Research Article

Investigating the Factors Affecting Depression By Using Structural Equation Modeling

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Abstract

The objective of the research was to study the factors affecting depression in general population.

Materials and Methods. A total of 1,291 individuals at the age of 15-68 years participated in this cross-sectional study. The Demographic Information Form, the Beck Depression Inventory for Primary Care and the Generalized Anxiety Disorder Scale were used as data collection tools. The data obtained were evaluated in the SPSS 23 package program. Missing data were validated for extreme values, and, then, tested for normality and homogeneity. Testing for the research model was implemented by structural equation modeling using the AMOS program.

Results. The following goodness-of-fit values were determined for the revised model predicting the factors influencing depression: $\chi^2 = 535.62$, $\chi^2/df = 4.74$, the normed fit index = 0.95, the Tucker-Lewis index = 0.95, the comparative fit index = 0.96, the goodness-of-fit index = 0.95, the adjusted goodness-of-fit index = 0.94, the root-mean-square error of approximation = 0.05, the root mean square residual = 0.12, which were within acceptable limits. According to our model, the generalized anxiety disorder-7 ($t = 15.923$; $p < 0.001$), gender ($t = -5.866$; $p < 0.001$), age ($t = -8.193$; $p < 0.001$) and marital status ($t = -6.107$; $p < 0.001$) had a significant effect on depression. However, there was no significant relationship between depression score and educational status, place of residence, family type, and smoking.

Conclusions. In this model of our study, generalized anxiety disorder was found to have the greatest effect on depression, followed by age, marital status, and gender, respectively.

Keywords

Depression; Generalized Anxiety Disorder; Structural Equation Modeling

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Problem statement and analysis of the latest research

Depression is a widespread health problem, affecting individual's life and functionality in all respects, and, eventually, causing socio-economic problems [1]. Depression is an emotional state when an individual feels unhappy and worthless. It is a complex problem presenting itself as feelings of social isolation and apathy, as well as various problems including nutrition, sleep, sexual functions and concentration [2, 3].

According to the "Prevalence of Chronic Illness in Turkey"

survey, depression reducing quality of life by preventing productivity, functionality, and happiness has a prevalence of 13.1% among women, 5% among men, and 9.3% in total [4, 5]. In addition to its high prevalence, depression has a high recurrence rate, it can become chronic and increase suicidality [6, 7] and it can also be considered as one of the most common causes of disability due to its effects causing loss of ability at quite high levels [8, 9]. Various factors including female gender, traumatic life events, serious financial problems, genetic predisposition, and dissatisfaction with life can be

mentioned among the causes of depression [10]. However, depression has been reported to be triggered by the combination of multiple variables, rather than by one single reason [8].

A review of the national literature revealed no recent study on mental health representing the society as a whole for a considerably long period. Especially since 2000s, studies on depression involving different groups such as women, adolescents, and students who are more sensitive and vulnerable than other groups in the society have been carried out [2, 11, 12]. However, a large-scale study representing the whole society has not been conducted, and the factors affecting depression have not been examined.

Therefore, **the objective of the research** was to investigate the factors influencing depression in general population.

Materials and Methods

This cross-sectional study was conducted to investigate the factors affecting depression in the general population. The random sampling method was used in the research. Data collection forms, prepared in accordance with the study objective, were entered into our online database. The link to these forms were shared through various applications (WhatsApp, BiP, etc.) with as many people as possible, expecting them to have these forms filled in and return to our database. The forms were shared online, and participants did not meet. Each of the researchers shared data collection forms with an average of 400 people (1,600 people in total). The data collection process was monitored regularly and it was terminated after no new data arrived for about a week. At the end of this process, a total of 1,291 forms were returned.

The Demographic Information Form, the Generalized Anxiety Disorder Scale (GAD-7) and Beck Depression Inventory for Primary Care (BDI-PC) were used as data collection tools.

Demographic Information Form

It collects information on the sociodemographic characteristics of the participants [2, 8, 12].

BDI-PC

The BDI-PC [13], developed by Beck *et al.* and adapted to Turkish by Aktürk *et al.*, is a measurement tool revealing the presence of depression over the past 15 days [14]. The survey conducts depression screening under seven topics using symptoms of sadness, pessimism, past failure, self-dislike, self-criticalness, loss of interest, and suicidal thoughts or wishes. Each topic contains a four-graded score from 0 to 3. Scoring is obtained by summing up the scores of each topic. On the scale, one can get a maximum of 21 points. Although there is no cut-off score reported, the probability of depression is above 90% with scores of 4 and above [14].

