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"What's a normal weight?" – Origin and receiving country influences on weight-status assessment among 1.5 and 2nd generation immigrant adolescents in Europe

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ABSTRACT

Many adolescents struggle with adequately assessing their weight-status, often leading to unnecessary weight-related interventions or preventing necessary ones. The prevalence of weight-status over- and underestimation differs considerably cross-nationally, suggesting that individual weight-status assessment is informed by cross-nationally differing standards of evaluation. For adolescents with a migration background, this brings up the possibility of a simultaneous influence of origin- and receiving country standards. The current study examines the magnitude of both influences using data from the 2014 Health Behaviour in School-Aged Children study. The cross-national design of the study enabled us to aggregate weight-evaluation standards for 41, primarily European, countries. Subsequently, we identified a sample of 8 124 adolescents with a migration background whose origin as well as receiving country participated in the study. Among those adolescents, we assessed the effects of origin and receiving country weight-evaluation standards using cross-classified multilevel regression analyses. Descriptive analyses revealed considerable differences in weight-evaluation standards between the countries. Regression analyses showed that both origin- and receiving country weight-evaluation standards were significantly associated cross-sectionally with weight-status assessment among the immigrant adolescents, with a stronger impact of receiving country standards. Results illustrate the context-sensitivity of adolescent weight-status assessment and reinforce the theoretical notion that immigrant adolescent development is not only informed by factors pertaining to their receiving country but also, albeit to a lesser extent, by those pertaining to their origin country.

1. Introduction

Many adolescents struggle with an adequate assessment of their weight-status (Sutin and Terracciano, 2015). Because of this, over- or underweight among adolescents often go unnoticed, preventing necessary intervention or causing unnecessary, potentially detrimental weight-loss efforts. Estimates of the prevalence of weight-status over- and underestimation differ considerably across different national contexts, indicating that individual weight-status assessment may be informed by cross-nationally differing standards of evaluation. For adolescents with a migration background, who are often bridging origin and receiving country realities (Kwak, 2003), this brings up the question to what extent their weight-status assessment is informed by standards from their origin country and to which extent by those from their receiving country. The current study seeks to answer this question. Using nationally representative samples of adolescents from the 41, primarily European, countries participating in the 2013-14 Health Behaviour in School-Aged Children Study (HBSC), we aggregated weight-evaluation standards among adolescents in those countries. Subsequently, we identified a sample of 8 124 adolescents with a migration background whose origin as well as receiving countries were among the participating countries. On this sample, we performed cross-classified multilevel regression analyses to determine the extent to which their weight-status assessment was informed by

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weight-evaluation standards from their origin and receiving countries. Research examining how origin and receiving country factors influence health, health behaviors and health beliefs among immigrants in general and immigrant adolescents in particular is extremely scarce (Acevedo-Garcia et al., 2012; Huijts and Kraaykamp, 2012; Stevens and Walsh, 2019), and, to the best of our knowledge, no study, to date, has examined such influences on weight-status assessment among immigrant adolescents.

1.1. Weight-status assessment among adolescents

We use the term weight-status assessment to describe how people perceive their weight-status in comparison to their actual weight-status. One's perception of one's weight-status may coincide with one's actual weight-status or it may deviate. This deviation in turn can either take the form of weight-status overestimation or weight-status underestimation (Fan et al., 2014).

Both weight-status over- and underestimation are associated with negative consequences. Adolescents who overestimate their weight-status often limit their intake of healthy foods and are more likely to engage in unhealthy weight control behaviors such as skipping meals, use of diet pills, or vomiting (Armstrong et al., 2014). Potential consequences can include eating disorders, stunted physical growth or delayed puberty (Dues et al., 2019; Isomaa et al., 2011). Weight-status underestimation, which is particularly common among adolescents with overweight, is associated with less motivation for weight-loss, less weight-reduction behavior (Chung et al., 2013; Edwards et al., 2010; Fan et al., 2014) and less healthy lifestyle behaviors (Maximova et al., 2008), all of which are likely to carry on into adulthood.

A number of individual characteristics, most prominently sex, actual weight-status, age, and socio-economic status (Fan et al., 2014), have been linked with adolescent weight-status assessment. While girls are more likely than boys to overestimate their weight-status, boys are more likely to underestimate theirs (Andrade et al., 2012; Brug et al., 2006; Viner et al., 2006). Equally well-documented is a tendency for individuals with overweight to underestimate their weight-status and for individuals with underweight to overestimate theirs (Kimber et al., 2015; Yan et al., 2009). Results on the association between age and weight-status assessment during adolescence are less clear. This may be because the age effect is not uniform across sexes. While older girls tend towards a higher weight-status assessment when compared to their younger counterparts, older boys, in comparison to younger ones, have a tendency towards lower weight-status assessment (Kaltiala-Heino et al., 2003; Ojala et al., 2007). Some studies, mainly among adult samples, have also found that higher socio-economic status is associated with higher weight-status assessment (Alwan et al., 2010; Gregory et al., 2008; Paeratakul et al., 2002).

