Item response drift in the Family Affluence Scale: A study on three consecutive surveys of the Health Behaviour in School-aged Children (HBSC) survey

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ABSTRACT

Comparable data on socio-economic position (SEP) is essential to international studies on health inequalities. The Health Behaviour in School-aged Children (HBSC) has used the Family Affluence Scale (FAS) on material assets. The present study used data collected from adolescents in eight countries in 2002, 2006 and 2010, and examined the construct validity of the FAS, by focusing on changes in item responses over time. The analyses reported the changes in means in item responses, and fitted models which estimated differential item functioning (DIF), and local dependency (LD) between items. DIF and LD were analysed by Graphical Log-Linear Rasch Models (GLLRMs), and changes in the measurement properties of the FAS over time and between countries were assessed. The results showed that the FAS items have changed their measurement properties between 2002 and 2010, and caution is warranted in studies comparing the FAS between different time points.

1. Introduction

International variations and trends in social inequalities in health are a staple of social epidemiological research [1]. Most of the research done in this area has involved adult populations, despite a broad consensus that reducing inequalities in child and adolescents health are essential to the health of future generations. A challenge in researching socio-economic differences in child and adolescent health lies in providing valid and comparable measurements on socio-economic status. Questionnaires to adolescents on their parents' education, occupation or income usually result in low completion rates and high misclassification rate [2–4] so various alternatives have been examined. Since 1998, the Health Behaviour in School-aged Children (HBSC) study has measured family affluence in more than 40 countries by collecting information on specific material assets in the Family Affluence Scale (FAS).

Different theoretical perspectives can be taken on the FAS [2,5–7]. One implies that the items that make up the FAS may be considered as indicators of the material assets that produce affluence, which is called formative. Another is that the FAS items reflect a latent construct, which is called reflexive. Either way, the procedure for using the FAS in analysis often involved adding the scores on each item to produce a sum score. A formative index considers the items to be separate independent (albeit correlated) exposures of the family's material wealth, whereas a reflexive assumes correlation between items and to an underlying (latent) construct such as material wealth or affluence. This approach assumes a cumulative effect of the different items, and that items can be combined to a reliable scale measuring an underlying construct. Scales constructed by several items potentially suffer from differential item functioning and this is exacerbated when used in cross-national and trend analyses [8,9]. Differential item functioning (DIF) occurs when item responses vary across different subgroups and local dependency (LD) occurs when items correlate beyond the underlying construct expressed by the sum score. Earlier studies have shown large country variations in the FAS in terms of DIF, and a cautious approach has been warranted on using the FAS for international comparisons, for validity reasons [6,10].

In our experience, the FAS is no different to many scales. DIF and LD appears to be the rule rather than the exception in health related scales; recently developed software tools can be useful for identifying validity problems such as DIF. Scales are validated to make sure that measurements are not confounded by DIF and/or items measuring something other than intended, but in most cases, the task of validating a scale is overlooked perhaps because it is considered subordinate to addressing empirical research questions. It could be argued that this is true in the case of the FAS which was developed as a measure of deprivation in order to study health inequalities among adolescents [2,11,12].

1.1. The Health Behaviour in School-aged Children and the Family Affluence Scale

HBSC is an international study with 41 participating countries in the European Region and North America. The study aims at providing comparable data on young people's health and lifestyle from countries with different economic conditions and cultural, societal and political systems.

The HBSC study includes 11-, 13- and 15-year-old school children in representative samples of schools in the participating countries. The students answer the standardised questionnaire during a school lesson after instruction from the teacher or survey administrator. HBSC has been collecting data on adolescents every fourth year since 1982, the most recent cross-national survey was conducted in 2009/10.

In the HBSC-study socio-economic position (SEP) is measured by the FAS. Assessing adolescent's absolute socio-economic status based on material markers provides an alternative to the more traditional social class [2,4] and is conceptually related to common consumption indices of material deprivation [13] and home affluence [4,14].

FAS items ask students about things they are likely to know about in their family (car, bedrooms, vacations, and computers), thus limiting the number of non-responses in the study. When the scale was introduced in 1998 it was used in a national context only and contained three items (family car, bedroom and telephone) [2]. In 2001/02 it was used cross-nationally and comprised family car, bedroom, holiday and computer. The items, their response categories, and their rationale are the following:

- *Does your family own a car, van or truck?* (No = 0, Yes, one = 1, Yes, two or more = 2). This item is a component of the Scottish deprivation index developed by Carstairs and Morris [13], which is used widely in health inequalities research.
- *Do you have your own bedroom for yourself?* (No = 0, Yes = 1). This item is a simple proxy for overcrowding, classified by Townsend [14] as housing deprivation, and is also a component of the Scottish deprivation index.
- *During the past 12 months, how many times did you travel away on holiday with your family?* (Not at all = 0, Once = 1, Twice = 2, More than twice = 3). This item is a measure of 'deprivation of home facilities' [14].
- *How many computers does your family own?* (None = 0, One = 1, Two = 2, More than two = 3). This item has been introduced to differentiate SEP in affluent countries.

In previous research the FAS has been included differently depending on the research question, the data being analysed and the statistical technique in use. The FAS has both been included at an individual, and as an aggregated school and country level variable [12], and is widely used in educational research [10].

1.2. Validity of FAS

Based on the thorough development of the survey items and the theoretical rationale of the scale, it is assumed that the scale is content valid [15]. From its early development, the validity of FAS has been discussed in several papers, and validated at both national and international levels. Studies found that the FAS has good criterion validity, on the basis of showing graded associations between SEP and various health outcomes [12,16,17]. Adolescents and parents report similarly to the FAS items [18] and the FAS is less affected by non-response bias than SEP measures that rely on child reports of household income or parental occupation [2,7,11]. Additionally, data from the FAS are far less burdensome to collect and manage than other sources on SEP, e.g. data on parental occupation. Within educational research, the FAS is considered valuable as a tool when assessing children's eligibility for free school meals, but so far it has been concluded that the FAS does not have good overall reliability [10]. Boyce et al. has discussed limitations in the use of FAS in relation to cross-national studies. The authors compared the FAS measurements internationally and recommended the inclusion of the FAS in aggregate analyses in studies on health inequalities [16].