GAD-7

It is a 7-item self-reporting scale developed by Spitzer *et al.* according to the Diagnostic and Statistical Manual of Mental

Disorders, Fourth Edition (DSM-IV-TR) criteria [15]. The items are rated on a 4-point Likert-type scale. It evaluates the generalized anxiety disorder in the past two weeks. It was adapted to Turkish by Konkan *et al.* and its validity and reliability were proven [16]. The acceptable cut-off value in the Turkish version was calculated as 8.

Data Analysis

The study data were analyzed by the SPSS 23 and AMOS 23 package programs. The data obtained were first validated for missing data and extreme values in the SPSS 23 package program, and, then, normality tests and homogeneity tests were conducted. Descriptive statistics of the research were performed using the SPSS 23 package program. Structural Equation Modeling (SEM) was used to determine the factors affecting depression. SEM is a more powerful technique as compared to other analysis methods, since it assumes a causal structure among a set of the latent variables, and those variables can be measured by using observable variables [17]. In fact, SEM is a modelling system, actively involving multivariate statistical analysis methods such as regression, factor analysis and variance (covariance) analysis. This technique includes one or more linear regression equations describing how the internal structures are linked to the external structures [18].

In SEM, detailed explanation of all the parameters associated with the relationships between the variables in the model means constructing the model. There are two main components in SEM: the measurement model and the structural model. SEM analysis should start with the measurement model [18, 19]. In the measurement model, relationships with non-predefined directions (correlations) among the variables can be calculated by defining the latent variables. In the structural model, however, the direction is determined for each relationship between the latent variables and variables that are not indicative of the latent variable, and some parameters are fixed. In determining the SEM model, all the indicator variables and even error variances in the model must be determined, in addition to the parameters about relationships among the latent variables [20].

Goodness-of-fit indices were used to determine the goodness of fit of the model. In structural equation models, there are different fit indices for assessing the model fit. When interpreting fit statistics, some acceptable limit values are used in determining whether the model will be accepted or not, and it is expected to have no difference between the data observed in the structural equation model and the theoretical data [19]. Goodness-of-fit values serve to determine how consistent the relationships in the model are with the study data.

Among the most commonly used indices, those recommended are the Chi Square (χ^2) / Degree of Freedom (df) Ratio, the Root-Mean-Square Error of Approximation (RMSEA), the Goodness-of-Fit Index (GFI) and the Adjusted Goodness-of-Fit Index (AGFI). In addition, the indices such as the Standardized Root Mean Square Residual (SRMR),

the Comparative Fit Index (CFI), the Normed Fit Index (NFI) and the Tucker-Lewis Index (TLI) are commonly used as well.

Although the chi-square-to-degrees of freedom ratio is expected to be no more than 3-4, there are also studies indicating that it can be up to 5. However, other goodness-of-fit values were developed as well, since the chi-square value can be easily affected by the sample size. The RMSEA is a value used to test the hypothesis assuming that the correlation is equally distributed [19]. This value is expected to be less than 0.08 (< 1 according to some studies); however, the RMSEA value below 0.05 is recognized as an even better indicator of compatibility [19, 21].

The GFI value indicates that two different models tested in the same sample can be compared. The AGFI value, however, is the adjusted version, considering the complexity of the GFI model. These values are expected to be 0.90 and above [19]. However, according to some reports, the GFI and AGFI values can be acceptable in the interval of 0.80-0.89 [22–24]. The SRMR is another criterion for the goodness of fit. The SRMR value is expected to be less than 0.08, as in case of the RMSEA [19].

Results

The mean age of the sample was 28.6 ± 10.1 years; 71.1% of the group were women; the majority was single (63%) and had nuclear family types (84.8%). According to the education level, university graduates (81.8%) predominated; the overwhelming majority lived in a metropolitan (43%) or a city (32.8%). In addition, 25.9% of the group smoked (Table 1).

Table 1. Demographic characteristics of the sample.

