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Self-reported Morbidity as a Sensitive Indicator of Variation in Anthropometry and Body Composition among Urban Slum Dwelling Adult Males in West Bengal, India

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ABSTRACT Self-reported morbidity (SRM) was positively associated with social cultural backwardness and with mortality in demographic studies. Its usefulness in assessing health status was criticized to be biased by subjectivity. This study assessed its association with anthropometric profile, an objective marker of health status. This cross-sectional study included 474 slum dwelling adult men. Height, weight and skin folds were measured. Body mass index, percent body fat, fat mass, fat mass index, fat-free mass, fat free mass index were computed. Morbidity was recorded as self-reported incidence of illness during the last month and in the previous year excluding the last month. All anthropometric measures, except height, and all body composition variables, except fat-free mass, showed the lowest values in repeated illness group and the highest values in the group reporting no illness. To conclude, SRM was strongly associated with anthropometry and body composition and thus with the health status.

INTRODUCTION

Self-reported morbidity (SRM) has been directly linked to the health status of any given population in epidemiological and public health studies (Paul and Singh 2017). As regards public health, self-reported or self-rated health (SRH) has been used to estimate prevalence of various types of illnesses at the population level (Dodd et al. 2017; Paul and Singh 2017). Community surveys dealing with prevalence and pattern of morbidity and its demographic correlates often relied upon self-reports of health by the participants (Gumber and Berman 1997; Dilip 2007). In India, a number surveys conducted by National Sample Survey Organization (NSSO) and National Centre for Applied Economic Research (NCAER), have also relied on the use of SRH (Paul and Singh 2017). Besides public health, the health economists and other social scientists have assessed links of SRM to various socio-economic aspects, for example income, gender, caste, region, ethnicity etc (Kondo et al. 2009; Imlach et al. 2011).

In spite of this widespread use of SRM in assessment of health status, the reliability of SRM as measure of poor health and morbidities, particularly in developing countries were extensively debated (Sen 1993, 2002; Manesh et al. 2008). Amartya Sen strongly argued that SRM could be "extremely misleading" as there was fundamental disconnect between an individual's subjective perception of their health and the objective or actual health condition that they may have (Sen 2002). According to this argument, an individual's assessment of their health is directly dependent on their social experiences. Thus the socially disadvantaged individuals will fail to perceive and report the presence of illness or health-deficits appropriately. Therefore instead of this subjective or "internal" approach of assessment, more "objective" or "external" measures could reveal the true extent of health deprivations (Sen 2002). However, despite this logical skepticism, the data obtained from the National Family Health Survey and National Sample Survey indicated the validity of SRM when it was assessed in relation to socioeconomic status (Subramanian et al. 2009). Indeed, SRM in most cases were linked with various

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measures of socioeconomic conditions like literacy level and income (IIPS, WHO 2006).

Although SRM or self-rated health was used in a vast number of studies, its utility in estimating objective measures of health was limited except that it was shown to be a strong predictor of mortality in industrialized countries (Baron-Epel 2004; Idler and Benyamini 1997; Sickles and Taubman 1997). In large epidemiological studies the simple self-assessment of health was shown to predict both total and cardiovascular mortality (Schnittker and Bacak 2014; Ganna and Ingelsson 2015; Olson et al. 2016). A very recent study showed that the self-perceived health, along with psychosocial and lifestyle-related factors, predicted cardiovascular events beyond other established indicators (Stewart et al. 2017). Similar evidence is absent in the context of developing countries (Prinja et al. 2012) and the validity of self-reported health measures in these countries are mostly based on examining the association between socio-economic status (SES) and self-reported health and morbidity measures (Subramanian et al. 2009). Besides, self-rated health could be relevant in both presence and absence of specific morbidity; and perceived problems in the environment were also associated with poor self-rated health in both the groups (Meireles et al. 2015). Reported morbidity, thus, bears more objective information than self-rated health as a whole. However, very few studies had actually dealt with self-reports of specific morbidity episodes rather than reported health condition in general.

Anthropometry has been a reliable and stable indicator of nutritional and health status. It is both inexpensive and non-invasive, and thus extremely useful in assessment of population health status through field surveys (WHO 1995; Chakraborty et al. 2009a). Anthropometric measurements not only indicate nutritional status but also the socio-economic condition of a population, especially adult populations of developing countries (Nube et al. 1998; Khongsdier 2002; Chakraborty et al. 2009a). Studies concerning SRM and anthropometry as an "objective" measure of health status are extremely rare (Khongsdier 2005; Chakraborty et al. 2009b, c, 2011a) and very few of them included multiple anthropometric and body composition parameters (Khongdier et al. 2005; Tang et al. 2017) rather than only BMI (Khongdier et al. 2002; Ha and Park 2012). The present study, therefore aimed at evaluating the sensitivity of SRM to detect anthropometric variation in a disadvantaged group of urban slum dwelling males. It was expected that there would be significant anthropometric difference between groups having less and higher reported illness.

