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Supplemental Information

Prevalence of Incorrect Posture among Children and Adolescents: Finding from a Large Population-Based Study in China

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TRANSPARENT METHODS:

Study design and participants

This is a school-based cross-sectional study in children and adolescent students from the Shenzhen city in south China. All students were selected by a 3-stage, stratified-cluster, random-sampling method. In stage 1, we divided Shenzhen city into three economic stratifications (high-level, middle-level, and low-level) by per capita GDP (gross domestic product), and then selected two districts from each stratification by simple randomization using random number generator. In stage 2, schools in each district were divided into three categories: primary schools (i.e., grades 1-6), junior high schools (i.e., grades 7-9), and senior high schools (i.e., grades 10-12). Based on the proportions of these three types of schools, six primary schools, six junior high schools, and three senior high schools were randomly selected from each representative district. In stage 3, all classes from each grade within the selected schools were included in our study, and all available students in the selected classes were invited to voluntarily participate in the present study. In total, 595,057 students were completed and qualified for our study.

Ethical statement

This study was conducted in accordance with the Declaration of Helsinki, and was approved by the Shenzhen Second People's Hospital Institutional Review Board. Written or oral informed consent was obtained from the parent or legal guardian of each participating student under 18 years old or from each participating student who was at least 18 years old.

Data collection

To protect the privacy of the students, all students in the selected classes were screened for scoliosis in a closed room or tent, and administered by research assistants without the presence of teachers or other school personnel (to avoid potential information bias). All screening data were collected from September 2019 to January 2020.

School screening program

The school screening program for AIS in Shenzhen was started in 2013 as part of the national public health project, and conducted and administered by the Shenzhen Youth Spine Health Center (SYSHC) of the Shenzhen Second People's Hospital using a national scoliosis screening standardized protocol (GB/T 16133-2014) (National Standardization Administration Commission of China, 2019).

The day before we started school screening, we informed parents to require their children to wear tight clothing and underwear for screening on the next day. On the day of screening, all students participating in the screening were divided into two groups according to their gender, and each group of students entered one by one in a sealed tent to ensure personal privacy. In order to ensure the accuracy of body posture measurement, boys and girls could only wear underwear during screening. If some students refused to wear only underwear for certain reason (such as not wanting the therapists to see their body), we respected their choice and let them wear tight clothing for screening. Students in primary schools, junior high schools, and high schools were invited to participate in the screening program voluntarily. School screening was performed by an experienced team of trained rehabilitation therapists from SYSHC using the Adams forward bending test (FBT), visual inspection, and measurement of the angle of trunk rotation (ATR) using the scoliometer (Grossman et al., 2018). Each student participating in the screening was judged by two independent therapists separately. If the results were inconsistent, a third therapist made a final judgment to minimize subjective bias.

Incorrect posture

Incorrect posture was assessed by visual inspection, FBT, and ATR (Hengwei et al., 2016; Fong et al., 2010). The standard visual inspection was performed in the upright position. The examiner checked for spine alignment, shoulder asymmetry (high and low shoulder), scapula prominence (scapula tilt), hip and pelvic obliquity (pelvic tilt), back symmetry (flat back, thoracic kyphosis), lumbar curvature (lumbar concave, lumbar

lordosis, and lumbar kyphosis), distance of the hands from the flanks, and length of the lower limbs (Luk et al., 2010). The FBT was performed with the student's feet placed together, knees straight, while bending at the hips to nearly 90 degrees with the arms freely hanging forward, palms together. Any significant clinical sign was recorded. The ATR was used to decide the angle of trunk rotation and when the students should be referred for radiography directly by measuring with a scoliometer, including angle of thoracic rotation, angle of lumbar rotation, and angle of thoracolumbar rotation (Grossman et al., 1995). Students with an ATR>5° or with 1 or more significant clinical signs were identified as having incorrect posture.

Demographic variables

Demographic variables included gender (boy, girl), age, ethnic group, school category, and grade. Ethnic group was assessed based on the student's self-report about their ethnic group (Han or minorities) (Yang et al., 1998). School category included primary school (grade 1-6), junior middle school (grade 7-9), and high school (grade 10-12).

Statistical analysis

First, descriptive analyses were conducted to describe the demographic characteristics (e.g. gender and age) of children and adolescents in south China. Second, prevalence of incorrect posture among total population was reported, and sample was further divided into different groups to calculate gender-, age, school-specific prevalence rates. Chi-square test (χ^2) was used to compare the differences between groups. Bias-corrected 95% confidence intervals (CI) were estimated using 1000 bootstrap samples. All data were analyzed using SPSS 22.0 (IBM Corp, Armonk, NY, USA), *P*-value less than 0.05 was considered statistically significant (tested two-sided).

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