Variable	Parameter	n	%
Gender	Female	918	71.1
	Male	373	28.9
Marital Status	Single	813	63
	Married	478	37
Family Type	Nuclear Family	1,095	84.8
	Extended Family	196	15.2
Educational Level	Primary School Graduate	24	1.9
	Middle School Graduate	23	1.8
	High School Graduate	188	14.6
	University graduate	1,056	81.8
Place of Residence	Village	81	6.3
	Town	232	18
	City	423	32.8
	Metropolis	555	43
Smoking Status	No	956	74.1
	Yes	335	25.9
Age	Mean (years)	Standard Deviation	
	28.6	10.1	

The first-level single-factor structure of the BDI-PC scale consisting of single dimension and 7 items was tested by

discriminant function analysis (DFA). Maximum likelihood estimation method was used due to the normal distribution of the data. Factor loads of all items in the scale ranged between 0.46 and 0.73. The measurement model for the BDI-PC scale was validated as a result of our data, due to the fit indices obtained in the study. Consequently, the fit indices on the BDI-PC scale were as follows: $\chi^2 = 46.17$, $\chi^2/\text{df} = 3.551$, the NFI = 0.98, the TLI = 0.97, the CFI = 0.98, the GFI = 0.99, the AGFI = 0.98, the RMSEA = 0.04, and the RMR = 0.02. The goodness-of-fit values obtained as a result of the second-level DFA indicated that the two-factor model was compatible with the data and within acceptable levels. These results demonstrated that the data obtained in the study were in compliance with the predicted theoretical structure of the Beck-PC scale (Fig. 1).

The structure of the GAD-7 scale, consisting of single dimension and 7 items, was tested with first-level single-factor DFA and maximum likelihood estimation method was used. Factor loads of the scale items ranged from 0.76 to 0.83, and all the items included in the original scale were included in the analysis and the fit indices of the scale were examined. According to the findings, the fit indices on the GAD-7 scale were as follows: $\chi^2 = 36.23$, $\chi^2/\text{df} = 3.294$, the NFI = 0.99, the TLI = 0.99, the CFI = 0.99, the GFI = 0.99, the AGFI = 0.98, the RMSEA = 0.04, and the RMR = 0.01. The goodness-of-fit values obtained as a result of the first-level DFA were found to show a perfect fit with the suggested single-factor structure of the model. These findings showed that the data obtained in the study were compatible with the proposed theoretical structure of the GAD-7 scale.

The reliability of the scales used in the study were assessed by Cronbach's alpha. Cronbach's alpha values obtained for the scales were calculated as 0.78 for the BDI-PC scale and 0.92 for the GAD-7 scale. These values showed that the reliability of the scales was within normal range (Table 2).

Table 2. Reliability data regarding the BDI-PC scale and the GAD-7 scale.

Scales	Number of items	Internal Consistency Coefficient (Cronbach's Alpha)
Beck-PC Scale	7	0.78
GAD-7 Scale	7	0.92

In order to predict the factors causing depression, the initial structural model was established and the goodness-of-fit values of this model were examined. The GAD-7 scale mean score, and the variables such as age, gender, marital status, family type, educational status and smoking status were included in the model. The goodness-of-fit values of the model revealed that the values did not provide the minimum goodness-of-fit values required for a valid model ($\chi^2 = 1676.41$, $\chi^2/\text{df} = 9.11$, the NFI = 0.84, the TLI = 0.83, the CFI = 0.85, the GFI = 0.89, the AGFI = 0.86 the RM-

Figure 1. Path diagram of the BDI-PC scale and the GAD-7 scale measurement model.

SEA = 0.08, the RMR = 0.26) (Fig. 2).

When the standardized regression weights of the variables included in the initial prediction model and the significance of their contribution to the model were examined, the variables of family type, place of residence, educational status and smoking status were found not to show a significant relationship with the model ($p > 0.05$). Moreover, the goodness-of-fit values of the initial structural model as a whole were not at an acceptable level. For these reasons, the variables of "family type", "place of residence", "educational level" and "smoking status" were excluded from the analysis and a new structural model was created in order to obtain a new model with higher goodness-of-fit values in comparison to the present model or to increase the fit of the model to the dataset (Table 3).

When the revised model predicting the factors affecting depression and the goodness-of-fit values were examined, the goodness-of-fit values were found to be at the desired level ($\chi^2 = 535.62$, $\chi^2/df = 4.74$, the NFI = 0.95, the TLI = 0.95, the CFI = 0.96, the GFI = 0.95, the AGFI = 0.94, the RMSEA = 0.05, the RMR = 0.12) and the design of the model was finalized. The GAD-7 ($t = 15.923$; $p < 0.001$), gender ($t = -5.866$; $p < 0.001$), age ($t = -8.193$; $p < 0.001$), and marital status ($t = -6.107$; $p < 0.001$) were found to have a significant effect on depression. As regards to the standardized regression coefficients in the model, among those independent variables that were determined to be significant, the effect of the GAD-7 scale was found to be more significant (0.69) than the other independent variables. The direction of the relationship between the variable "gender" and depression showed that women had a significantly higher level of depression than men. The variable "age", however, was found to be inversely related to depression. According to these data, the level of depression decreased with age. "Marital status", as another variable, had a significant effect on depression as well. It can be said that depression levels were higher in single individuals

as compared to married ones (Fig. 3).