METHODOLOGY

Subjects and Setting

The present cross-sectional study was conducted in a slum called *"Bidhan Colony"* situated near the Dum Dum Railway Station, approximately 15 km from the center of Kolkata in West Bengal province of India. A total of 474 adult (18 years and above) male individuals were studied. The subjects lived with their families and the majority of them belonged to low socio-economic status (Chakraborty et al. 2009a). The mean (SD) per capita income was RS 885.95 (500.84). Information on age, monthly family income and self-reported morbidity status (illness present or absent during the last month) were recorded for all individuals. Ethical standards were followed according to Helsinki Declaration as regards studies on human subjects (Goodyear 2007). The participants were selected randomly by household survey. The strategy of sampling was described elsewhere in more detail (Chakraborty et al. 2011b, 2012). Informed consent was also obtained from each participant before commencing the study.

Anthropometry

One of the researchers (RC) took all anthropometric measurements following the standard procedure (Lohman et al. 1988). Height, weight and mid-upper arm circumference were recorded to the nearest 1mm, 500g and 1mm, respectively. Skin fold measurements were taken to the nearest 0.1mm by a skin fold caliper (Holtain Ltd., UK). Sum of four skin folds was calculated by adding up Biceps, triceps, subscapular and supra-iliac skin folds. Height was recorded by a standard anthropometer. Weight was measured by a weight scale (Libra). BMI was computed as Weight (kg)/height (m^2).

Measurements of Body Composition

Percent Body Fat (PBF) was calculated using four skin folds with the following standard equations (Durnin and Womersley 1974):

PBF = (4.95 / density-4.5) x 100

Where, Density = 1.1356-0.07 x $\log_{10}$ (BSF+TSF+SSF+SISF).

Fat mass (FM), fat free mass (FFM), fat mass index (FMI) and fat free mass index (FFMI) were computed using following standard equations (VanItallie et al. 1990; Bose and Chaudhuri 2003).

FM (kg) = (PBF/100) x Weight (kg)

FFM (kg) = Weight (kg) – FM (kg)

FMI (kg/m^2) = FM (kg) / Height (m^2)

FFMI (kg/m^2) = FFM (kg) / Height (m^2)

Self-reported Morbidity (SRM)

The morbidity profile was recorded as self-reported incidence of any kind of illness during 30 days preceding the study and also for the preceding one year excluding the last 30 days. This method was employed as was used in earlier studies without involvement of any clinical expert or physician (Strickland and Ulijaszek 1993; Garcia and Kennedy 1994; Khongsdier 2002; Chakraborty et al. 2009a, 2011). This method, based on self-reporting, has been considered preferable in consideration of the greater amount of time, cost and availability of technical expertise required in clinical diagnosis, which is not always possible in conducting community based studies in a developing country like India (Khongsdier 2002). Therefore, it has been a good proxy measure for assessment of general morbidity at the community level. Each participant was asked if he had been ill at any time in the last four weeks or the last one-year excluding the last month. Individuals were classified as *'ill'* or *'not ill'* on for each of the two parameters mentioned above. If an individual reported any illness during the last one month, he was termed as *'recently ill'* and if reported illness at any time during the last one year before the last month, was called *'previously ill'*. They were further classified according to this Combined Morbidity Categories (CMC), as combinations of the two criteria defined above, as follow: CMC I: Who experienced both (Repeated); CMC II: Who experienced the first (Recent); CMC III: Who experienced the second (Previous); CMC IV: Who experienced none (No illness).

Statistical Analyses

Data were collected on a pre-tested schedule and finally transferred from data sheets onto a computer software programme (SPSS). All the entries were double-checked for any probable keyboard mistake. All statistical analyses were computed using the SPSS Package (SPSS 10) on a computer. The statistical tests were two-tailed; Results were considered statistically significance at $p<0.05$.

RESULTS

A 25.1 percent of the slum males reported their illness during the last 30 days and forty percent reported during the previous year. About forty-nine percent of them did not report any illness during the previous month as well as during the previous year. Around fourteen percent had illness both recently as well as in the last year. Eleven percent were only recently ill and about twenty-six percent were ill previously. 48.7 percent did not report any illness. Table 1 shows the mean (SD) values of age, and MPCI as being 37.5 (14.2) years and INR 885.9 (500.8), respectively. The mean (SD) BMI and PBF were 20.29 (3.29) and 15.8 (6.96), respectively.

