Disparities in health-related quality of life among healthy adolescents in a developing country – the impact of gender, ethnicity, socio-economic status and weight status

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Abstract

Background  Physical functioning and psychological resilience in adulthood is shaped during adolescence. Self-reported health-related quality of life (HRQoL) assessments during this life phase are important first-hand accounts of their well-being. This study aimed, firstly, to identify differences in HRQoL according to gender, ethnicity, socio-economic status and weight status; and secondly, to examine associations between weight status and HRQoL among an urban sample of multi-ethnic adolescents in Kuala Lumpur, Malaysia.

Methods  A cross-sectional study involving 652 adolescents (aged 13 years) was conducted in Kuala Lumpur. Weight and height were measured. Body mass index z-scores were categorized according to the International Obesity Task Force criteria. HRQoL was assessed using the Malay version of the Pediatric Quality of Life Inventory 4.0 Generic Core Scales. Univariate analyses of differences in HRQoL according to gender, ethnicity (Malays, Chinese and Indians), maternal education level and weight status were performed. Complex samples general linear model was used to examine the associations between HRQoL and weight status, adjusted for confounders.

Results  Female adolescents reported significantly lower emotional functioning scores (mean, 95% confidence interval: 59.25, 57.33–61.17). When the three main ethnic groups were studied, Malay adolescents scored significantly lower emotional functioning scores (59.00, 57.13–60.87) compared with their Chinese peers. Adolescents with tertiary-educated mothers reported lower emotional functioning scores (57.45, 53.85–61.06) compared with those with primary-educated mothers. Obese adolescents reported poorer HRQoL scores with significantly impaired physical and social functioning after controlling for confounders.

Conclusions  These findings detected disparities in HRQoL among the adolescents when gender, ethnicity, maternal education level and weight status were considered. Further studies should address these health inequalities by implementing gender-specific and culturally appropriate measures to attain optimal well-being and avoid potential burden of disease.
Introduction

Adolescence can be a turbulent phase for a teenager when forced to grapple with changes and adjustments physically, emotionally and socially. Often, many adolescents are ill-prepared to cope with these stressors and this can make teenage years tumultuous. Furthermore, self-identity, self-esteem and psychological resilience are developed during these years (Yeo et al. 2007).

Health-related quality of life (HRQoL) assessments has emerged as an essential health outcome measure, both in research and clinical practice (Varni et al. 2005). This is evidenced by the significant growth of multidimensional generic and disease-specific HRQoL measures particularly for paediatric populations (Solans et al. 2008). The trend towards advocating patient-reported HRQoL outcomes across cultures has further strengthened the value of child or adolescent self-reports in providing salient perspectives on their own health and well-being, identifying health needs and evaluating effectiveness of healthcare interventions (Upton et al. 2005; Reinfjell et al. 2006; Varni et al. 2006; Gkoltsiou et al. 2008; Riazi et al. 2010; Amiri et al. 2012).

Commonly reported paediatric HRQoL tools include the Child Health Questionnaire (Landgraf et al. 1996), Screening for Promotion of Health-Related Quality of Life in Children and Adolescents, KIDSCREEN-52 (Ravens-Sieberer et al. 2008), KIDSCREEN-27 (Ravens-Sieberer et al. 2007) and KIDSCREEN-10 (Ravens-Sieberer et al. 2010) and the widely used Pediatric Quality of Life Inventory 4.0 (PedsQL 4.0) (Varni et al. 2001). The PedsQL 4.0 Generic Core Scales has been used among schoolchildren (Varni et al. 2006) while the disease-specific modules has been utilized across a wide spectrum of childhood diseases including diabetes, cancer and gastrointestinal disorders (Varni et al. 2007).

