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Original Article

Small area method: General health of students

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ABSTRACT

Background & Aim: Awareness of adolescents' general health status is important. The aim of this study was an assessment of general health status by estimating the mean of general health score of high school students in eight counties of Bushehr province in 2014 with small area method.

Methods & Materials: In this cross-sectional study, students' general health score at the counties levels was estimated by small area method. The data were collected based on the general health questionnaire (GHQ28) and the accuracy of estimations was measured by using of standard error.

Results: The overall estimated mean±standard error of general health score for 138 students, using the synthetic estimation of small area method was 26.65±0.21. The means of general health at eight counties were 26.96, 26.85, 26.41, 26.48, 26.74, 26.76, 26.62 and 27.41, respectively

Conclusion: A little difference between the averages and the small standard errors of estimations in eight counties, showed that the synthetic estimator has a high accuracy for estimating the mean of adolescents' general health scores.

Introduction

Health has multiple concepts that there are several definitions of it. The WHO defines health as physical, psychological, and social comfort (1). Mental health is a broad component of the general health. In different studies, global health is described by measuring the burden of disease. Mental disorders are the cause of about 13% of the global burden of disease (2). According to WHO's data for Iran in 2008, 16.6% of the burden of disease is due to mental disorders (3) and one major issue over the past few decades has been an assessment of mental health in adults (4-6). Therefore, study the status of mental disorders and find its pattern is an increasingly important part of general health. Depression is the third leading cause of illness and disability among adolescents, and suicide is the third leading cause of death in older adolescents (15–19 years) (6). Further, Adult mental disorder begins in adolescence (7) and the WHO announced that half of all mental health disorders in adulthood start by age 14. Also, approximately about one-third of Iran's population is between the ages of 15–29 years, that they are at risk of confrontation with major health problems such as neuropsychiatric disorders and psychological problems. Providing psychosocial support in schools for children and adolescents can help promote good mental health, thus in this research, the general health state of high school students is studied. There are several reasons for the incidence of mental disorders. The mental health is linked to changing global climate, include stress and mental disorders such as depression. A study showed the mental health facing increasing climate change (8, 9). In recent studies in Iran, disease burden of some provinces shown that neuropsychiatric disorders have the second rank in Bushehr and Hormozgan Provinces (10). In most studies, an adequate sample size for direct

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estimations is determined based on statistical calculations, while in this studies, it may be that the sample size in subgroups is not determined based on mathematical computations and one of the goals of such studies is to determine the outcome in subgroups (small areas). In such studies, one major weakness is that the sample size in the subgroups usually is low and direct estimation methods can't be used. Therefore, indirect estimation methods should be used for produce estimations with a less standard error in small areas. An indirect method that is used for obtaining valid estimations in areas with low sample size, is the small area method (11, 12). Although extensive research has been carried out on mental health, no single research exists which covers student's mental disorder status in warm air. Based on no clear pattern of mental disorders in the south of Iran (13) and also importance of adolescents' mental health state, this study set out with the aim of estimating the mean of general health score of high school students in counties level (small areas) of Bushehr province using the Synthetic method and the relevant standard errors.

Methods

The population consisted of all male and female high school students in Bushehr province. Participants were recruited using proportion sampling method by sex and grade in counties. The random sample of 138 people (88 males, 50 females) was selected using multi-stage random sampling. To measure general health score and demographic information, valid and reliabile (14) General Health Questionnaire (GHQ28) and a demographic questionnaire were used during the 2013-2014 academic year. The GHQ was used for screening the mental disorders. This questionnaire has four-point Likert-type items that they are scored according to a 0-1-2-3 system, so persons' score will be between 0 and 84 that a lower score was indicating better mental health status. The used cutoff to categorize GHQ score into without mental disorder and with a mental disorder was 23(<=23: without a mental disorder, >23: with a mental disorder) (15). Inclusion criteria for selecting students were aged 15 to 19 years. In this cross-sectional study to compute mean of general health score among adolescents were aged between 15-19 years, in eight subdivisions of Bushehr province, we used Synthetic estimation. The population means of students' age that used as an auxiliary variable, were given from Bushehr Office of Education. The software R version 3.2.3 for data analysis and Adobe Photoshop CS6 for map drawing were used, respectively.

Small-Area models are a special case of linear mixed models, including fix and random effects (16). In the present study, the Synthetic estimator was used in order to estimate the general health, and the standard error was used to measure the accuracy of the estimations. Also, for estimating random effects and variance components, the restricted maximum likelihood method (REML) has been used. The large areas include subgroups (small areas). If assumed small areas have same characteristics of a large area, direct estimators at the large area can be used to achieve indirect estimators at small areas; such estimators are called Synthetic that they are biased estimates of the area means. The Synthetic estimator is based on the implicit linear model that information about the values of the studied variables and auxiliary variables of regions or time periods that have not been sampled, using an implicit or explicit relevance model is entered (17-19). By using the mean age of students in population as an auxiliary variable, the Synthetic estimates were based on the following model:

$$\bar{Y}_i = \beta \bar{X}_i + u_i$$

Where u_i is a random error in each area, which is normally distributed with zero mean and constant variance σ^2_u. Therefore the Synthetic estimators can be obtained by

$$\bar{\bar{Y}}_{i,SYNTH} = \bar{X}_i \hat{\beta}$$

Where $\hat{\beta}$ is the estimation of the regression coefficient of the individual-level sampled data.