1.2. Cross-national variation in weight-status assessment

Cross-nationally differing standards of evaluation seem to play an important role in shaping the way individuals assess their weight-status. Estimates of the prevalence of weight-status over- and underestimation differ considerably across countries (Zaborskis et al., 2008). For example, while only 1.5% of Dutch adolescents with overweight were found to underestimate their weight-status (Brug et al., 2006), 53% of US adolescents with overweight did (Chung et al., 2013). Estimates of the prevalence of weight-status overestimation among adolescents with normal weight differ to a similar extent between 5 and 7% in the US (Chung et al., 2013) and UK (Viner et al., 2006) respectively and 27% in the Netherlands (Brug et al., 2006). Similarly indicative of cross-national variation in the relationship between objective and subjective weight-status are a number of cross-nationally comparative studies (Mikolajczyk et al., 2010; Page et al., 2006; Wardle et al., 2006). Page and colleagues, for example, comparing adolescents from three world regions, found a strong inclination towards underestimation of weight-status within their US sample and an equally strong inclination towards overestimation among Asian adolescents (Page et al., 2006). Mikolajczyk and colleagues found some evidence for intra-European variation in weight-status assessment. In particular, participants from Germany were more inclined towards overestimation of weight-status than participants in any of the other six participating European countries, whereas those from Lithuania were more inclined towards underestimation (Mikolajczyk et al., 2010). Similarly, Ojala and colleagues found some intra-European variation in the association between objective weight-status and weight-reduction behavior (Ojala et al., 2007). In particular, they found that while in some countries, such as, Denmark, France, Switzerland and Belgium the prevalence of trying to lose weight was relatively high among overweight adolescents and they were considerably more likely to try to lose weight than their non-overweight counterparts, in other countries, such as, Russia or Lithuania the prevalence of trying to lose weight among overweight adolescents was markedly lower and differences to non-overweight adolescents were less pronounced. Further cross-national variation can be found in body size ideals (Forbes et al., 2012), and weight-related attractiveness judgements (Swami et al., 2007a, 2007b, 2009). These findings suggest that individuals, when assessing their weight-status, apply cross-nationally differing standards of evaluation. Explanations for this are typically sought in differing national aesthetic traditions (Carof, 2017) or different frames of reference due to cross-national variation in average BMI or the prevalence of over- and underweight (Mellor et al., 2014; Wardle et al., 2006). For immigrant adolescents, the existence of such cross-national variation in weight-evaluation standards brings up the question of the extent to which their weight-status assessment is shaped by weight-evaluation standards from their origin country and to which extent it aligns with weight-evaluation standards in their receiving country.

1.3. Adolescents with a migration background: between origin and receiving country standards

While native adolescents are primarily affected by conditions in their country of residence, for immigrant adolescents their country of origin can be relevant as well (Acevedo-Garcia et al., 2012). We can distinguish between first and 1.5 generation immigrants on the one side and 2nd generation immigrants on the other side. First and 1.5-generation immigrants are individuals who themselves migrated from another country to the receiving country, in the case of first generation immigrants, as adults or, in the case of 1.5-generation immigrants, as minors accompanied by their parents. Second generation immigrant describes individuals born in the receiving country to parents born outside of it. First and 1.5 generation immigrants lived previously in their country of origin for a certain amount of time. As a result, they might have first-hand experience of origin country societal norms regarding what constitutes normal-, over- and underweight. From a life-course perspective, it can be argued that these earlier exposures to evaluative standards in the origin country can have sustained effects on the way they assess their weight-status even after having migrated (Acevedo-Garcia et al., 2012). Second generation immigrant adolescents might internalize these origin country standards, after having been exposed to them through their parents. Additionally, transnational theory suggests that first- and 1.5 as well as 2nd generation immigrants often continue to engage with their origin country for example via media consumption or social ties with friends or family members and, as a consequence, often continue to be influenced by origin country conditions (Acevedo-Garcia et al., 2012; Cook et al., 2015; Soehl, 2017). Weight-evaluation standards might be among those. Such a continued influence of origin country weight-evaluation standards could help explain the often observed interethnic differences in weight-status assessment (and related concepts) between immigrants within the same receiving country (Bush et al., 2001; Martin et al., 2010; Nicolaou et al., 2012; Park, 2011).

In terms of the extent to which weight-status assessment among

adolescents with a migration background aligns with evaluative standards from either the origin or the receiving country, theory suggests that receiving country standards might be more influential. Both developmental theories which emphasize the importance for adolescents to feel socially accepted (Collins and Steinberg, 2007) and theories of cultural dissonance (Wang et al., 2012) stress the tendency for adolescents with a migration background to learn and internalize the new culture quickly, and, as a consequence, to be more influenced by the receiving than the origin country.