Evidence suggests that HRQoL varies according to gender (Wake et al. 2000; Yeo et al. 2007; Bonsergent et al. 2012). Female adolescents often report more frequent and longer emotionally intense episodes compared with their male peers (Kraaij et al. 2003). A review conducted in the United States on racial and ethnic disparities in paediatric populations revealed that minority groups (Latinos, African-Americans, Asians/Pacific Islanders and American Natives) had poorer quality of life compared with the Whites (Flores 2010). To date, literature comparing HRQoL among ethnically diverse Asian populations is limited (Thumboo et al. 2003; Ng et al. 2005; Lee et al. 2012).

Socio-economic status (SES) is an extensively studied determinant of health (Mackenbach et al. 2008), with education and economic status identified as strong predictors of HRQoL. Lower education attainment, material deprivation and lack of access to healthcare services are linked to higher mortality and morbidity rates, health risk behaviours and reduced HRQoL (Braveman et al. 2005; Wu et al. 2013). Socio-economic inequalities are not only confined to adults with social gradients in health detected among children and adolescents (Rajmil et al. 2014). The Health Behaviour in School-Aged Children (HBSC) study has demonstrated that lack of access to material resources and facing psychosocial strains were drivers for health problems according to Ravens-Sieberer and colleagues (2009). Published findings on the associations between SES and HRQoL among the Malaysian paediatric populations remain scant.

Maternal education has been used as a proxy for SES in previous studies (Frost et al. 2005; Makoka 2013) as maternal education has been positively associated with child health and nutrition (Currie et al. 2007), and not paternal education. Mothers are the primary caregivers in the household and have greater influence in establishing health behaviours in families (Makoka 2013). Higher educational attainment of mothers often results in steadier income, better household conditions, and greater acceptance towards health prevention or treatment. Education facilitates the mother’s knowledge, attitudes and behaviour on health as they often show more interest and responsibility for their child’s health and are more empowered in decision-making in the household (Makoka 2013).

The escalating rates of paediatric obesity have grown into a global public health concern (Wang & Lobstein 2006; Han et al. 2010). Malaysia, a multi-ethnic country located in South-East Asia, is no less facing an upsurge of paediatric obesity (Moy et al. 2004; Sumarni et al. 2006; Rampal et al. 2012; Rezali et al. 2012). There is clear evidence that excess weight often results in physical impediments and psychological ramifications ranging from poor self-esteem to depression (Swallen et al. 2005; Ul-Haq et al. 2013). Research on HRQoL among Malaysian children using the Malay version of the PedsQL 4.0 has been conducted among thalassemic paediatric patients, children with disabilities and young school children (Ismail et al. 2006; Hamzaid et al. 2011; Rahman et al. 2011). To the best of our knowledge, disparities in HRQoL among non-diseased school-going adolescents have received relatively little attention. To address the gaps mentioned, the objectives of this study were to examine differences in HRQoL among Malaysian adolescents according to gender, ethnicity, SES and weight status and to investigate associations between weight status and HRQoL among these adolescents.
Methods

Study design and participants

This cross-sectional study involved 13 year old, Malaysian adolescents, literate in the Malay language, from government-funded urban secondary schools in Kuala Lumpur. Private, boarding, religious, vernacular, vocational and special needs schools were excluded. Chronically ill adolescents, those on long-term medication, restricted diets or on weight gain supplements based on parent-report were likewise excluded from this study.

Ethics clearance was obtained from the Medical Ethics Committee of University of Malaya Medical Centre (Reference Number: MEC 896.123). Written approval to conduct the study was obtained from the Ministry of Education, Malaysia, the Federal Territory of Kuala Lumpur Education Department and the respective school principals. Written informed consent was obtained from all parents of participating adolescents prior to the study.

Sample size calculation

Sample size was calculated using the Open Epi version 2.3.1 software (Dean et al. 2011). Swallen and colleagues (2005) reported that overweight adolescents were twice more likely [odds ratio (OR): 2.17; 95% confidence interval (CI): 1.34–3.51] to have poorer HRQoL compared with their normal weight peers. With a confidence level of 95%, power of 80%, percent of unexposed with outcome of 8.2%; the prevalence of overweight among Malaysian adolescents as reported by Rezali and colleagues (2012), the minimum sample size required was 520. The final sample size determined to accommodate a non-response rate of 20% was 624 subjects.

