Research Article

Estimation of Mental Disorders Prevalence in High School Students Using Small Area Methods: A Hierarchical Bayesian Approach

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Abstract

Background: Adolescence is one of the most important periods in the course of human evolution and the prevalence of mental disorders among adolescence in different regions of Iran, especially in southern Iran.

Objectives: This study was conducted to determine the prevalence of mental disorders among high school students in Bushehr province, south of Iran.

Methods: In this cross-sectional study, 286 high school students were recruited by a multi-stage random sampling in Bushehr province in 2015. A general health questionnaire (GHQ-28) was used to assess mental disorders. The small area method, under the hierarchical Bayesian approach, was used to determine the prevalence of mental disorders and data analysis.

Results: From 286 questionnaires only 182 were completely filed and evaluated (the response rate was 70.5%). Of the students, 58.79% and 41.21% were male and female, respectively. Of all students, the prevalence of mental disorders in Bushehr, Dayyer, Deylam, Kangan, Dashtestan, Tangestan, Genaveh, and Dashty were 0.48, 0.42, 0.45, 0.52, 0.41, 0.47, 0.42, and 0.43, respectively.

Conclusions: Based on this study, the prevalence of mental disorders among adolescents was increasing in Bushehr Province counties. The lack of a national policy in this way is a serious obstacle to mental health and wellbeing access.

Keywords: Small Area Technique, Hierarchical Bayesian, Mental Disorders, Adolscent

1. Background

Adolescence is one of the most important periods in the course of human evolution, while the tension is higher, commitment and identity will become weaker (1). Almost all societies are paying particular attention to the issues of public health, particularly to mental health (2-4). For this reason world health organization (WHO) has named 2017 as the year of combating depression (5). Public health is multi-dimensional and anxiety and depression are the most important aspects of it (6). With a glimpse of the studies, it is observed that anxiety and depression are the most common mental disorders among young people (6). In addition, a report according to the WHO shows that approximately 1 in 5 young people suffer from mental disorders (7).

The recent studies show that the average age of onset of symptoms of depression is 16 years among 2% - 8% of people (6, 8). Relatively high prevalence of mental disorders has been reported in the world (4). In a meta-analysis, it was observed that the prevalence of mental disorders among children and adolescents in the world is 13.4% (CI 95%: 11.3 - 15.9) (4).

For this reason, recent studies have focused on the prevalence of mental disorders and related factors (9-11).

Furthermore, in a comprehensive study that was accomplished in 2010, it was found that depression is the second leading cause of disability in the world (Figure 1) (12). Based on this study, Iran is among the countries where years of disability due to depressive disorders is high (12).

Mental disorders impose a high economic burden on individuals and society as well as disabling in people (13). There are no statistics regarding the direct and indirect cost of mental disorders in Iran, however, the total cost of major depression disorders was about 210.5 billion dollars in USA in 2010 (14).

Various studies show that the prevalence of mental disorders in different regions of Iran, especially in southern Iran is high and is becoming an epidemic. Therefore Soltanian et al. (15) reported the prevalence of mental disorders among high school students in 2005 to be about 40.7% and Mousavi-Bazaz et al. reported it at about 51.1% in 2015 (16). The literature review shows that the prevalence of depression among young Iranians is 55/43%. This disorder is more common in girls (17). In addition, some studies showed that the prevalence of mental disorders is increasing in southern Iran (11).

