Effects of Indoor Lighting on Depression Probability and Academic Performance in a Population of Turkish Adolescents

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Introduction

Previous research

There is an accumulating body of research evidence indicating that depression is a common and largely unrecognised mental health problem in Turkish adolescents (Eskin et al., 2008; Toros et al., 2004) and their peers worldwide (Frigerio et al., 2001; Saluja et al., 2004). While depression is not highly prevalent in prepubertal children, the incidence of this problem in children, especially in girls, increases substantially during the period following puberty (Kessler et al., 2001; Lewinsohn et al., 1994). One should be aware of the fact that overlooking or disregarding adolescent depression can have profound and tragic consequences. There is convincing evidence that it leads to serious social and academic problems (Frigerio et al., 2001; Saluja et al., 2004) and constitutes a major risk factor for substance abuse and suicidal behaviour (Kovacs et al., 1993; Saluja et al., 2004). Therefore, it is viable to deduce that both the diagnosis and treatment of adolescent depression is of vital importance.

Because of its high prevalence and detrimental effects, a concerted effort has been made to identify the major determinants of depression in adolescent boys and girls. A large number of empirical studies have provided a wealth of information on the association between adolescent depression and perceived social support, or more specifically, the feeling of being cared for, esteemed, loved and valued by others. It has been demonstrated that the perception of having inadequate social support from family members, friends and teachers increases the likelihood of depression in Turkish adolescents (Eskin et al., 2008; Yildirim, 2004) and their Western counterparts (Kaltiala-Heino et al., 2001; Newman et al., 2007). In addition to the protective role of perceived social support, the influence of a variety of sociodemographic factors have been repeatedly reported in the literature. In most of the studies carried out on Turkish and non-Turkish adolescents, it has been found that parents' education, family size, parents' employment, family income and separation from both or one of the parents are directly related to the severity of depressive symptoms (Sund et al., 2003; Toros et al., 2004).

It has been demonstrated that, apart from vision, the lighting of interiors may have implications for our somatic and psychological well-being (see Boyce, 2003). This raises the question as to whether indoor lighting can be used effectively to ameliorate depression in adolescents and improve their quality of life. Even though it is currently hard to give a definitive answer to this question, there is suggestive evidence that indoor lighting conditions may affect adolescent depression. For example, by retrieving and analysing hospital records for over a 2-year period, Beauchemin and Hays (1996) compared the average duration of hospitalisation in a cohort of psychiatric inpatients who had been suffering from severe depression and assigned to "bright and sunny" rooms in a Canadian ward with that of a corresponding group of patients treated in "dull" rooms. The researchers observed that a plentiful supply of daylight could significantly expedite recovery. The discharge of the patients accommodated in the sunny rooms was almost 3 days earlier. This finding is supported by an analogous study of Benedetti and colleagues (2001) in an Italian facility. In accord with the others, they stated that the length of stay was

approximately 4 days shorter in a group of psychiatric inpatients hospitalised for bipolar depression in comparatively brighter and sunnier rooms. A methodologically similar study by Kecskes et al. (2003) is also well-worth citing in the present context. By scrutinising hospital records for over a span of 3 years, the researchers investigated the influence of season upon the average length of hospitalisation in a large number of depressive inpatients. The findings of Kecskes and colleagues were in line with those of the other research groups. The hospitalisation periods of both male and female depressives were comparatively shorter in summer. However, the significant difference was confined to the females older than 50 years of age.

It should be noted here that the above-mentioned studies and a substantial portion of the research into the non-visual effects of indoor lighting has been conducted on healthy and patient adult populations. Therefore, there is a lack of knowledge about whether the conclusions drawn from the studies on adults are valid for children and adolescents.

Present research

To our best knowledge, there exists no empirical work that has been devoted to investigate the relationship between the lighting of indoors and adolescent depression. Accordingly, in an attempt to investigate and reveal whether there is an optimal indoor lighting condition for alleviating depressive symptoms and, as a direct consequence, improving academic achievement in adolescents, the present research was undertaken.

Methodology

Participants

In total, 275 9th-grade high school students, of whom 114 (41.5%) were female, were recruited to voluntarily participate in the study. The mean age of the participants was 14.7±0.7 years (participants' age range, from 14 to 17 years). In order to minimise the confounding effects of prior knowledge or expectations on their self-evaluations, no information on the aim and possible outcomes of the study was given to the participants before the completion of data collection.