Furthermore, theory suggests, that receiving country standards are more influential among 2nd generation immigrant adolescents (i.e., those born in the country of residence to immigrant parents) than among 1.5-generation immigrant adolescents (i.e., those born outside the country of residence but who immigrated prior to the age of 18). The central notion behind this is that as adolescents spend more time in the receiving country, their attitudes, values and behaviors reflect those of the receiving country more strongly (Berry, 1997). In line with this, a number of researchers investigating the so-called immigrant paradox, the finding that, 1st or 1.5-generation immigrants often exhibit better health outcomes than their native or 2nd generation peers, have attributed this to 2nd generation immigrants' stronger convergence towards receiving country health behaviors and beliefs (Antecol and Bedard, 2006; Marks et al., 2014). Conversely, origin country standards might have a more pronounced effect on 1.5-generation immigrant adolescents with first-hand experience of living in the origin country than among 2nd generation immigrants whose exposure to these standards is of a more indirect nature.

Empirical research examining how relevant such origin country factors are for immigrants and how they compare in relevance to receiving country factors is extremely scarce (Huijts and Kraaykamp, 2012). A small number of studies investigating attitudes among adults with a migration background found that their attitudes are informed both by those prevalent in their origin as well as those prevalent in their receiving country, with the receiving country being more influential (Helliwell et al., 2016; Soehl, 2017). Research examining the influence of origin country factors on immigrant adolescents has been primarily concerned with substance use. In line with theory, a positive association was found between the prevalence of certain substance use behaviors in immigrant adolescents' origin country and their own substance use behavior (Barsties et al., 2017; Cook et al., 2015; Sarasa-Renedo et al., 2015). However, with the exception of the study conducted by Barsties and colleagues, they each conducted their study only among immigrant adolescents in one receiving country, severely limiting the generalizability of their results (Huijts and Kraaykamp, 2012), and none of them simultaneously assessed the effect of receiving country factors. Barsties et al. (2017), on the other hand, employed a so-called double comparative design (Huijts and Kraaykamp, 2012). This means they used a sample of immigrant adolescents from multiple origin countries in multiple receiving countries to simultaneously examine origin and receiving country effects. They found that origin country alcohol per capita consumption was more relevant for immigrant adolescent drinking behavior than receiving country alcohol per capita consumption, emphasizing the relevance of origin country standards for immigrant adolescent behaviors.

Research investigating influences of origin and receiving country standards on weight-status assessment among people with a migration background is even sparser. In a study of women of Mexican origin in the US, Altman and colleagues found evidence of an influence of origin country standards that faded with length of residency in the US and a receiving country influence that increased in parallel (Altman et al., 2018). Yet, as far as we know, no research to date has focused on adolescents or has employed a double comparative design, making it difficult to assess how generalizable those findings are.

1.4. The current study

The current study seeks to address this gap in the literature. Employing a double comparative study design, with a sample of immigrant adolescents from 41 primarily European origin countries in 23 European receiving countries, we assess the extent to which origin as well as receiving country weight-evaluation standards inform weight-status assessment among adolescents with a migration background. In line with theory, we expect weight-status assessment to be informed by weight-evaluation standards from both their origin as well as their receiving country, with a stronger influence of the receiving country (Hypothesis 1). Furthermore, we expect the origin country effect to be stronger among 1.5 than 2nd generation immigrant adolescents and the effect of receiving country weight-evaluation standards to be stronger among 2nd than among 1.5-generation immigrants (Hypothesis 2).

2. Methods

2.1. Sample

The study used data from the 2013-14 Health Behaviour in School-Aged Children (HBSC) study. The HBSC is a large school-based cross-sectional cross-national survey carried out in over 40 primarily European countries (for a list of the 41 participating countries in 2013–14 see Table 2) which examines health behavior and its social determinants among children and adolescents, aged 11, 13, and 15 (Currie et al., 2013). The survey is conducted by teams of researchers in each member country led by Principal Investigators approved by the International Coordinating Centre currently based at the Child and Adolescent Health Research Unit at the School of Medicine at the University of St Andrews in Scotland. Data collection is organized in accordance with the international research protocol which details instruments and data collection procedures and ensures comparability of samples across countries (Inchley and Currie, 2013). Individual country samples are nationally representative. Informed consent was obtained from all individual participants or their legal guardians, in line with the ethical demands in each country. An important advantage of HBSC is the large number of participating countries. The majority of adolescents with a migration background who participated in the 2013-14 HBSC study originated from countries in which the HBSC study was conducted as well. This made it feasible to determine both origin and receiving country weight-evaluation standards for those adolescents based on HBSC data.

Weight-evaluation standards for the different countries were aggregated based on data from all 41 participating countries comprising a total sample of 166 798 adolescents. Subsequent analyses were performed on a subset of this data consisting of adolescents with a migration background whose origin, as well as receiving, country participated in the study. In 23 countries, participants were asked to indicate their own as well as their parents' country of birth based on which migration background, immigrant generation and origin country were assessed. Among the 14 024 adolescents with a migration background in those countries 8 638 (62%) originated from another of the 41 countries that participated in the HBSC study, and, consequently, remained in the sample. Among those, 514 (6%) participants had to be excluded from further analysis because they did not have valid responses on all of the variables in the model. Accordingly, a sample consisting of 8 124 adolescents with a migration background in 23 receiving countries from 41 origin countries was used to answer our research questions.