Figure 1. World Map Marking Countries with Statistically Higher or Lower Years with Disability
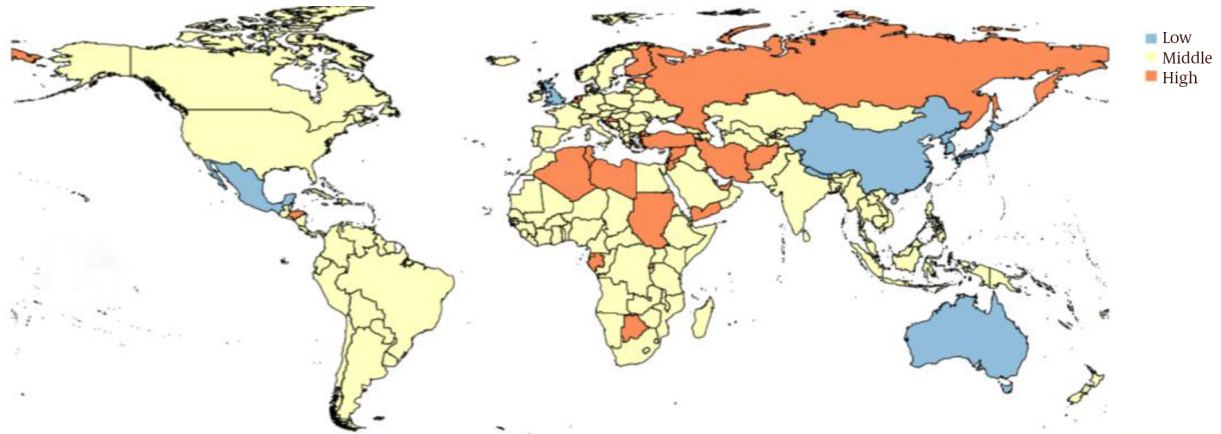
The map is adapted from Ferrari AJ et al. 2013 (12).

2. Objectives

Due to the increasing prevalence of mental disorders in south Iran, continuously monitoring the spread of the disease is necessary. Furthermore, when the sample size is small, we should use advanced statistical methods to fix the problem. Therefore, we use the hierarchical Bayesian method to estimate the prevalence of mental disorders among high school students in Bushehr province, south of Iran.

3. Methods

3.1. Study Design

In this cross-sectional study, 286 high school students were recruited in 2015, which is about 10% of the sample size in Soltanian's study in 2005 (15). They were selected by the multistage random sampling method from 8 counties of the Bushehr province. The number of students in each county was determined as quotas under sex and grade level.

In this study, the Iranian version of the GHQ-28 was also used to estimate the mental health status. GHQ-28 is a self-rating questionnaire based on 4 dimensions of psychological symptoms including: anxiety, depression, somatic symptoms, and social dysfunction. The 28-items GHQ is scored on a four point Likert-type scale according to a 0 - 1 - 2 - 3 system. Minimum and maximum score of GHQ-28 is 0 and 84, respectively. In this study, the cut-point was < 23 and ≥ 23 for health and mental, respectively. Reliability of GHQ-28 was determined 0.87 by Coronbach's alpha.

Previous studies confirmed the validity of GHQ-28 (18). People who had a history of mental illness were excluded. Furthermore, this study was conducted 1 month prior to the students' examinations or quizzes. The 12th graders were excluded due to their final quizzes and examinations.

After collecting the questionnaires, only 182 questionnaires were evaluated. In this study, sample size collapses due to the fact that some questionnaires were not fulfilled (the response rate was 63.6%). Therefore, we tried to eliminate this defect using the small area method by the hierarchical Bayesian approach as follow section.

3.2. Statistical Analysis

Due to the nature of mental disorders as a dichotomous response to variable and auxiliary data at the unit level, the logistic linear mixed model under hierarchical Bayesian approach was used to estimate the prevalence of mental disorders. The linear mixed model logistic by hierarchical Bayesian approach was considered as follows:

$$y_{ij}|p_{ij} \sim^{iid} Bernolli\left(p_{ij}\right); i = 1, \ldots, m; j = 1, \ldots, N_i \quad (1)$$

Where, y_{ij} and p_{ij} represent a dichotomous response variable and probability of mental disorders for j^{th} individual at i^{th} area, respectively. Additionally, m and N_i is the number of small areas and sample size, respectively.

$$\begin{aligned} \theta_{ij} &= \text{logit}\left(p_{ij}\right) \\ &= x_{ij}^T \beta + v_i, v_i \sim^{iid} N\left(0, \sigma_v^2\right) \end{aligned} \quad (2)$$

Where, x_{ij} is auxiliary variable at unit level for j^{th} individual at i^{th} area, and v_i is the random effect of the small area.

$$f\left(\beta\right) \propto 1; \sigma_v^{-2} \sim Gamma\left(a, b\right), a \geq 0, b > 0 \qquad (3)$$