Setting

The study was carried out in nine similar classrooms of a high school in Izmir, Turkey. Izmir is a large city located in the western extremity of Anatolia and has a typical Mediterranean climate. The classrooms were similar in size, interior décor and artificial lighting. They mainly differed from each other with respect to the location, number and transparency of windows, or in other words, the provision of daylight (Figure 1).

Fig. 1: Two different classrooms

Study protocol

Between the 22nd of March 2012 and 21st of April 2012, three data collections were executed at approximately 2-week intervals in order to assess participants' depressive symptoms by administering the Turkish version (Oy, 1991) of the Children's Depression Inventory (CDI; Kovacs, 1985). The CDI is a 27-item inventory that can be administered to children from 7 to 17 years of age. The items in the inventory are rated on a 3-point scale to report on the severity of the depressive symptoms experienced in the past 2 weeks. A CDI score is obtained by adding the scores for each item, and it can vary between 0 and 54. A score equal to or greater than 19 is considered to be indicative of depression.

Table 1: Determinants of the probability of depression

Variable	Coefficient	Standard Error
Gender (male)	-1.32*	0.49
Academic performance	-1.44*	0.36
Vertical illuminance	-0.0014*	0.0006
# of observations	740	
Wald Test $x^2(3)$	77.37*	

Note: * denotes the level of significance at 5 per cent.

Participants' grades on their examinations were obtained from the school administration in order to assess their average scholastic success in Turkish, history, mathematics, physics, chemistry and biology. Moreover, vertical illuminance levels at sitting eye height (i.e., at 120 cm) in each classroom were measured[1] on the days of data collection.

Statistics

In order to estimate the effects of lighting conditions in the classrooms on the probability of depression, we employed a probability model based on the logistic distribution, namely the panel logit model. As a complementary analysis, in order to investigate the effects of the lighting conditions on academic success, a linear regression on the cross-section of the students was estimated. All calculations regarding the statistical analysis were carried out with the STATA (version 11.1; STATA Corp., College Station, TX, U.S.).

Results

The regression results presented in Table 1 are based on the panel data from all three administrations of the depression inventory and measurements of vertical illuminance. It is evident from the table that the probability of being depressed (i.e., having a CDI score greater than 18) is significantly lower for male participants. Furthermore, it can be

Fig. 2: The probability of depression for the participants having low academic performance

deduced that there is a causal relationship between depression and low academic performance. The probability is significantly higher for the students having lower examination scores. Moreover, it is reasonable to infer from the table that the level of illumination reaching the eye has a profound effect on the probability of depression. The higher the illuminance, the lower the probability of depression. The results are summarised in Figure 2.

Table 2: Determinants of academic performance

Variable	Coefficient	Standard Error
Gender (male)	0.21**	0.11
Vertical illuminance	N.S.	
Intercept	1.53*	0.26
# of observations	268	
F(2, 263)	3.03*	

Note: * and ** denote the level of significance at 5 and 10 per cent, respectively.

The associations between vertical illuminance and academic achievement, as well as gender, were also investigated. Average vertical illumination levels for each classroom were computed based on all three illuminance measurements. A cross-section sample of 263 students in all nine classrooms was obtained. The regression results are reported in Table 2. Although it is possible to infer from the table that male participants exhibit higher academic performance on average, it is not viable to deduce that there is a significant relationship between

[1] It is relevant to mention here that, during the illuminance measurements, the occupants of the classrooms were not using artificial lighting due to adequate illumination from the classroom windows.
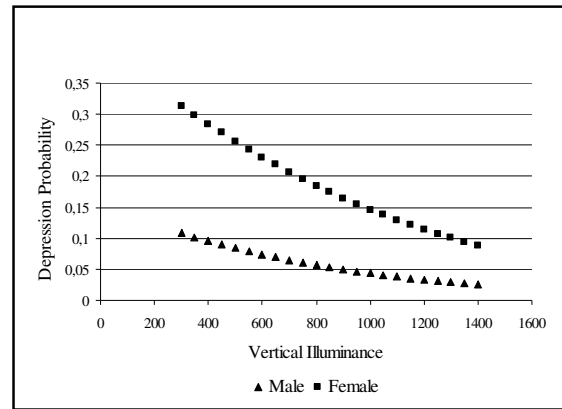
participants' scholastic performance and vertical illuminance at eye level.