2.2. Measures

2.2.1. Weight-status assessment

To determine weight-status assessment among individuals, we employed an index measuring feel-status minus actual status inconsistency (FAI). The FAI is a bi-directional measure of weight-status assessment where a negative value represents weight-status

underestimation and a positive value represents weight-status overestimation with a value of zero indicating adequate weight-status assessment (Toselli et al., 2019; Zaccagni et al., 2014). The FAI was calculated by assigning scores to individuals' weight-status based on self-reported height and weight and to individuals' perceived weight-status, and subsequently subtracting the former from the latter.

Weight-status was assessed through individual BMI, calculated from self-reported height and weight. Classification into weight-status categories was based on age- and sex-specific cut-off values, which were derived from the WHO growth reference for school-aged children and adolescents (Onis and Lobstein, 2010). Accordingly, adolescents were classified as moderately to severely underweight if they were more than 2 standard deviations (SD) below the median for adolescents of their age and sex, mildly underweight if they were between 2 SD to more than 1 SD below the median, normal weight if they were between 1 SD below and less than 1 SD above the median, overweight if they were between 1 SD and less than 2 SD above the median and obese if their BMI was at least 2 SD above the median. The assigned codes were 1 for moderately to severely underweight, 2 for underweight, 3 for normal weight, 4 for overweight, and 5 for obese.

Perceived weight-status was assessed using an item: "Do you think your body is … ?" Response categories were: 1 "Much too thin", 2 "A bit too thin" 3, "About the right size" 4, "A bit too fat", and 5 "Much too fat". The FAI was calculated by subtracting the assigned score on weight-status ranging from 1 for moderately to severely underweight to 5 for obese from the assigned score on perceived weight-status ranging from 1 for "Much too thin" to 5 for "Much too fat". Accordingly, the resulting FAI index ranges from −4 indicating the most severe underestimation of one's weight-status to +4 indicating the most severe overestimation.

2.2.2. Migration background

Adolescents were regarded as having a migration background if they themselves or at least one of their parents was born outside of the survey country. If they themselves were born outside of the survey country they were regarded as 1.5-generation immigrants, otherwise, they were regarded as 2nd generation immigrants. Adolescents with a migration background were classified as having one native parent if one of their parents was born in the receiving country.

Table 1
Numbers of adolescents with a migration background by receiving country and immigrant generation.

Receiving Country	1.5-Generation (%)	2nd Generation (%)	Total
Albania	95.1	4.9	267
Austria	36.5	63.5	104
Belgium	34.7	65.3	1058
Bulgaria	27.1	72.9	70
Croatia	23.3	76.7	296
Czech Republic	19.8	80.2	126
Denmark	21.4	78.6	192
Estonia	11.8	88.2	525
Finland	29.4	70.6	231
Germany	17.5	82.5	252
Greece	22.9	77.1	668
Iceland	66.9	33.1	267
Ireland	47.6	52.4	124
Italy	48.5	51.5	101
Luxembourg	28.5	71.5	1261
Portugal	29.4	70.6	153
Republic of Moldova	29.7	70.3	333
Romania	57.8	42.2	83
Scotland	43	57	437
Slovenia	21.5	78.5	316
Spain	81.5	18.5	81
Ukraine	10.6	89.4	359
Wales	35.7	64.3	820
Total	2603	5521	8124

Source: 2013-14 Health Behaviour in School-Aged Children Study.

2.2.3. Origin and receiving country

For 1.5-generation immigrant adolescents, we defined their origin country as their own country of birth. For 2nd generation immigrant adolescents, we defined their origin country as their mother's country of birth based on the mother's typically more pronounced role in their children's socialization (Knight et al., 2011). If the mother's country of birth was unknown or the receiving country, we defined their origin country as their father's country of birth. The receiving country was the survey country.

2.2.4. FAS

Family socio-economic status was measured using the HBSC Family Affluence Scale (FAS III). The FAS III is a linear composite of six items (e.g. number of computers, cars in household, family holidays) developed for children and adolescents (Hobza et al., 2017). Based on the FAS III age, sex and country specific percentiles were calculated and categorized into quintiles (Currie et al., 2013). FAS has been shown to be a reliable instrument that is easily answered by adolescents (Currie et al., 2008).

2.2.5. BMI z-score

To account for the relationship between actual weight-status and weight-status assessment, we controlled for actual weight-status using BMI z-scores. The BMI z-score is defined as individual BMI minus the age

Table 2
Numbers of adolescents with a migration background by origin country and immigrant generation.