Discussion

In this study examining the factors affecting depression, which is one of the most common and important social challenges, the data obtained were discussed in the light of the literature.

Generalized anxiety disorder has been found to play a great role as one of the triggers of depression. These data were consistent with studies reporting about a significant overlap between anxiety and depression and that depression-anxiety comorbidity was always common [25–27].

Most studies on depression looked at the female-to-male ratio and higher depression scores were found in women as compared to men [28–31]. Moreover, the majority of patients with depression in Turkey were reported to be women (65–70%) with higher risk in terms of both dysthymia and major depressive disorder; hence, one in four women had depression [28]. Depression is more common in women in most societies, and it has been attributed to the women's physical and psychological nature. In this study, females were found to have higher risk of depression than men. The way a woman copes with stress, her physical and psychological structure, personality traits and sociocultural status cause women more prone to depression.

Depression risk has been found to decrease with age. In the literature, depression was reported to occur mostly in middle age, and to decrease with age [5, 32]. On the other hand, the decreased risk of depression with increasing age may be interpreted as a natural result of developing more effective ways of dealing with problems with age, as well as a decrease in the occurrence of adverse life events and personality maturation over time. Age is considered to be a protective factor against depression.

The single lifestyle has been determined as another risk factor for depression. It can be stated that single individu-

Figure 2. Initial structural model predicting the factors affecting depression.

Table 3. Regression weights of the initial model describing the factors affecting depression.

Parameter		Latent Structure	Standardized Regression Weight	Significance
GAD-7	<—	BDI-PC	0.687	0.000
Gender	<—	BDI-PC	-0.193	0.000
Age	<—	BDI-PC	-0.310	0.000
Marital Status	<—	BDI-PC	-0.248	0.000
Family Type	<—	BDI-PC	0.019	0.548
Place of Residence	<—	BDI-PC	0.001	0.969
Educational Status	<—	BDI-PC	0.040	0.199
Smoking Status	<—	BDI-PC	-0.013	0.670

als may experience depression more common than married ones. When the risk factors for depression were examined in the literature, the absence of close relations [32] and loneliness [33] were pointed out as the causes of depression. These research data suggested that single individuals have lower rates of social support; they mostly live alone, and, therefore, are at greater risk of depression. There were studies reporting higher levels of depression among single individuals, which was consistent with our findings [34, 35]. The results of our study are consistent with the literature.

We have found that educational status is not involved in developing depression. Some studies reported that educational status was highly related to depression and individuals with

low educational levels were at higher risk of depression [28, 36]. The inconsistency in the results can be attributed to ever-changing structure of society and higher levels of education.

Family type and smoking status turned to be the other variables that did not play any role in developing depression as well. Similar results were found in the literature. A number of authors determined that smoking did not affect depression [27, 37]. Similarly, according to some studies, family type and smoking status were not involved in developing depression [38, 39]. After collecting and reviewing the data obtained by the studies examining the risk factors that affect depression, we can state that, our data are quite in conformity with other studies.

Figure 3. Revised model predicting the factors affecting depression.

Conclusions

According to the results of our study examining the factors affecting depression, generalized anxiety disorder was found to be a very important factor for developing depression. In addition, the variables such as age, marital status, and gender, respectively, could be considered as important parameters for explaining depression. Young age seemed to be strongly associated with depression; single individuals were more vulnerable to depression than married people. In our sample, women were at higher risk of depression as compared to men.

According to these results, special attention is recommended to be given to women, young people and single ones, who are at high risk of depression.

Considering the significant effect of generalized anxiety disorder on depression, all kinds of measures suppressing generalized anxiety disorder in society may eventually decrease the prevalence of depression. The initiatives for preventing generalized anxiety disorder in society, are therefore, needed to be planned.

Ethical Statement

Ethical permissions required for the study were obtained from the Artvin Coruh University Scientific Research and Ethical

Review Board (date - 08.05.2020 and session - 2020/7).

Informed Consent

At the stage of data collection, individual consent was obtained from each participant.

Conflict of Interest

The authors declare that no conflicts exist.

Financial Disclosure

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