Discussion

It is beyond the scope of this paper to undertake a full-fledged analysis of depression probability by taking the effects of sociodemographic factors and social support into consideration. The aim of this paper is to reveal whether or not indoor luminous conditions can influence depression and academic performance in adolescents. In the light of our findings, it does not seem unreasonable to suggest that the amount of light, particularly natural light, reaching the eye is likely to be an important factor in altering depressive feelings, but not performance, in adolescents. What is also possible to discuss here that there may be a threshold illuminance level (i.e., approximately 1,400 lux) above which no further benefits are seen.

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References

Beauchemin, K. M., & Hays, P. (1996). Sunny hospital rooms expedite recovery from severe and refractory depressions. *Journal of Affective Disorders*, *40*, 49-51.

Benedetti, F., Colombo, C., Barbini, B., Campori, E., & Smeraldi, E. (2001). Morning sunlight reduces length of hospitalization in bipolar depression. *Journal of Affective Disorders*, *62*, 221-223.

Boyce, P. R. (2003). *Human Factors in Lighting* (2nd ed.). London: Taylor & Francis.

Eskin, M., Ertekin, K., Harlak, H., & Dereboy, C. (2008). Lise ogrencisi ergenlerde depresyonun yaygınlığı ve iliskili oldugu etmenler. *Turk Psikiyatri Dergisi*, *19*, 382-389.

Frigerio, A., Pesenti, S., Molteni, M., Snider, J., & Battaglia, M. (2001). Depressive symptoms as measured by the CDI in a population of northern Italian children. *European Psychiatry*, *16*, 33-37.

Kaltiala-Heino, R., Rimpela, M., Rantanen, P., & Laippala, P. (2001). Adolescent depression: The role of discontinuities in life course and social support. *Journal of Affective Disorders*, *64*, 155-166.

Kecskes, I., Rihmer, Z., Kiss, K., Vargha, A., Szili, I., & Rihmer, A. (2003). Possible effect of gender and season on the length of hospitalisation in unipolar major depressives. *Journal of Affective Disorders*, *73*, 279-282.

Kessler, R. C., Avenevoli, S., & Merikangas, K. R. (2001). Mood disorders in children and adolescents: An epidemiologic perspective. *Biological Psychiatry*, *49*, 1002-1014.

Kovacs, M. (1985). The Children's Depression Inventory (CDI). *Psychopharmacology Bulletin*, *21*, 995-998.

Kovacs, M., Goldston, D., & Gatsonis, C. (1993). Suicidal behaviors and Childhood-onset depressive disorders: A longitudinal investigation. *Journal of the American Academy of Child & Adolescent Psychiatry*, *32*, 8-20.

Lewinshon, P. M., Clarke, G. N., Seeley, J. R., & Rohde, P. (1994). Major depression in community adolescents: Age at onset, episode duration, and time to recurrence. *Journal of the American Academy of Child & Adolescent Psychiatry*, *33*, 809-818.

Newman, B. M., Newman, P. R., Griffen, S., O'Connor, K., & Spas, J. (2007). The relationship of social support to depressive symptoms during the transition to high school. *Adolescence*, *42*, 441-459.

Oy, B. (1991). Cocuklar icin depresyon olcegi: Gecerlik ve guvenirlik calismasi. *Turk Psikiyatri Dergisi*, *2*, 132-136.

Saluja, G., Iachan, R., Scheidt, P. C., Overpeck, M. D., Sun, W., & Giedd, J. N. (2004). Prevalence of and risk factors for depressive symptoms among young adolescents. *Achieves of Pediatrics & Adolescent Medicine*, *158*, 760-765.

Sund, A. M., Larsson, B. & Wichstrom, L. (2003). Psychosocial correlates of depressive symptoms among 12-14-year-old Norwegian adolescents. *The Journal of Child Psychology & Psychiatry*, *44*, 588-597.

Toros, F., Gamsiz-Bilgin, N., Bugdayci, R., Sasmaz, T., Kurt, O., & Camdeviren, H. (2004). Prevalence of depression as measured by the CBDI in a predominantly adolescent school population in Turkey. *European Psychiatry*, *19*, 264-271.

Yildirim, I. (2004). Depresyonun yordayicisi olarak sinav kaygisi, gundelik sikintilar ve sosyal destek. *Hacettepe Universitesi Egitim Fakultesi Dergisi*, *27*, 241-250.