Where, β and σ^2_v are mutually independent. The parameters were estimated by hierarchical Bayesian methods after determining the auxiliary variables associated with p_{ij} with respect to equation and initial values a = b = 0.001. Markov Chain Monte Carlo algorithm (MCMC) and Gibbs sampling method was used to determine posterior distribution [19]. To evaluate the reliability of the small area estimation, the indicator as below was used, where p_i and $\dot{P}_i$ are true estimations and small area estimations of mental disorders prevalence, respectively [20]. The cluster analysis was used for clustering the counties. Statistical software SPSS version 16 was used to determine the auxiliary variables associated with mental disorders and cluster analysis. WinBUGS 4.1 was used to run the MCMC algorithm.

$$ASE = \frac{\sum_{i=1}^{m}\left(p_i - \bar{p_i}\right)}{m} \qquad (4)$$

4. Results

In this study, 182 high school students were evaluated. Of the 182 high school students, 48.34% and 51.66% were male and female, respectively. Furthermore, 36.26%, 31.32%, and 32.42% of the high school students were in the 9th, 10th, and 11th grade, respectively. Other demographic characteristics of the participants were shown in Table 1.

In this study, the age of students was considered as an auxiliary variable for determining the prevalence of mental disorders by the hierarchical Bayes small area technique (Table 2). Frequency distribution of high school students and prevalence of mental disorders was shown in Table 2 in Bushehr province counties.

Kangan and Bushehr had the highest prevalence of mental disorders among the counties, respectively, while the prevalence of mental disorders in Dashtestan and Ganaveh was lower than in the other counties, respectively.

Cluster analysis on prevalence of mental disorders showed that all counties of the Bushehr province can be divided into 3 clusters (Figure 2). The first cluster was Dayyer, Genaveh, Dashti, and Dashtestan, the second cluster was Bushehr, Tangestan, and Deylam, and the third cluster was Kangan.

5. Discussion

In this study, we have shown that the prevalence of mental disorders among high school students in Bushehr province was high in 2015 as well as 2005 [15]. The highest prevalence of mental disorders was related to Kangan

Table 1. Demographic Characteristics of High School Students

| Characteristic	No. (%)
Sex	
Boy	88 (48.34)
Girl	93 (51.66)
Mother education	
Illiterate	7 (3.85)
Primary	29 (15.93)
Secondary	47 (25.82)
High School	71 (39.01)
Academic	22 (12.09)
Non-response	7 (3.85)
Father education	
Illiterate	4 (2.20)
Primary	9 (4.94)
Secondary	44 (24.18)
High School	79 (43.41)
Academic	43 (23.63)
Non-response	5 (2.75)
Mother job	
Housewife	62 (34.07)
Employed	115 (63.19)
Non-response	5 (2.75)
Father job	
Unemployed	15 (8.24)
Employed	167 (91.76)
Family income (Iranian's Rial)	
< 15 million	45 (24.73)
15 - 20 million	51 (28.02)
20 million and more	80 (43.96)
Non-response	8 (4.39)
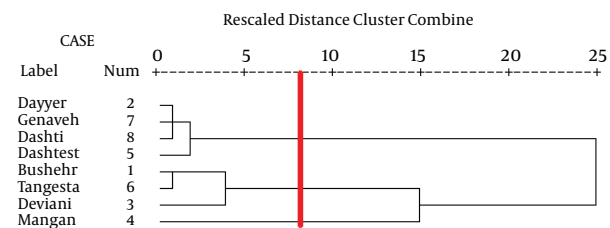
Figure 2. Dendrogram of cluster analysis for prevalence of mental disorders among 8 counties.

(51.6%) and Bushehr (48.2%) counties, respectively. Additionally, the lowest prevalence of mental disorders was related to Dashtestan County (41.2%), which was more than that prevalence of mental disorders in Tehran [21].