Origin Country	1.5-Generation (%)	2nd Generation (%)	Total
Albania	30	70	404
Armenia	42.3	57.7	26
Austria	28.1	71.9	64
Belgium	21.9	78.1	137
Bulgaria	46.5	53.5	43
Canada	21.4	78.6	42
Croatia	7	93	142
Czech Republic	30.8	69.2	26
Denmark	53.2	46.8	94
England	37.1	62.9	1281
Estonia	55.6	44.4	45
Finland	39.3	60.7	28
France	24.3	75.7	577
Germany	24.2	75.8	654
Greece	90.9	9.1	197
Greenland	0	100	12
Hungary	21.4	78.6	28
Iceland	52.9	47.1	17
Ireland	34	66	50
Israel	27.8	72.2	18
Italy	35.8	64.2	386
Latvia	40.9	59.1	22
Lithuania	58.3	41.7	24
Luxembourg	71.1	28.9	38
Macedonia	34.4	65.6	90
Malta	0	100	3
Netherlands	39.7	60.3	229
Norway	52.4	47.6	21
Poland	48.8	51.2	361
Portugal	31.1	68.9	708
Republic of Moldova	37.7	62.3	114
Romania	60.2	39.8	246
Russia	17.7	82.3	1193
Scotland	23.3	76.7	30
Slovakia	18	82	100
Slovenia	9.6	90.4	52
Spain	36.6	63.4	123
Sweden	10.4	89.6	135
Switzerland	57.9	42.1	57
Ukraine	19.2	80.8	287
Wales	25	75	20
Total	2603	5521	8124

Source: 2013-14 Health Behaviour in School-Aged Children Study

Table 3
Descriptive statistics of immigrant sample.

Variable	Mean	Standard Deviation	Minimum	Maximum
All Immigrants				
FAI	.19	.89	−4	4
Age	13.83	1.65	10.58	16.5
FAS III	3.09	1.43	1	5
zBMI	-.01	1.22	−5.56	4.87
% Girls	51			
1.5-Generation				
FAI	.18	.88	−4	4
Age	13.91	1.65	10.58	16.5
FAS III	3.05	1.48	1	5
zBMI	0	1.21	−5.53	3.99
% Girls	49			
2nd Generation				
FAI	.20	.90	−4	4
Age	13.79	1.64	10.58	16.5
FAS III	3.11	1.41	1	5
zBMI	-.01	1.22	−5.56	4.87
% Girls	52			

Source: 2013-14 Health Behaviour in School-Aged Children Study

and sex-specific median BMI divided by the standard deviation. Age and sex-specific medians as well as the standard deviation were drawn from the WHO growth reference for children and adolescents.

2.2.6. *Weight-evaluation standards*

Origin and receiving country weight-evaluation standards were aggregated using data from all adolescents in the 41 countries participating in the study. They were operationalized as the sex-specific country mean FAI. Given that the FAI, which we used as an operationalization of weight-status assessment, captures an individual's inclination towards over- or underestimation of weight-status, the country mean of the FAI captures how inclined the average adolescent in the country in question is towards over- or underestimation of weight-status. We relied on the sex-specific country mean FAI, to account for the fact that sex differences in weight-status assessment are likely to differ between countries. To separate the effect of individual sex from the effect of origin and receiving country weight-evaluation standards in the regression analyses, we centered the weight-evaluation standards around the overall sex-specific mean of the FAI over all countries (Gollwitzer et al., 2015).

2.3. *Analysis*

Analyses were performed in two steps. As a first step, we investigated the extent to which origin and receiving country weight-evaluation standards informed individual weight-status assessment using a cross-classified multilevel regression model (Model 1). To avoid confounding through non-independence of observations within the same higher level-unit, multilevel models (MLM) separate the overall variance among observations in within unit- and between unit variance, thereby adjusting for the similarity of observations within the same unit (Hox et al., 2017). In the standard application, hierarchical MLM, each observation is part of only one higher level unit. For the present study, however, this structure is inappropriate as individual observations are neither independent of other observations from their receiving country nor of those from individuals with the same origin country. To account for this, when estimating effects of origin and receiving country weight-evaluation standards, we fit a cross-classified MLM with individuals simultaneously nested in their origin and receiving country (Dunn et al., 2015). Model 1 was performed in Stata using Iterative Generalized Least Squares (IGLS) estimation procedures and controlled for age, sex, the interaction between age and sex, FAS, BMI z-scores, a dummy for being a 1.5-generation immigrant, and a dummy for having one native parent.

In step two, we fit a second cross-classified multilevel regression model to assess whether effects of origin and receiving country weight-evaluation standards differed between immigrant generations. To this end, Model 2 included two cross-level interaction terms, one for 1.5-generation X origin country weight-evaluations standards and one for 1.5-generation X receiving country weight-evaluation standards. Model 2 was run in MLwiN using Markov Chain Monte Carlo (MCMC) estimation methods (Browne and Rasbash, 2009) and controlled for age, sex, the interaction between age and sex, FAS, BMI z-scores, and a dummy for having one native parent.

3. Results

Table 1 provides an overview of the immigrant sample by receiving country and immigrant generation. The largest groups of adolescents with a migration background in the sample lived in Luxembourg, Belgium and Wales. In all countries except Albania, Spain, Iceland, and Romania, there were more 2nd generation than 1.5-generation immigrant adolescents. In total, the sample consisted of 5521 (68%) 2nd, and 2603 (32%) 1.5-generation immigrant adolescents.

Table 2 provides an overview of the immigrant sample by origin country and immigrant generation. The biggest origin countries among immigrant adolescents in our sample were England, Russia, and Portugal.

Table 3 provides an overview of descriptive statistics for all individual-level variables in the model for the immigrant sample as a whole and divided by immigrant generation. The mean age for adolescents in the sample was 13.8 years old (51% girls). The mean FAI was 0.19, indicating a slight tendency towards weight-status overestimation over both sexes and all countries.