Table 1: Mean (SD) of the age, MPCI and anthropometric variables among the male slum dwellers

Variable	*Mean*	*SD*
Age (years)	37.5	14.2
MPCI (Rupees)	885.9	500.84
HT (cm)	161.5	6.24
WT (kg)	53.0	9.51
WC (cm)	73.9	92.5
SumSF (mm)	91.0	49.1
BMI (kg/m^2)	20.3	3.3
PBF (%)	15.8	6.96
FM (kg)	8.9	5.4
FMI	3.4	2.0
FFM (kg)	44.1	5.5
FFMI	16.9	1.7

Table 2 shows the mean (SD) values of variables according to combined mortality categories (CMC). Mean (SD) of all the anthropometric measures except height increased significantly from morbidity group I through IV. The values were highest in the group not reporting any illness incidence (CMC IV) compared to other illness groups and the lowest in the group which reported incidences of repeated illness (CMC I). However, the strongest differences were seen in case of weight, BMI, WC, SumSF, PBF and also in MPCI. Mean (SD) values of age and HT, how-

Table 2: Mean (SD) values of variables according to illness-groups among the male slum dwellers

Variables	*Illness Groups ^*				
	CMC I (n=67)	*CMC II (n=52)*	*CMC III (n=124)*	*CMC IV (n=231)*	*F*
Age (years)	40.5 (16.6)	36.7 (13.6)	36.8 (15)	37.2 (13.1)	1.2
MPCI (INR)	730.9 (329.9)	710.3 (298.9)	957.0 (575.4)	932.3 (518.5)	5.94**
HT (cm)	162.3 (6.5)	160.9 (4.9)	161.4 (6.7)	161.5 (6.2)	0.5
WT (kg)	50.3 (9.8)	51.2 (7.5)	52.8 (9.6)	54.3 (9.6)	3.9***
WC (cm)	71.6 (8.7)	72 (8.4)	73 (9.3)	75.5 (9.3)	9.0**
BMI (kg/m^2)	19.1 (3.5)	19.8 (2.8)	20.2 (3.1)	20.8 (3.3)	5.3***
SumSF (mm)	78.4 (49.3)	81.6 (41.8)	87.6 (47.5)	98.5 (51.9)	4.85**
PBF (%)	14 (7.1)	14.2 (6.3)	15.4 (6.9)	17 (6.9)	4.65**
FM (kg)	7.7 (5.6)	7.6 (4.4)	8.6 (5.3)	9.7 (5.4)	3.98**
FFM (kg)	43.1 (5.5)	43.6 (1.7)	44.2 (2)	44.6 (5.6)	1.46
FMI	2.9 (2.1)	3 (4)	3.3 (5.7)	3.7 (2)	4.04*
FFMI	16.4 (1.7)	16.8 (1.4)	16.9 (1.6)	17.1 (1.7)	3.19*

*p<0.05; **p<0.01; ***p<0.005; CMC = Combined morbidity status
^I = repeated illness; II = recent illness only; III = previous illness only; IV = no illness

ever, did not significantly differ between the combined morbidity categories. The body composition measures also showed the same trend, except that the FFM did not differ significantly between groups.

Scheffe's post hoc test was also carried out to see whether these overall differences in the variables across the illness groups were also significant between each pair of the groups. Table 3 shows the results of these tests. Although most of the variables demonstrated significant overall difference across the illness groups in One Way ANOVA, the post hoc analyses showed that the differences were only significant between the extreme CMCs, that is, the no illness group (CMC IV) and the repeated illness group (CMC I) in Weight, BMI and PBF (not even in WC) and body composition parameters except the FFM.

Table 3: Results of Sheffe's post hoc tests showing significance of between group differences in one-way ANOVA.

Variable	*Illness-group contrasts*					
	I vs. II	*I vs. III*	*I vs. IV*	*II vs. III*	*II vs. IV*	*III vs. IV*
Income	-	*	*	*	*	-
Weight	-	-	*	-	-	-
BMI	-	-	*	-	-	-
PBF	-	-	*	-	-	-
FM	-	-	*	-	-	-
FMI	-	-	*	-	-	-
FFMI	-	-	*	-	-	-
SumSF (mm)	-	-	*	-	-	-

*Significant difference at p < 0.01

Income however showed significant difference between all the morbidity groups.

DISCUSSION

SRM or Self-reported/rated health status remains a widely used measure in clinical, public health, social and economic research. Its validity in terms of measuring ill health and public health interventions has been both established as well as criticized in different studies. However, self-reported morbidity prevalence often reveals important aspects of the morbidity profile of a population where information on morbidity based on medical diagnosis is unavailable or inadequate (Paul and Singh 2017). The present study tested whether anthropometry, being a relatively objective health measure, differed according to SRM status among the urban slum dwelling adult males. The results revealed that all the anthropometric measures except height, and also the body composition variables, except FFM, increased significantly from CMC I (repeatedly ill) through group CMC IV (no illness reported). The group who did not undergo any illness at all had always had the highest mean values of all these anthropometric variables. The mean (SD) values of the SumSF increased significantly from CMC I through CMC IV. However, it's worth mentioning that age did not differ according to illness status.