Most studies have pointed out that the prevalence of mental disorders and its dimensions are more in females than males [11, 15, 17, 22], however, in this study, such com-

Table 2. Frequency Distribution of Students, Mean ± Sd Age (Year) and Prevalence of Mental Disorders in Bushehr Counties

County	Sex	N	Age[a]	Prevalence (95% C.I.)
Bushehr	Boy	19	16.1 ± 0.87	0.482 (0.362 , 0.602)
	Girl	12	16.40 ± 0.99	
	Total	31	16.21 ± 0.82	
Dayyer	Boy	4	15.25 ± 1.25	0.425 (0.245,0.605)
	Girl	6	15.66 ± 1.21	
	Total	10	15.50 ± 1.17	
Deylam	Boy	8	15.94 ± 1.20	0.454 (0.304 , 0.604)
	Girl	17	16.57 ± 0.53	
	Total	25	16.23 ± 0.90	
Kangan	Boy	10	16.10 ± 1.52	0.516 (0.376,0.656)
	Girl	9	15.30 ± 0.44	
	Total	19	15.81 ± 1.32	
Dashtestan	Boy	15	16.06 ± 0.88	0.412 (0.155,0.669)
	Girl	12	16.06 ± 1.08	
	Total	27	16.07 ± 0.95	
Tangestan	Boy	15	15.66 ± 0.61	0.472 (0.362,0.582)
	Girl	10	15.10 ± 0.01	
	Total	26	15.62 ± 0.61	
Genaveh	Boy	10	15.80 ± 1.03	0.421 (0.221,0.621)
	Girl	10	15.01 ± 0.72	
	Total	20	15.82 ± 1.13	
Dashty	Boy	7	16.00 ± 1.00	0.433 (0.284,0.583)
	Girl	17	15.92 ± 0.89	
	Total	24	15.91 ± 0.94	

[a] Values are expressed as mean ± sd.

parison was not possible due to the small sample size.

Khademolhosseini and Ahmadi have shown that smoking among high school students is associated with depression and anxiety ([23]). Therefore, considering the high prevalence of mental disorders among high school students in Bushehr province, the risk of increased prevalence of smoking is to be felt in the near future.

Some studies have shown that poor economic and social conditions can affect the mental health of adolescents ([17], [24]). Furthermore, the Bushehr province rank is lower in terms of economic and social development provinces in Iran ([25]). Therefore, underdevelopment and low quality of life of in Bushehr province may be the cause of increasing the prevalence of mental disorders.

Another possible causes of the increased prevalence of mental disorders in southern Iran is not a priority. Such thinking and behavior is also observed in European countries ([26]). Previous studies demonstrated that an educational intervention, even in low-income communities, could reduce the anxiety and depression

Although this study was conducted on small dimensions, it clearly shows that the situation of mental health among high school students in Bushehr province counties

is not appropriate. Furthermore, the study shows that if preventive action is not done in this province, the community should have irreparable consequences such as suicide, crime, epidemic of depression, and anxiety.

Although the prevalence of mental disorders in the counties of Bushehr province was almost identical, the cluster analysis showed that these counties could be divided into 3 categories. Range of the prevalence of mental disorders in the province was about 10.4% (from 51.6% in Kangan to 41.2% in Dashtestan), which is relatively high in variation.

The incidence of mental disorders may have different origins in each region. Because the origin of mental illness has not been identified in Bushehr province, so it is suggested that a comprehensive study be carried out on this subject; and the prevalence of mental disorders be controlled by identifying its main factors.

This study has several limitations. First; the sample size was reduced due to the loss of some questionnaires. Therefore, in the study there may be a decreased power of statistical tests. Additionally, small sample sizes may affect measures of the prevalence. Of course, we tried to make this problem using a Baysian's small-area technique. Second;

due to the fact that we did not find suitable auxiliary variables, the prevalence of GHQ subscales such as depression, anxiety, etc. could not be estimated by Bayesian's small area technique.

5.1. Conclusions

Based on this study, the prevalence of mental disorders among adolescents was increasing in Bushehr Province counties. The lack of a national policy in this way is a serious obstacle to mental health and wellbeing access. In addition, according to the psychological problems, students should be responsible according to the consulting psychology used in schools.

Acknowledgments

Footnotes

Conflict of Interest: We declare that we have no conflict of interest.

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