Sampling method

Participants were selected from government-funded national secondary schools in Kuala Lumpur via multi-stage sampling, in that sampling was performed sequentially across two or more hierarchical levels. These schools (co-educational, all-boys and all-girls schools) located across three different geographical zones (Pudu/Bangsar, Keramat and Sentul) were the primary sampling unit. Simple random sampling was used to select an approximately equal number of schools from each zone to form the secondary sampling unit. The final list of selected schools comprised of 28 co-educational schools, four all-girls schools and four all-boys schools. Only 23 schools agreed to participate in this study. Sampling of students in each school was on a voluntary basis and required parental consent.

Study instrument

The PedsQL 4.0 developed by Varni and colleagues (2001) is the only generic paediatric HRQoL measurement instrument that spans ages 2–18 for self-report and proxy report. The items for each of the forms are essentially identical, differing in age-appropriate language or first- or third-person tense. The PedsQL 4.0 was utilized in this study as it has demonstrated good internal consistency, test–retest reliability and validity across many populations and settings (Varni et al. 2001, 2006; Reinfjell et al. 2006; Gkoltsiou et al. 2008; Kook & Varni 2008; Amiri et al. 2012). Furthermore, factorial invariance of the PedsQL 4.0 child self-report (age 5–18) has concluded that children interpreted the items in a similar manner regardless of their age (Limbers et al. 2008b), race or ethnicity (Limbers et al. 2009), and socio-economic group (Limbers et al. 2008a).

Prior written permission to use the PedsQL 4.0 Generic Core Scales was obtained from the original author, Professor James W. Varni (Varni et al. 2001). A user agreement was signed between the Mapi Research Institute, Lyon, France and the researcher.

The 23-item PedsQL 4.0 comprised of four dimensions, physical (eight items), emotional (five items), social (five items) and school (five items). Participants were asked how much of a problem each item had been in the past month. Response options were on a 5-point Likert scale from 0 (never) to 4 (always). All items were reverse-scored and linearly transformed to a 0–100 scale (0 = 100, 1 = 75, 2 = 50, 3 = 25, 4 = 0).

Mean scale scores were calculated as the sum of items divided by the number of items in that scale. The scale scores were not computed if more than 50% of the items in the scale were missing. The Physical Health Summary Score (eight items) is equivalent to the Physical Functioning Scale score. The Psychosocial Health Summary Score (15 items) is the mean score derived from the sum of items divided by the number of items completed in the Emotional, Social and School Functioning Subscales. The Total Score is the sum of all the items over the number of items answered on all the scales. The Total Score indicates an overall measure of HRQoL, with higher scores indicating a better HRQoL (MAPI Research Trust 2012).

Study procedures

The Malay PedsQL 4.0 was recently validated among school-going students (Ainuddin et al. 2013). A pre-test was conducted...
with a mixed-gender group of 13-year-olds \((n = 8)\) of Malay, Chinese and Indian descent to reflect the three main ethnicities in Malaysia. Face-to-face interviews facilitated discussion to assess the clarity of the questionnaire.

A required amendment included, for instance, item 1 on the Physical Functioning Subscale (‘It is hard for me to walk more than one block’). ‘One block’ is a commonly used scale of measure in the United States. However, it is not the case in Malaysia and thus, the definition of ‘one block’ had to be quantified. The pre-test participants concurred that quantifying ‘one block’ as ‘one block (200 steps)’ (San Juan Regional Medical Center n.d.) improved the comprehensibility of the item. Throughout the pre-test process, it was ensured that the meaning and the context of the final Malay version closely reflected the original English version.

