their peers with ID who do not regularly participate in Special Olympics. Therefore, our results may in fact underestimate the health concerns of people with ID. However, Special Olympics is an international organization with extensive reach and this is the largest global dataset on the health of individuals with ID. The results are further bolstered by the fact that height and weight are directly measured by trained professionals. More research is needed on a wider spectrum of participants with ID to understand if these results are generalizable.

Compliance with Ethical Standards

All procedures performed in the study were in accordance with the ethical standards of the institutional research committees of each participating university. (In order of authorship: University of Jyväskylä, University of Victoria, University of Ontario Institute of Technology, and State University of New York College at Cortland.)

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