3.1. *Cross-national variation in weight-evaluation standards*

Results showed that weight-evaluation standards differed considerably between countries and within countries between sexes, with the mean FAI ranging from −0.4 among boys in Greece to +0.6 among girls in Poland. In all countries boys had significantly lower weight-evaluation standards than girls. In 37 of the 41 participating countries, weight-evaluation standards among girls were indicative of a tendency towards overestimation as evidenced by a mean FAI significantly larger than zero (see Fig. 1). Among boys, such a tendency towards overestimation was found in nine countries (see Fig. 2). A tendency towards underestimation was seen for girls in only one country, Macedonia, whereas for boys the same was true in 24 of the 41 countries. A particularly strong inclination towards weight-status underestimation can be found among boys in Greece, Macedonia and Canada. Boys and girls in the same country tended to be more similar to each other in their weight-evaluation standards than to adolescents of the opposite sex in other countries. Around 68% of the country variance in boys' weight-evaluation standards could be explained by weight-evaluation standards of girls' in their country and vice versa.

3.2. *Influence of origin- and receiving country weight-evaluation standards*

Log-ratio tests revealed that the cross-classified null-model had a significantly better model fit than both the hierarchical multilevel null-model with individuals nested in receiving countries and the hierarchical multilevel null-model with individuals nested in origin countries, indicating that the structure of the data necessitated the use of cross-classified multilevel models. Inspection of regression results from Model 1 (see Table 4) revealed that girls had a higher FAI than boys, meaning that they were less inclined to underestimate their weight-status and more inclined to overestimate it. BMI z-score had a highly significant negative effect on FAI, meaning that adolescents with a higher BMI relative to other adolescents of their age and sex were more inclined to under- and less inclined to overestimate their weight-status.

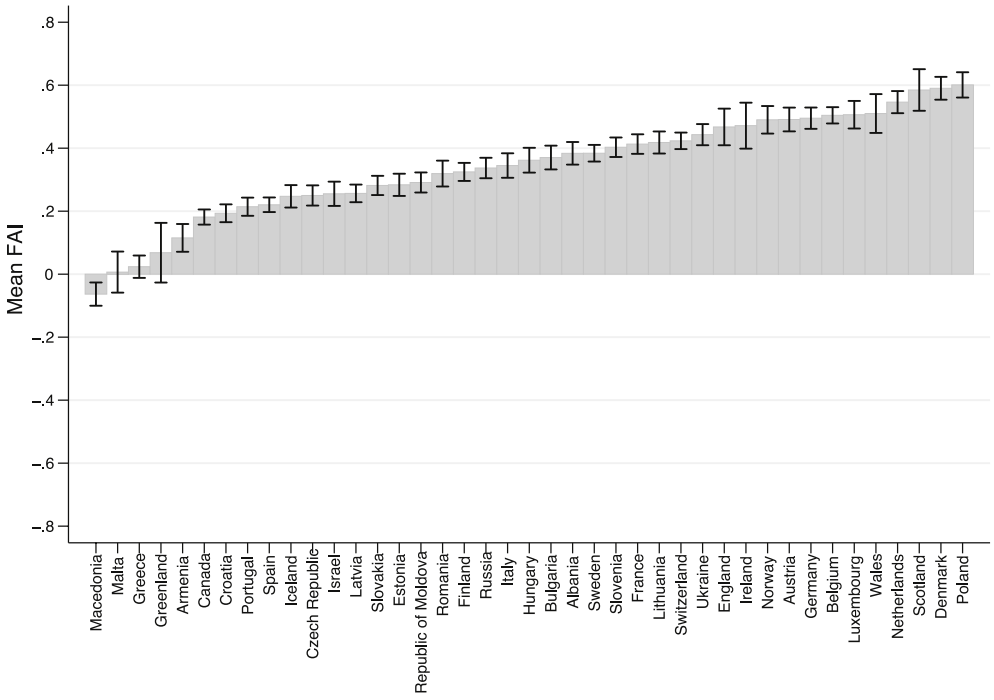

Fig. 1. *Weight-evaluation standards among girls in participating countries with 95% confidence intervals.*

For boys being older was associated with a lower FAI whereas for girls it was associated with a higher one. Lastly, more affluent adolescents had a higher FAI than their less affluent counterparts.

