Surveillance of childhood overweight: comparison of “OKkio alla SALUTE” survey and general paediatrics data in the Province of Trento

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Abstract
Estimates of childhood overweight and obesity for the Province of Trento provided by the 2014 “OKkio alla SALUTE” survey (Italian national surveillance system for weight and nutrition in children) were compared with estimates provided by paediatric health forms. The Province of Trento is the only region that makes use of the information gathered through these forms, which are completed by primary care paediatricians as part of the 6-year health evaluation. OKkio alla SALUTE data for children, obtained from students enrolled in the third year of primary school in 2014 (845 children aged 8-9 years), were compared with data collected at the age of 6 for cohorts born in 2006, evaluated in 2012-2013 (3101 subjects). The following prevalence figures were obtained from OKkio alla SALUTE and the 6-year paediatrician evaluation respectively: overweight, 17.4% vs 11.7%; obese, 4.1% vs 4.5%; severely obese, 1.4% vs 1.0%. The two information sources provide similar estimates, suggesting the potential for their integrated use.

INTRODUCTION
Childhood obesity is one of the greatest health emergencies in developed countries while not sparing the children living in low and middle income countries [1]. Italian figures are among the highest among the European countries participating in the Childhood Obesity Surveillance Initiative (COSI) promoted by the World Health Organization European Region [2]. In order to understand the magnitude of the phenomenon and the associated behaviour of Italian children, since 2007 the Italian Ministry of Health/National Centre for Disease Prevention and Control has promoted the development of the “OKkio alla SALUTE” surveillance system, which is coordinated by the National Centre for Epidemiology, Surveillance and Health Promotion at the Italian National Institute of Health and conducted in collaboration with the regions and the Ministry of Education. The surveillance system, for which the fifth survey has been done in 2016, covers all Italian regions and is essential to national disease prevention and health promotion strategies like the “Guadagnare Salute” programme and the National Prevention Plan [3].

In the Province of Trento, there is an additional childhood health monitoring system that has been in place for twenty years and makes use of information from forms completed by primary care paediatricians as part of the health evaluations performed at the ages of 12 months, 6 years and 13 years.

This study compares overweight/obesity estimates calculated from data on paediatric evaluation forms completed at the age of 6 years with estimates provided by the 2014 OKkio alla SALUTE survey (the fourth survey) for the Province of Trento.

MATERIALS AND METHODS
In the preventive care framework, the collective national agreement for primary care paediatricians provides for performing health evaluations at the following specific ages: 1, 3, 6, 12 and 24 months, and 3, 6, 9 and 13 years. During these evaluations, the primary care paediatrician records age-specific data in the child’s paediatric health booklet, which is given to all babies born in the Province of Trento.

Since the 1990s the provincial contract, which supplements the national agreement, has also required primary care paediatricians to complete paper forms (attached to the health booklet) as part of the 12-month, 6-year and 13-year health evaluations and send these data to the health care system. Individual paediatricians send the completed forms to the appropriate health dis-
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...which records the information in the health care database. The data are exported and processed annually by the Clinical and Evaluative Epidemiology Services.

The Provincial Health Authority for the Province of Trento therefore has access to a series of health indicators for children aged 6 years. Data collected at birth (through the CedAP record, a certificate issued by the hospital that includes health statistics data), 12 months and 6 years are currently available for several birth-year cohorts. The different data sources can be linked using a specific link key.

The data relating to cohorts born in 2006, the cohort most similar chronologically to the 2014 OKkio alla SALUTE sample, were extracted from 6-year health evaluation forms. This cohort was examined by primary care paediatricians during the 6-year health evaluation performed in 2012-2013 (tolerance of ± 90 days from the 6th birthday). Weight status was analyzed and categorized using the Body Mass Index (BMI) threshold values established by Cole et al., as recommended by the International Obesity Task Force (IOTF) [4, 5].

The estimates calculated from the paediatric forms were compared with those for the Province of Trento obtained by the 2014 OKkio alla SALUTE survey [6]. This survey was a cluster sample of children enrolled in the third year of primary school (8-9 year-old) and used the appropriate Cole et al. standards for categorizing weight status.

The procedure for obtaining the anthropometric data for individual children, in the clinics of the primary care paediatricians, is that recommended by the WHO [7], with most of the children wearing just undergarments. In the OKkio alla SALUTE surveys, children are measured by trained Local Health Unit personnel, using standardized scales and stadiometers (a feature that is unfeasible in the general paediatrician clinics) with children wearing light clothes. The percentages of overweight, obesity and severe obesity, with 95% confidence intervals, were compared. In the estimated prevalences, overweight does not include obesity and obesity does not include severe obesity. The chi-squared test was used to analyse the significance of the differences.