A study from Bangladesh found that self-reported health status was significantly associated with measured physical performance among adult men and women aged 50 and older (Rahman and Barsky 2003). A prospective data from Indonesia showed that individuals who perceived their health to be 'poor' are significantly more likely to die in subsequent follow-up periods compared to those who reported good health, even after allowing for measures of nutritional status, physical function, and symptoms of poor health, depression and hypertension (Frankenberg and Jones 2004). In India, SRM has been used to estimate prevalence of illness in several populations (Ghosh and Arokiasamy 2010; Yadav et al. 2016). Self-reported health status was also associated with risk of undernutrition in older people in UK (Margetts et al. 2003). However, anthropometry as a measured health parameter has not been much studied in relation to morbidity or SRM in particular.

As stated earlier, an inverse association between self-reported health and SES is generally expected and was found in several studies. The present study also showed that the per capita family income was also inversely related to SRM in male slum dwellers. To draw example of similar findings, the prevalence of self-reported illness was the highest in low income group followed by the middle and high income groups among the War Khasi males in North East India (Khongsdier 2002). The lowest family income group among the adult male slum dwellers showed the highest rate of morbidity than those in the highest family income group (Bose et al. 2007). The inverse association between self-rated health and SES was previously explained by the linkage of objective measures of health, like mortality and undernutrition, with social marginalization in India (Subramanian and Smith 2006; Subramanian et al. 2006a; Subramanian et al. 2006b). However, those studies did not record self-reported specific morbidity episodes but the self-rated general health status. Self-reported health may be influenced by age, socio-cultural, ecological, economical, historical factors (French et al. 2012; Wang et al. 2014).

Anthropometry was shown to be a reliable and sensitive indicator of both SES and health (Chakraborty et al. 2009a, 2011b, 2012). The present study provided evidence that anthropometric parameters, being such an indicator, could also be sensitive to morbidity status assessed through self-reporting. Strickland and Ulijaszek (1993), in a cross-sectional study among the Iban tribe of rural Sarawak, showed that the symptoms of self-reported illness had a negative association with BMI. A study from Brazil (de Vasconcellos 1994) indicated that there was a marked increase in morbidity among the adult undernourished as defined by BMI<18.5 kg/m^2. In War Khasi males, the reported illness also showed the highest frequency below BMI of 17 kg/m^2 (Khongsdier 2002). This is consistent with the results of this present study. Khongsdier (2005) showed among the rural people that FMI but not FFMI was associated with SRM. Subjects with either lower or higher FMI reported higher incidents of illness. In the present study, however, both FMI and FFMI showed lower values in men reporting lower illness episodes. A very recent study showed clear association of anthropometric and body composition parameters with self-rated health, weight and BMI being the strongest correlates (Tang et al. 2017).

There were very few studies on the relationship between SRM and anthropometry among urban low SES people or more particularly in urban slums (Chakraborty et al. 2009b, 2009c). In a study among adult males of an urban slum in Bangladesh, there was a significant inverse association between BMI and work-disabling morbidity (Pryer 1993). In a study among the poor men of Kolkata city, BMI was found to be the best overall discriminator of retrospective morbidity (Campbell and Ulijaszek 1994). Bose et al. (2007) showed an inverse association of SRM with BMI among slum population of in West Bengal. Those with the largest mean BMI, also had lowest rate of morbidity. The frequency of morbidity and hospitalization was lowest among normal BMI individuals.

The present study on the urban slum dwelling men was in conformity with the above-mentioned studies. Coming again to the debate over the reliability of SRM, particularly Amartya Sen's argument for "positional objectivity" (Sen 1993, 2002), it can be added here that the socially disadvantaged slum dwellers of this study might still have possibly underestimated the incidence of morbidities. However, in spite of such possibility, the results showed that SRM is a useful indicator of health status as it had a clear effect on anthropometric status. It might also be possible that within an ecological setting of limited SES variation, or less variation in social experience condition among the socio-economically disadvantaged people, SRM could be useful parameter to assess community health.

CONCLUSION

To conclude, self-reported morbidity status is associated with anthropometric profile and thus, in turn, is a sensitive indicator of general health status of individuals and community.

RECOMMENDATIONS

Self-reported morbidity is to be included in assessment of community health status especially in relation to public health nutrition. More studies, however, should be conducted to confirm its association with other objective measures of health in populations living in different ecological contexts.

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