In line with Hypothesis 1, we found that both receiving and origin country weight-evaluation standards informed individual weight-status assessment. Both factors had a significant positive effect on individual FAI. In other words, the higher adolescents in immigrant adolescents' countries of origin assessed their weight-status the higher the immigrant adolescents assessed their weight-status. In the same way, the higher adolescents in immigrant adolescents' receiving countries assessed their weight-status the higher the immigrant adolescents assessed their weight-status. Equally in line with Hypothesis 1, inspection of the confidence intervals associated with the regression coefficients for Model 1 revealed that the receiving country effect was significantly stronger than the origin country effect, meaning that weight-status assessment among adolescents with a migration background more closely aligned with weight-evaluation standards from their receiving than with those from their origin country. Neither of the two cross-level interaction terms in Model 2 (see Table 4) was statistically significant, showing that the influence of origin and receiving country weight-evaluation standards did

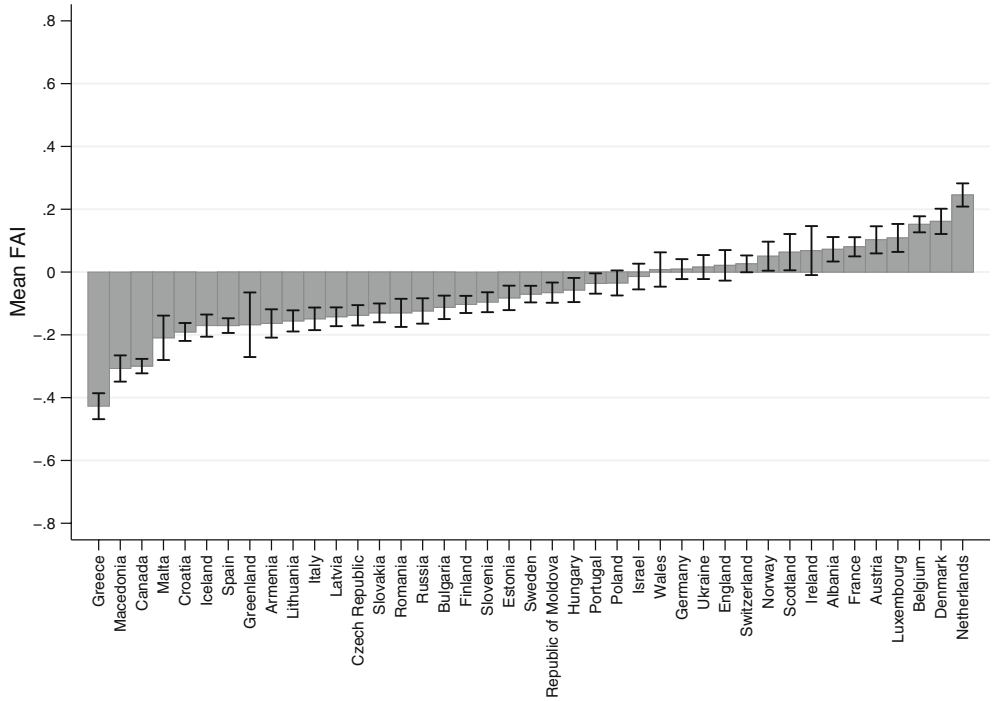

Fig. 2. *Weight-evaluation standards among boys in participating countries with 95% confidence intervals.*

Table 4
Effect of weight-evaluation standards in origin and receiving country.

	Model 1	Model 2[b]
Age[a]	−0.03*	−0.03*
	(-0.05; 0.00)	(-0.05; 0.00)
Girl	0.34***	0.34***
	(0.31; 0.38)	(0.30; 0.37)
Girl # Age	0.11***	0.11***
	(0.07; 0.14)	(0.07; 0.14)
FAS	0.01*	0.01*
	(0.00; 0.02)	(0.00; 0.02)
1.5 Generation	−0.01	−0.02
	(-0.05; 0.03)	(-0.04; 0.08)
One native parent	0.06***	0.07***
	(0.02–0.10)	(0.03–0.11)
zBMI	−0.29***	−0.29***
	(-0.31; −0.28)	(-0.31; −0.28)
Mean FAI (Receiving Country)	0.71*** (0.54; 0.89)	0.80*** (0.52; 1.07)
Mean FAI (Origin Country)	0.17* (0.03; 0.32)	0.04 (−0.19; 0.26)
1.5 Generation # Mean FAI (Rec. Co.)		−0.19 (−0.52; 0.16)
1.5 Generation # Mean FAI (Orig. Co.)		0.24 (−0.11; 0.60)
Variance (Receiving Country)	0.002	0.001
Variance (Origin Country)	0	0
Variance (Individual)	0.595***	0.595***
Observations	8124	8124

95% Confidence Intervals in parentheses.
*p < 0.05, **p < 0.01, ***p < 0.001.
[a] Standardized.
[b] Bayesian confidence intervals obtained from the posterior distribution.
Source: 2013-14 Health Behaviour in School-Aged Children Study

not differ significantly across immigrant generations. Accordingly, we did not find support for Hypothesis 2.