RESULTS

The 2014 OKkio alla SALUTE survey in the Province of Trento studied a sample of 845 children enrolled in the third year of primary school, with an average age 8 years and 10 months and 55% males and 45% females.

For the cohort born in 2006, 3101 6-year paediatric forms were obtained by 69 family paediatricians. These children had an average age of 5 years and 11 months; 34.8% were evaluated before the age of 6 years, 51.4% between 6 years and 6 years and 1 month, 13.8% over 6 years and 1 month. There were 52% males and 48% females.

The 2014 OKkio alla SALUTE survey for the Province of Trento reports the following weight status distribution for males and females combined: 17.4% (95% CI 14.9%-20.4%) overweight (not including obesity), 4.1% (95% CI 2.9%-5.6%) obese (not including severely obese), and 1.4% (95% CI 0.6%-2.1%) severely obese.

Data from the 6-year paediatric forms provides the following estimates, for males and females combined: 11.7% (95% CI 10.5%-12.9%) overweight, 4.5% (95% CI 3.8%-5.1%) obese and 1.0% (95% CI 0.6-1.4%) severely obese. There are no statistically significant differences between the OKkio alla SALUTE 2014 survey and 6-year paediatric forms for obesity and severe obesity estimates. The estimate of overweight by 6-year pediatric forms is lower, 11.7% compared to OKkio alla SALUTE 2014 survey 17.4% (Figure 1), with a statistically significant difference (p < 0.0001).

Figure 1
Weight status categorization. Comparison 6-year paediatric forms vs 2014 OKkio alla SALUTE surveys at 8/9 years
The estimates by gender, provided by 6-year paediatric forms are as follows: for males 10.7% (95% CI 9.8-11.5) overweight, 4.0% (95% CI 3.4-4.5) obese, 0.8% (95% CI 0.4-1.2) severely obese; for females 12.5% (95% CI 11.9-13.0) overweight, 5.1% (95% CI 4.5-5.7) obese and 1.2% (95% CI 0.8-1.6) severely obese. Females show a prevalence for both overweight and for obesity higher than males, with a statistically significant difference ($p < 0.0001$). In the OKkio alla SALUTE survey 2014 14.4% of boys were overweight and 5.9% obese or severely obese; 21.1% of girls were overweight and 5.0% obese or severely obese [6].

Six-year paediatric forms show also a certain variability of the estimates in relation to the individual primary care pediatrician, the season (lower values in the assessments made in summer months) and the precise age of the child in which the assessment is made as reported in Table 1.

**DISCUSSION**

OKkio alla SALUTE surveillance system is the gold standard for monitoring the childhood weight status in Italy. The data from the paediatric forms, generated by primary care paediatricians and routinely available only in the Province of Trento, cannot be viewed as a substitute for those obtained by OKkio alla SALUTE. However the paediatric forms can be a useful instrument to follow the weight of each child and study the evolution of obesity in a cohort of children from a very young age to teenager.

The OKkio alla SALUTE and 6-year paediatric form survey are different regarding the age of the study population and the methods of detection of anthropometric data, although a recent study by the OKkio alla SALUTE coordination group reported a strong agreement for BMI estimates between WHO and OKkio alla SALUTE procedures [8].

However, while the obesity and severe obesity estimates are very similar for both sources of data, the overweight figure calculated from the paediatric forms is lower.

This difference could be due to fact that the paediatric data are collected for children at the age of 6 years, which is almost 3 years younger than the data for the OKkio alla SALUTE survey. The estimate of overweight or obesity at age 6, in addition to the logistical conditions, can be affected by adiposity rebound phenomenon, that is the age at which BMI reaches its minimum value before its physiological increase. The adiposity rebound average corresponds to the age of 5-6 years [9, 10], even if new evidence indicate its earliest occurrence than reported in the past [11].