A pilot study involving 362 adolescents not included in this study was conducted prior and revealed that the Malay PedsQL 4.0 demonstrated good psychometric properties adding to previous works (Varni et al., 2001; Reinfjell et al., 2006; Gkoltsiou et al., 2008; Kook & Varni, 2008; Petersen et al., 2009; Amiri et al., 2010; Atilola & Stevanović, 2013). Cronbach’s alpha for each subscale of the Malay PedsQL 4.0 ranged from 0.66 to 0.89. Test–retest reliability of the PedsQL 4.0 showed good agreement (Intraclass correlation coefficient (ICC): 0.60–0.78). Exploratory factor analysis produced a 7-factor solution, which accounted for 60.08% variance. Confirmatory factor analysis performed with the sample from this study exhibited an improved model fit with the 4-factor, 23-item model (chi-squared/degrees of freedom = 2.760, comparative fit index (CFI) = 0.850, Tucker–Lewis index (TLI) = 0.827, goodness-of-fit index (GFI) = 0.879, adjusted goodness-of-fit index (AGFI) = 0.849, root-mean-square error of approximation (RMSEA) = 0.066). Factorial invariance analyses further confirmed that the adolescents interpreted the items in a similar manner irrespective of their gender and ethnicity.

Demographic information, anthropometry and HRQoL assessment

This cross-sectional study was conducted between March and October 2013 involving a total of 652 adolescents aged 13 years old from 23 participating schools. These students were not involved in the pilot test. Prior to data collection, parents were requested to provide demographic information including ethnicity, parental education level, total monthly household income and medical history of their child. Ethnicity was self-reported (Malay, Chinese, Indian, others).

Anthropometric measurements were performed by trained enumerators following a standard protocol. Body weight was measured in light clothing and with shoes removed to the nearest 0.01 kg using a digital calibrated floor scale (SECA 813, Hamburg, Germany). Height was measured without shoes to the nearest 0.1 cm with a portable stadiometer (SECA 217, Hamburg, Germany). Body mass index was calculated in kg/m$^2$ and was converted to standardized $z$-scores according to gender and age based on the International Obesity Task Force cut-off points (Cole & Lobstein 2012). Waist circumference was measured to the nearest 0.1 cm at the umbilicus, between the tenth rib and the iliac crest. Hip circumference was measured to the nearest 0.1 cm at the point of maximum extension of the buttocks using a flexible tape measure (SECA 203, Hamburg, Germany). The 90th percentile was taken as the cut-off point to identify abdominal obesity among Malaysian adolescents (Poh et al., 2011). This translated to waist circumferences above 83.8 cm for boys and above 78.8 cm for 13-year-old girls.

Following anthropometric measurements, the participants completed the PedsQL 4.0 without the guidance of the researcher or teachers, in the school hall or classrooms depending on the venue allocated for data collection.

Statistical analyses

Weights were applied to samples to correct for unequal selection probabilities and non-response because of multi-stage sampling. Maternal education level was selected as a proxy for SES for reasons discussed earlier. Complex samples univariate analyses were used to assess gender, ethnic, maternal education level and weight status differences in HRQoL. The ‘others’ ethnic group was heterogeneous and too small to subdivide \((n = 21)\) and thus, was excluded from ethnic analyses. Complex samples general linear model analyses were conducted to investigate associations between PedsQL 4.0 subscales scores and weight status, adjusted for gender, ethnicity and maternal education level. All statistical tests were two-sided and significance level was set at \(P < 0.05\) with 95% CI. Statistical analyses were performed with SPSS version 21.0 (SPSS Inc., Chicago, IL, USA).

Results

Descriptive characteristics

A total of 646 adolescents completed the questionnaire. Six cases were excluded because of missing data and outliers.
Descriptive characteristics of the participants are presented in Table 1. Majority of the participants in this study were female and Malay. The average waist circumference was in the normal range. About 27% of the adolescents were identified as overweight or obese. While close to 64% of the parents completed secondary school education, another 28% possessed tertiary-level qualifications. Overall means for Total Score, Physical Health Summary Score and Psychosocial Health Summary Score ranged between 68.94 and 72.26 (Table 2).

