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Depression Levels Following Discharge Predict Quality of Life in Heart Disease Patients

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ABSTRACT – Depression and stress have been related with poor Health Related Quality of Life (HRQoL) prognosis. However, it is not clear when these depressive symptoms should be measured. A sample of 177 Coronary Heart Disease patients were followed for 15 months aimed to compare the effect of depression and stress measure at time of hospitalization and three months later on the physical HRQoL trajectory. Linear growth models' results showed that depression and stress after discharge are negatively correlated with the physical HRQoL and depressive symptoms negatively affect the prognosis of these patients.

KEYWORDS: depression, stress, quality of life, heart disease, linear growth models

Depressão após Alta Prediz Qualidade de Vida Prévia em Pacientes Cardíacos

RESUMO – Depressão e estresse têm sido associados ao prognóstico da Qualidade de Vida Relacionada à Saúde (QVRS). Contudo, não há clareza sobre quando os sintomas de depressão devem ser mensurados. Uma amostra de 177 pacientes com cardiopatia isquêmica foi acompanhada por 15 meses, para comparar o efeito do estresse e a depressão durante a internação e, três meses depois, avaliou-se a trajetória do componente físico da QVRS. Os resultados da comparação de duas curvas de crescimento latente mostraram que a depressão e o estresse pós-alta estão negativamente correlacionados com o componente físico da QVRS, e que os sintomas depressivos afetam negativamente o prognóstico desses pacientes.

PALAVRAS-CHAVE: depressão, estresse, qualidade de vida, cardiopatia isquêmica, curvas de crescimento latente

Coronary Heart Disease (CHD) is a common cause of death and disability worldwide (Puddu, Piras, & Menotti, 2017; Wang, Dixson, Schiller, & Whooley, 2017). This disease represents an important proportion of deaths before the age of 70 years (Khan, Kella Kunutsor, Savonnen, & Laukkanen, 2018). Over three quarters of these deaths occur in low- and middle-income countries (World Health Organization, 2014). Furthermore, CHD is one of the five leading contributors of disability in elderly people in these countries (Mendis, Puska, & Norrving 2011). Thus, the burden caused by CHD is not only due of the mortality but also of nonfatal cardiac events and their consequences (Dahlöf, 2010; Heidenreich et al., 2011).

Depression and stress are common in CHD patients (Gorayeb, Bovo, de Lima, Magaldi, Tamie & Schmidt, 2015; Palacios, Khondoker, Tylee & Hotopf, 2018). Depression is highly prevalent (Abbasi et al., 2018; Almeida, Alfonso, Flicker, Hankey, & Norman, 2011). A systematic review of the literature found that approximately 20% of patients with an Acute Myocardial Infarction (AMI) fulfilled the criteria for major depression and another 31% reported some depressive symptoms (Thombs et al., 2006). Regarding

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stress in CHD, is has been recognized that patients report more stress levels than controls (Lanas et al., 2007; Rosengren et al., 2004).

These two psychological factors have been related to poor prognosis (Iles-Smith, McGowan, Campbell, Mercer, & Deaton, 2014; Rosengren et al., 2004). Researchers have shown that depression is related with morbidity and mortality after an acute cardiac syndrome (Carney et al., 2008; Davidson et al., 2010; Lichtman et al., 2014; Nabi et al., 2010); and also with poor Health Related Quality of Life (HRQoL) (de Jonge, Spijkerman, van den Brink, & Ormel, 2006; Lane, Carroll, Ring, Beevers, & Lip, 2001; Ruo et al., 2003; Wang, Jiang, & Lee, 2016), which has been recognized as a relevant parameter to measure the prognosis and success of interventions on CHD patients (Ladwig et al., 2014). This relation was found in a systematic review of 11 studies that showed that depression predicted subsequent physical HRQoL, independently of confounding factors such as the severity of CHD and baseline HRQoL (Dickens, Cherrington, & McGowan, 2012).

Conversely, other studies have found that depressive symptoms in the moment of the hospitalization due to the acute cardiac syndrome are not related with worse prognosis (Dickens et al., 2007; Lane et al., 2001; Parakh, Thombs, Fauerbach, Bush, & Ziegelstein, 2008). This could be related to the different trajectories that depressive symptoms can take in CHD patients (Kaptein, de Jonge, van den Brink, & Korf, 2006). Depressive symptoms at the moment of hospitalization could be explained by the event and be transient for some patients, while others might have persistent symptoms (Thombs et al., 2008).

Hence, it is plausible to think that the relationship between depression and poor prognosis in CHD patients is related to the time frame when the depressive symptoms appeared and their duration. In this vein, it has been suggested that the main action of depression on worse prognosis in CHD patients occurs after the cardiac event takes place (Carney & Freedland, 2012b; de Jonge, Spijkerman, et al., 2006). Furthermore, some researchers have conveyed that resistant depression was associated with high risk of mortality in this population (Carney & Freedland, 2009; Scherrer et al., 2012). Finally, persistent depressive symptoms or new depressive symptoms after the discharge have been found to be associated with poor prognosis in the physical HRQoL one year later (Thombs et al., 2008).