Results

In 2014 a sample of 138 high school student aged 15-19 years were selected from Bushehr province highschools. The overall students' mean and standard error of general health score was 26.61±16.15, indicating somes degrees of mental disorder. The overall estimation of mental disorder's prevalence was 48.6%. There was a significant association at 5% level between mental disorder and students' sex (p=0.043). The estimated mean of the general health of females

Table 1. Frequency distribution and general health scores based on GHQ-28 among adolescents in Bushehr Province in 2014

County	Sex	Grade			Mean of general health	Sample mean of age	Population mean of age
		9	10	11			
Bushehr	Male	5	8		6 22.73±13.39	16.10±0.87	16.11±0.86
	Female	7	2		3 35.66±19.08	16.41±0.99	16.15±0.84
Deylam	Male	3	2	3	21.13±9.05	15.94±1.10	16.13±1.01
	Female	0	3	4	25.29±24.10	16.57±0.53	16.04±0.97
Dashtestan	Male	4	3	8	25.06±15.82	16.06±0.88	15.83±0.95
	Female	5	1	6	34.91±22.99	16.08±1.08	15.91±0.83
Dayyer	Male	4	0	0	31.00±6.16	15.25±1.25	16.05±0.96
	Female	3	1	2	31.66±18.04	15.66±1.21	15.73±2.07
Kangan	Male	4	0	6	23.60±8.79	16.10±1.52	16.17±0.94
	Female	5	0	0	39.40±19.76	15.20±0.44	15.88±1.00
Tangestan	Male	7	7	1	21.13±15.08	15.66±0.61	15.94±0.92
	Female	1	0	0	19.00	15.00	16.21±0.85
Genaveh	Male	3	3	4	18.90±13.21	15.80±1.03	15.89±0.94
	Female	0	0	0	0	0	16.05±0.95
Dashty	Male	4	0	3	30.14±20.86	16.00±1.00	16.44±0.87
	Female	3	2	2	27.00±17.88	15.85±0.89	16.21±0.94

Table 2. Displays mean of age in the sample and in population as auxiliary variable at eight counties

County	Population	Sample
Bushehr	16.14	16.23
Deylam	16.08	16.23
Dashtestan	15.87	16.07
Dayyer	15.90	15.50
Kangan	16.03	15.80
Tangestan	16.04	15.63
Genaveh	15.97	15.80
Dashty	16.36	15.93

Table 3. The mean and standard error of general health in counties with Synthetic

County	Mean	Standard error
Bushehr	26.96	1.04
Deylam	26.85	0.98
Dashtestan	26.41	1.88
Dayyer	26.48	2.01
Kangan	26.74	1.90
Tangestan	26.76	2.56
Genaveh	26.62	1.03
Dashty	27.41	0.97

was more than males (32.38>23.34), therefore males had better general health status.

Table 1 provides the frequency distribution of sex, grade, and means of age and general health at the level of eight counties of Bushehr province.

The estimated means and standard errors that obtained from the Synthetic method are presented in Table 3. As can be seen, the range of estimation is small, it can thus be suggested that the means in eight counties are approximately same. It is necessary to mention that the standard errors in this method are small.

Figure 1 can be seen as the prevalence of mental disorders by the Synthetic method in eight counties of Bushehr province. According to this figure, the calculated range of general health for all counties is from 21.25-42.5. Therefore, it is apparent that the mean of general health score in the mentioned counties is upper than 23 (the used cutoff), then to improve the students' mental health, policies should be adopted.

Discussion

We used data on the general health score of high school students in Bushehr province in 2014. These data were collected in the level of Bushehr province, but we needed information at counties level. Since the sample size in counties level had not determined according to mathematical rules, the indirect estimations were

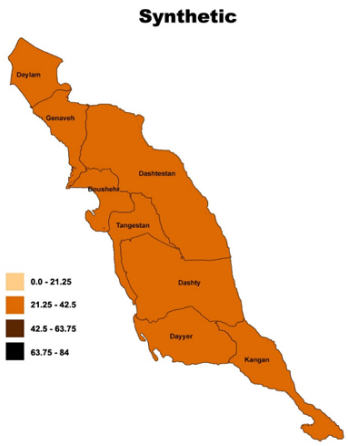

Figure 1. Prevalence of mental disorders by Synthetic method in Bushehr province in 2014

preferred. Because of the response variable's nature, we used the Synthetic method. The results showed the accuracy of the Synthetic method was high because the standard errors of estimations and the estimation's range of variation were small. In many studies, the goodness of the Synthetic method has been identified and it has been widely used (13, 20-23). However, there is more complex type of small area estimators, which according to the nature of the study, a particular type of methods is selected (1). In this research, similar to other studies, the Synthetic method was produced a reliable estimation (13) with a small standard error. The Synthetic estimation same as the overall estimation of general health eventuated to presence the pattern of mental disorder.

Conclusion

The most obvious evidence from this research is that when the object of a study is an assessment in the level of subgroups and sample size not calculated in the subgroups, the Synthetic method is proper for obtaining valid estimations with a low standard error in every subgroups. As regard to presence of mental disorders pattern, therefore, it seems that some policies should be adopted.

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Conflicts of interests

The authors declare that there is no conflict of interest regarding the publication of this article.

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