Gender and ethnic differences

Female adolescents reported significantly lower emotional functioning scores (Table 2). Although the teenage boys reported higher scores on most scales except for social and school functioning, these results were statistically insignificant.

When the three main ethnic groups were analysed, Malay adolescents reported poorer emotionally functioning compared with their Chinese peers (Table 3). A trend of Chinese adolescents scoring highest on most scales was observed; however, these results did not reach statistical significance.

Maternal education level

As a proxy for SES, maternal education level was stratified into three categories (primary, secondary and tertiary) with data available from 432 adolescents. Decreased emotional functioning was observed among adolescents with tertiary-level educated mothers (Table 4).

Associations between weight status and HRQoL scores

HRQoL scores according to weight status are shown in Table 5. Obese adolescents consistently reported the lowest scores on all PedsQL 4.0 scales although not significant. When adjusted for gender, ethnicity and maternal education level, significantly impaired physical and social functionings were found among obese adolescents (Table 6).

Discussion

This study describes previously unexplored disparities of HRQoL according to gender, ethnicity and SES among Malaysian school-going adolescents.

An evident emotional impairment was observed among female adolescents in our study. Similar findings were observed across paediatric populations in the United Kingdom, Norway, Greece, Estonia and Singapore (Upton et al. 2005; Reinfjell et al. 2006; Yeo et al. 2007; Gkoltsiou et al. 2008; Viira & Koka 2012). The onset of puberty along with maturation, hormonal fluctuations and body image insecurities teenage girls experience may exacerbate their emotional well-being (Sanborn & Hayward 2003). In addition, women tend to shoulder family-related responsibilities, are more emotionally involved in interpersonal relationships and therefore, are more sensitive and vulnerable to emotional distress, depression and anxiety compared with men (Avison & McAlpine 1992; Kraaij et al. 2003; Yeo et al. 2007). Furthermore, women often internalize their emotions when faced with problems and may succumb to destructive coping strategies such as eating disorders. Men, however, manage stress differently and relieve stress through outward expression including stress-busting activities, physical exertion or aggression (Yeo et al. 2007).

Our findings show that Malay adolescents reported significantly lower emotional functioning scores compared with their Chinese peers. A study among urban primary school students in East Malaysia, Lee and colleagues (2012) likewise reported similar findings. In studies involving multi-racial participants, those who had strong ethnic identity, that is, the sense of belonging and commitment to their ethnic group had higher self-esteem scores (Phinney et al. 2001; Bracey et al. 2004). Our findings corroborated with Liu and colleagues (2002) who reported that Chinese participants had the strongest ethnic identity, which was positively correlated with emotional and
cognitive well-being. In a study investigating ethnicity, effort, self-efficacy and worry, Awang-Hashim and colleagues (2002) similarly reported that Malay students were generally more anxious compared with their Chinese peers. Another possible elucidation for our finding concurs with Shamsuddin and colleagues (2013) whereby Malay students were more vulnerable to stress, depression and anxiety possibly because of poorer economic status. The influence of ethnicity is complex and is often mediated by biological, demographic, psychosocial, behavioural and environmental factors (Ng et al. 2005). Within a multi-ethnic Asian context, the unmeasured determinants of HRQoL including significant interethnic variation in education, income, family structure, health perceptions, cultural beliefs and practices may contribute to ethnic differences in HRQoL (Thumboo et al. 2003). That said, more sufficiently powered population-based studies are warranted to tease out the drivers behind the ethnic variation in HRQoL particularly in a multi-racial population.