4. Discussion

The current study examined the relationship between origin and receiving country weight-evaluation standards and weight-status assessment among adolescents with a migration background in 23 countries. In line with Hypothesis 1, we found that individual weight-status assessment among adolescents with a migration background is simultaneously informed by both origin and receiving country weight-evaluation standards. The fact that significant influences of both factors were detectable is particularly remarkable given that our sample was restricted to immigrants to and from the primarily European countries participating in the HBSC study. This geographical restriction meant that many of the immigrant adolescents in the sample had origin and receiving countries that did not differ very strongly in weight-evaluation standards making simultaneous effects of both hard to detect. The association was such that higher weight-evaluation standards in either of the two countries were associated with a higher assessment of one's weight-status among adolescents with a migration background living in or originating from those countries. These findings are in line with those from a previous study conducted among adult women with a migration background of Mexican origin living in the US (Altman et al., 2018). In the present study, we were able to show, firstly, that these results are generalizable to other immigrant groups in other receiving countries and, secondly, that they also apply to adolescents with a migration background. This simultaneous effect of origin and receiving country weight evaluation standards corroborates our understanding that adolescents with a migration background are simultaneously navigating two realities, both of which shape the way they perceive themselves (Benet-Martínez and Haritatos, 2005). Equally, in line with Hypothesis 1, weight-status assessment among adolescents with a migration background more strongly aligned with weight-evaluation standards of the receiving country than with those of the origin country. Both developmental theories (Collins and Steinberg, 2007) and theories of cultural dissonance (Wang et al., 2012) stress the tendency for adolescent immigrants to quickly learn and internalize the receiving country norms and standards, often attributing this to their strong desire to feel socially accepted. Study results suggest that this is also true for internalization of receiving country weight-evaluation standards.

In contrast to Hypothesis 2, we did not find any significant differences in the effects of either origin or receiving country weight-evaluation standards between 1.5- and 2nd generation immigrant adolescents. This is in contradiction to previous findings (Altman et al., 2018) indicating a stronger inclination towards origin country weight-evaluation standards among first generation immigrants and a stronger inclination towards receiving country weight-evaluation standards among 2nd generation immigrants. In light of our previous elaborations, we suggest that this might be due to the fact that our study was conducted in an adolescent sample. Given adolescents' desire to adapt to the receiving country rather quickly and the often relatively limited first-hand exposure to the origin country even among 1.5-generation immigrants in our sample, differences between 1.5 and 2nd generation immigrants might not be as pronounced.

4.1. Limitations

Despite the strengths of the current study, which include a large samples of adolescents with a migration background in 23 receiving countries from 41 origin countries, for all of which we were able to aggregate reliable weight-evaluation standards based on nationally representative samples of adolescents, there are some limitations. Most importantly, weight-status was assessed based on self-reported height and weight. While this is often unavoidable and deemed acceptable for population-based studies (Goodman et al., 2000; Spencer et al., 2002), we cannot rule out the possibility of cross-national differences in reporting behavior, which might have led to a misassessment of weight-evaluation standards in some countries. Additionally, because our data is cross-sectional, we were unable to assess whether potential changes in weight-evaluation standards in immigrant adolescents' origin or receiving countries over time result in changes of their weight-status assessment. Another limitation lies in the fact that almost all of the origin- and all of the receiving countries of the adolescents with a migration background in our sample are located within Europe. This limits the generalizability of our results to immigrants to and from other world regions. Lastly, there are several variables pertaining to immigrant adolescents' level of acquaintance with their origin and receiving country, such as age at arrival, length of residency in the receiving country, language use at home, and level of acculturation which are not included in the study but might be relevant to immigrant adolescents' weight-status assessment and the impact that origin and receiving country standards have on it.

4.2. Implications and conclusions

Results from the study are important both theoretically and practically. On a theoretical level, they suggest that weight-status assessment among adolescents with a migration background is associated with evaluative standards of both the origin country and the receiving country. Particularly the continued influence of origin country weight-evaluations standards, while clearly weaker than the receiving country effect, is theoretically relevant as it might help explain why researchers continue to find differences in weight-status assessment and related phenomena between members of different ethnic groups within the same country (Bush et al., 2001; Martin et al., 2010; Nicolaou et al., 2012; Park, 2011), and, by extension, why inter-ethnic differences in overweight and obesity rates often persist even in studies controlling for numerous potential confounders (Gordon-Larsen et al., 2003; Krauss

et al., 2012). More generally, study results reinforce a theoretical perspective in which immigrant adolescent development is influenced by both their origin and receiving countries. Future research simultaneously examining origin and receiving country influences on other health outcomes, health behaviors, and health believes among immigrant adolescents is highly encouraged. On a practical level, results suggest that working with young people with a migration background who misperceive their weight-status demands culturally sensitive interventions that take into account norms and standards from the two countries which the young person is bridging. Educational frameworks can be encouraged to explore with young people how weight evaluation standards may differ across countries and help young people understand how they evaluate their own weight. A greater understanding of the way cross-nationally differing standards can impact how young people see their own weight may enable a greater sense of agency over their feelings toward their bodies. This is imperative since weight-status assessments can have wide implications for young people's self-esteem, eating patterns and ultimately their growth, and well-being (Isomaa et al., 2011).

Credit author statement

Matthias Robert Kern: Conzeptualization, Methodology, Formal analysis, Writing - original draft, Writing - review & editing. **Andreas Heinz:** Methodology, Writing - review & editing, Supervision. **Gonneke W.J.M. Stevens:** Conzeptualization, Writing - original draft, Writing - review & editing; Supervision. **Sophie D. Walsh:** Conzeptualization, Writing - original draft, Writing - review & editing; Supervision. **Helmut Willems:** Funding acquisition, Supervision.

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Declaration of competing interest

The authors declare that they have no competing interest.

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