Other factors which should also be taken into account include: the season in which the health assessment of the 6th year is made, the number of subjects evaluated for each pediatrician and the operational variation among individual pediatricians. It is also difficult to compare the data from the Province of Trento with other Italian studies because they differ in the age range, setting, type of population and procedures used [12, 13]. The data of the prevalence of overweight and obesity reported are also rarely disaggregated by single age. Prevalence data recorded in our study tend to be lower than those reported in other regions [12-15]. Our prevalence values are also lower, for both gender, than those observed in the three European countries (Belgium, Slovenia and Spain) that, as part of the WHO European Childhood Obesity Surveillance Initiative, have also provided data for age 6 years [16]. The prevalence of overweight and obesity in our study substantially coincide with those reported in a study of 2012 by Brambilla et al. [17] obtained in an area of Milan. In this study the pediatric forms for health check at 6th year of life were used for the recovery of anthropometric parameters of interest. A higher prevalence of overweight in girls than boys has already been reported in some other Italian regional studies [12, 13] and it is also confirmed, although with no statistically significant difference, by the Report ISTAT-Unicef of 2013 [18].

Nevertheless, the six-years paediatric forms, disregarding potential reproducibility limitations, provides two important indications: a) a large number of overweight and obese children can be identified at this young age; b) the collection of weight status data at the age of 6 years may allow for a personalized approach, with the primary care paediatrician taking early charge of overweight children at the age when compulsory school attendance begins. Moreover, the paediatric forms can provide the basis for local longitudinal studies designed to answer questions regarding associations between perinatal variables and outcome variables at the age of 6 [19]. These could be facilitated, for example, through a record linkage between birth certificate (Cedap) and pediatric databases which, in the province of Trento, share common link keys.

Productive integration of the two systems therefore seems possible, with OKkio alla SALUTE oriented towards the population and the paediatric forms oriented

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**Table 1**

Overweight and obesity prevalence according to children’s chronological age at the 6th year assessment

<table>
<thead>
<tr>
<th>Chronological age</th>
<th>Male overweight prevalence and CI 95%</th>
<th>Male obesity prevalence and CI 95%</th>
<th>Female overweight prevalence and CI 95%</th>
<th>Female obesity prevalence and CI 95%</th>
<th>Total overweight prevalence and CI 95%</th>
<th>Total obesity prevalence and CI 95%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before 6th year</td>
<td>10.9 (9.4-12.3)</td>
<td>3.9 (3.0-4.8)</td>
<td>12.7 (11.1-14.3)</td>
<td>5.5 (4.6-6.6)</td>
<td>11.8 (10.7-12.9)</td>
<td>4.5 (3.7-5.6)</td>
</tr>
<tr>
<td>At 6 year- 6.1 month</td>
<td>10.5 (9.3-11.7)</td>
<td>4.0 (3.2-4.7)</td>
<td>12.6 (11.2-13.9)</td>
<td>5.2 (4.3-6.0)</td>
<td>11.6 (10.7-12.5)</td>
<td>4.5 (3.9-5.2)</td>
</tr>
<tr>
<td>At 6.2 + years</td>
<td>10.0 (7.8-12.2)</td>
<td>5.1 (3.5-6.7)</td>
<td>11.8 (9.4-14.2)</td>
<td>5.1 (3.4-6.7)</td>
<td>10.9 (9.2-12.6)</td>
<td>5.2 (4.2-6.2)</td>
</tr>
</tbody>
</table>
towards individual “case” children, providing a possible tool for identifying and taking charge of overweight children [20].

It is important to raise awareness among primary care pediatricians about the usefulness of the data collected in order to create the conditions for improving the quality and reproducibility of the data recording.

The role of the primary care paediatrician could be supported through the development of specific training courses [21-23] and a favourable organizational system, as has already been envisaged by some other Italian regions [24].

The population approach, which focuses more on the whole population, including mostly low-risk subjects, integrated with a case-based approach, which focuses on high-risk subjects, may lead to improved efficacy in the prevention strategy for complex phenomena such as childhood overweight and obesity, addressed in a general sense in the work of Professor Rose [25].

Taking charge of overweight/obese children could occur even before the 6-year evaluation, given that individual primary care pediatricians have access to the child’s history and development through the data contained in his or her paediatric health booklet. Paediatricians can be informed about potential risk factors of increased BMI, e.g. children who were not breastfed and children who were born prematurely and/or with a low birth weight [26].

The role of the primary care paediatrician must undoubtedly be enhanced since the paediatrician has the opportunity to continuously follow the child and his or her family from birth. The 2014-2018 National Prevention Plan may provide the appropriate framework to facilitate integration of family paediatricians in a public health action [27].

Conflict of interest statement

There are no potential conflicts of interest or any financial or personal relationships with other people or organizations that could inappropriately bias conduct and findings of this study.

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