This study showed contradictory findings in that adolescents with tertiary-educated mothers reported significantly lower emotional functioning compared with those whose mothers had primary education. This finding warrants further investigation as it shows reversed trends compared with previous studies on SES and health whereby lower SES groups were consistently associated with poorer HRQoL and could be extenuated by improving educational opportunities, wealth distribution, lifestyle behaviours and access to health care (Mackenbach et al. 2008). That said, it is plausible that in our

<table>
<thead>
<tr>
<th>Scales</th>
<th>Total (n = 646)</th>
<th>Males (n = 182)</th>
<th>Females (n = 464)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>70.10 (67.62, 72.58)</td>
<td>71.34 (67.68, 75.01)</td>
<td>69.60 (68.04, 71.16)</td>
</tr>
<tr>
<td>Physical</td>
<td>72.26 (66.86, 77.66)</td>
<td>73.40 (68.72, 78.09)</td>
<td>71.71 (69.34, 74.08)</td>
</tr>
<tr>
<td>Psychosocial</td>
<td>68.94 (67.55, 70.34)</td>
<td>70.25 (66.74, 73.76)</td>
<td>68.49 (66.97, 70.00)</td>
</tr>
<tr>
<td>Emotional</td>
<td>60.63 (58.67, 62.59)</td>
<td>66.26 (62.23, 70.28)</td>
<td>59.25 (57.33, 61.17)</td>
</tr>
<tr>
<td>Social</td>
<td>79.30 (76.34, 82.25)</td>
<td>76.97 (73.04, 80.91)</td>
<td>78.51 (76.37, 80.65)</td>
</tr>
<tr>
<td>School</td>
<td>66.88 (64.91, 68.85)</td>
<td>67.33 (62.96, 71.70)</td>
<td>67.61 (65.81, 69.41)</td>
</tr>
</tbody>
</table>

*Statistical significance was determined by 95% CI.
CI, confidence interval.

<table>
<thead>
<tr>
<th>Scales</th>
<th>Malays (n = 493)</th>
<th>Chinese (n = 78)</th>
<th>Indians (n = 54)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>69.53 (68.12, 70.93)</td>
<td>71.15 (65.28, 77.02)</td>
<td>69.91 (64.23, 75.60)</td>
</tr>
<tr>
<td>Physical</td>
<td>72.97 (71.05, 74.90)</td>
<td>68.41 (59.70, 77.11)</td>
<td>69.32 (60.99, 77.66)</td>
</tr>
<tr>
<td>Psychosocial</td>
<td>67.71 (66.27, 69.15)</td>
<td>72.58 (67.62, 77.54)</td>
<td>70.23 (64.97, 75.49)</td>
</tr>
<tr>
<td>Emotional</td>
<td>59.00 (57.13, 60.87)</td>
<td>66.57 (60.90, 72.25)</td>
<td>64.68 (58.67, 70.70)</td>
</tr>
<tr>
<td>Social</td>
<td>78.02 (76.07, 79.97)</td>
<td>78.48 (71.80, 85.17)</td>
<td>76.17 (70.51, 81.82)</td>
</tr>
<tr>
<td>School</td>
<td>65.98 (64.30, 67.66)</td>
<td>72.63 (66.95, 78.31)</td>
<td>69.80 (61.58, 78.02)</td>
</tr>
</tbody>
</table>

*Statistical significance was determined by 95% CI.
CI, confidence interval.

<table>
<thead>
<tr>
<th>Scales</th>
<th>Primary (n = 43)</th>
<th>Secondary (n = 287)</th>
<th>Tertiary (n = 102)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>73.79 (70.27, 77.31)</td>
<td>69.70 (68.24, 71.17)</td>
<td>69.61 (67.10, 72.13)</td>
</tr>
<tr>
<td>Physical</td>
<td>75.93 (70.22, 81.65)</td>
<td>73.18 (71.31, 75.05)</td>
<td>72.65 (68.89, 76.40)</td>
</tr>
<tr>
<td>Psychosocial</td>
<td>72.61 (69.14, 76.10)</td>
<td>67.87 (66.33, 69.40)</td>
<td>68.02 (65.46, 70.58)</td>
</tr>
<tr>
<td>Emotional</td>
<td>66.40 (61.61, 71.18)</td>
<td>61.66 (59.64, 63.68)</td>
<td>57.45 (53.85, 61.06)</td>
</tr>
<tr>
<td>Social</td>
<td>81.74 (77.80, 85.69)</td>
<td>76.69 (74.69, 78.69)</td>
<td>79.71 (76.31, 83.10)</td>
</tr>
<tr>
<td>School</td>
<td>69.62 (64.66, 74.58)</td>
<td>65.10 (63.26, 66.94)</td>
<td>66.85 (63.67, 70.03)</td>
</tr>
</tbody>
</table>

*Numbers do not add up to 646 because of missing data.
*Statistical significance was determined by 95% CI.
CI, confidence interval.
sample, tertiary-educated mothers may often hold more demanding careers have to balance busy schedules between work and family. In some cases, parent–child connectedness may be affected as their children are unable to share their issues with their mothers. This may result in low parent–child communications and adolescents may perceive these as low caring from their parents (Ackard et al. 2006).

Our study supported the hypothesis that overweight and obese adolescents had impaired overall HRQoL compared with their normal weight peers, consistent with previous observations (Pinhas-Hamiel et al. 2006; Tsiros et al. 2009; Hamzaid et al. 2011; Al-Akour et al. 2012; Jalali-Farahani et al. 2013). The negative impact of excess weight on HRQoL often include physical impediments, low self-esteem, social stigmatization and peer victimization (Bagchi 2011).

In the multivariate model, obese adolescents differed from their lean counterparts significantly on physical and social functioning scores after adjustments for covariates. These findings were in agreement with previous HRQoL studies among paediatric overweight and obese samples (Williams et al. 2005; Pinhas-Hamiel et al. 2006; Tsiros et al. 2009; Hamzaid et al. 2011). In a meta-analysis, Ul-Haq and colleagues (2013) concluded that excessive weight were detrimental both physically and psychosocially. Our findings further confirmed that emotional and school functioning were not significantly different between obese and lean samples (Swallen et al. 2005; Williams et al. 2005; Zeller & Modí 2006; Varni et al. 2007). Further study is required to understand the forms of physical limitations and social discrimination or mal-adjustments these individuals face and how they are affected. Adopting a paradigm shift in identifying variables that are positively related with higher levels of HRQoL may be promising to improve the well-being and in turn, attenuate the negative impact of obesity.

Among the limitations of this study is the cross-sectional study design, whereby cause–effect directionality could not be determined in the associations found. Data in this study were obtained from adolescent self-reports, which may contain social desirability bias. Generalizability of these findings may be limited as findings may not reflect the gender and ethnic distribution nationwide because of respondent bias. The authors observed a trend whereby the male adolescents in most schools were less interested in participating in the study resulting in a respondent bias. The trend of more female participation in research has been documented by Hille et al. (2005) and Galea and Tracy (2007) who observed that significantly more male adolescents were non-responders. This skewed gender distribution may be explained in part in that teenage girls tend to be more concerned about their body image and health compared with their male peers. This may have contributed to the observation that male adolescents constituted less than 30% of the study participants.

### Table 5. Pediatric Quality of Life Inventory 4.0 Generic Core Scales scores and weight status (n = 646)

<table>
<thead>
<tr>
<th>Scales</th>
<th>Underweight (n = 52)</th>
<th>Normal weight (n = 424)</th>
<th>Overweight (n = 103)</th>
<th>Obese (n = 67)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>69.67 (63.53, 75.81)</td>
<td>70.49 (68.38, 72.59)</td>
<td>70.35 (66.07, 74.63)</td>
<td>65.28 (61.53, 69.03)</td>
</tr>
<tr>
<td>Physical</td>
<td>69.39 (60.04, 78.73)</td>
<td>72.88 (69.60, 76.16)</td>
<td>72.77 (67.86, 77.69)</td>
<td>66.93 (61.85, 72.01)</td>
</tr>
<tr>
<td>Psychosocial</td>
<td>69.83 (63.69, 75.96)</td>
<td>69.21 (67.25, 71.16)</td>
<td>69.10 (64.60, 73.60)</td>
<td>64.38 (60.08, 68.68)</td>
</tr>
<tr>
<td>Emotional</td>
<td>64.67 (58.47, 70.87)</td>
<td>61.13 (58.39, 63.86)</td>
<td>61.40 (56.19, 66.60)</td>
<td>57.42 (52.45, 62.40)</td>
</tr>
<tr>
<td>Social</td>
<td>76.57 (69.07, 84.07)</td>
<td>79.40 (76.74, 82.06)</td>
<td>77.33 (71.82, 82.85)</td>
<td>71.19 (64.47, 77.90)</td>
</tr>
<tr>
<td>School</td>
<td>68.19 (59.10, 77.29)</td>
<td>67.01 (64.67, 69.35)</td>
<td>68.54 (63.72, 73.35)</td>
<td>64.45 (59.98, 68.93)</td>
</tr>
</tbody>
</table>

Statistical significance was determined by 95% CI.

### Table 6. General Linear Model Analyses of Pediatric Quality of Life Inventory 4.0 Generic Core Scales scores and weight status

<table>
<thead>
<tr>
<th>Scales</th>
<th>Underweight (n = 52)</th>
<th>Overweight (n = 103)</th>
<th>Obese (n = 67)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>−1.49 (−7.37, 4.38)</td>
<td>0.618</td>
<td>0.612</td>
</tr>
<tr>
<td>Physical</td>
<td>−4.43 (−13.03, 4.17)</td>
<td>0.312</td>
<td>0.064</td>
</tr>
<tr>
<td>Psychosocial</td>
<td>0.09 (−5.81, 6.00)</td>
<td>0.975</td>
<td>0.187</td>
</tr>
<tr>
<td>Emotional</td>
<td>2.45 (−3.96, 8.87)</td>
<td>0.452</td>
<td>0.749</td>
</tr>
<tr>
<td>Social</td>
<td>−4.06 (−11.00, 2.88)</td>
<td>0.251</td>
<td>0.036</td>
</tr>
<tr>
<td>School</td>
<td>1.94 (−7.36, 11.24)</td>
<td>0.682</td>
<td>0.667</td>
</tr>
</tbody>
</table>

Values are beta coefficients relative to the normal weight reference group with 95% confidence intervals in parentheses. Adjusted for gender, ethnicity and maternal education level. *P < 0.05.
The strength of this study lies in the use of a widely and internationally accepted HRQoL instrument with a sample drawn from a developing, multi-ethnic country. This is a step forward as previous studies on health disparities have largely been reported in developed Western countries. While the pattern of HRQoL outcomes according to gender and weight status reaffirms existing findings, ethnic and maternal education (as a proxy for SES) differences in HRQoL among school-going adolescents in a multi-racial population was previously relatively unexplored. These findings allow cross-cultural comparison and more importantly, contributes to the body of knowledge on the ethnic and socio-economic disparities in HRQoL outcomes existing in a developing, Asian nation.

These findings uncover significant gender, ethnic and SES disparities in HRQoL among multi-ethnic Malaysian adolescents. Impaired emotional functioning was identified among female adolescents, Malays and adolescents with tertiary-educated mothers. Obese adolescents reported significantly poorer physical and social functioning. Future research should investigate the underlying factors of these HRQoL disparities to allow triangulation of data. Culturally appropriate strategies are imperative to address the ethnic and SES variations in HRQoL for improved well-being of different segments of the population.

**Key messages**

Detection of poor scores on the physical, emotional and social functioning alerts the need for:

- Insights into the impact of gender on HRQoL to develop gender-specific measures to nurture a healthier sense of well-being among adolescents;
- An understanding of the sociocultural influences on health to develop culturally appropriate measures for improved health;
- Narrowing the gap in HRQoL disparities resulting from SES differences;
- Evaluation of health policies on health promotion and equity to ameliorate impaired HRQoL.

**Conflict of interest**

The authors declare no conflict of interest.

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