Given this evidence and the fact that it has been recommended to assess depressive symptoms in CDH patients (Lichtman et al., 2008), it is necessary to know when is the appropriate time to do this in order to implement an intervention. Thus, the present longitudinal study aimed to compare the effect of depression and stress measure at time of hospitalization and three months later on the physical HRQoL trajectory in CHD patients followed for 15 months in Colombia.

METHOD

Design and Patients

Overall, 190 patients with a documented CHD voluntarily participated in the study. Patients were invited to participate while they were hospitalized for an acute cardiac syndrome. The patients were followed up for 15 months. Trained staff administered the questionnaires every 3 months. At the end of the study, data retrieved in 6 measurements and from 177 participants was suitable for the analyses. 67% of the participants were men, and the average age was 64 years (*SD* = 11.27). The majority of the participants were married or had a long-term partner (62.6%). 38.4% of the patients had a low socio-economic position and 48.6% were employed. Concerning their clinical characteristics, 42.6% had had a Myocardial Infarction, 20.0% of the sample fulfilled the criteria for a depression disorder at time point 0, and 7.4% fulfilled these criteria three months after discharge.

Measures

In order to assess depression, we used a composite measure drawn from the Patient Health Questionnaire depression module (PHQ-9) (Kroenke & Spitzer, 2002). The PHQ-9 is composed by 9 items and is suitable to assess depression and its severity (Spitzer, Kroenke, & Williams, 1999). Respondents score in a 4 point Likert scale that goes from 1-absence to 3-every day. A total score less than 8 in this module suggests absence of depression; scores from 8 to 9 indicate possible depression: scores of 10 or above strongly suggest depression (Kroenke & Spitzer, 2002). In this study, Cronbach's alphas were .73 for time 0 (hospitalization) and .82 for time 1 (three months after discharge).

Perceived stress was assessed using the Perceived Stress Questionnaire (PSS) (Cohen, Kamarck, & Mermelstein, 1983). The PSS has 14 items and respondents score on a five-point Likert scale that ranges from 0 (never) to 4 (almost always). The Spanish version of the PSS-14 showed good reliability, Cronbach's $\alpha = .81$; test-retest $r = .73$ (Remor, 2006). Similarly, the Colombian version of the PSS obtained a good reliability coefficient (Cronbach's $\alpha = .86$) (Campo-Arias, Bustos-Leiton, & Romero-Chaparro, 2009). The PSS obtained good reliability in time 0 and time 1, Cronbach's $\alpha = .82$ and .84 respectively.

Finally, Physical component of HRQoL was measured with the relevant composite sub-scale of the 36 item Short Form (SF-36). This instrument was developed for the Medical Outcome Study in order to assess quality of life with a generic and easily administered measure. The SF-36 has demonstrated

good reliability (Vilagut et al., 2005) and has been validated for CHD patients (Nascimento, Alves, Pio, & Carisi, 2009). The Colombian version has satisfactory psychometric properties (Lugo, Garcia, & Gomez, 2006). In a study with post-CHD Colombian patients, the subscales of the physical health component of the SF-36 showed good reliability (Cronbach's α between 0.90 and 0.74) (Romero, 2010). This component obtained good reliability for all the time measures in the current sample, Cronbach's alpha of .92 for time 0, .93 for time 1, .95 for time 2 (6 months after discharge), .96 for time 3 (9 months after discharge), time 4 (12 months after discharge) and time 5 (15 months after discharge).

Statistical Analyses

Mplus (v. 6.12; Muthén & Muthén, 2010) was used to conduct the statistical analyses. The Growth Modeling approach was adopted to test the effects of depression and stress on the physical HRQoL trajectory in CHD patients. Two linear growth models (LGMs) were tested in which the change of Physical component of HRQoL over a 15-month period was predicted by depression and stress levels. The two LGMs were specified as follows: in the first model (LGM1) depression and stress at time 0 (hospitalization) (t_0) were constrained to predict the intercept and slope of Physical component of HRQoL over the following 15 months. In the second model (LGM2) depression and stress at time 1 (3 months after discharge) (t_1) were constrained to predict the intercept and slope of Physical component of HRQoL over the following 12 months. Model fit was assessed using the χ^2/df ratio test, the Root Mean Square Error of Approximation (RMSEA) and Tucker Lewis Index (TLI). Critical values for these coefficients are: χ^2/df ratio below 2 suggest good model fit (Byrne, 1989). For RMSEA, values of < .70 are acceptable (Hu & Bentler, 1999). For TLI, values of > .90 are considered satisfactory and > .95 are desirable (Bentler, 1990). Further, 95% confidence intervals were calculated for all the regression paths composing the LGMs. Finally, having in mind that older age and being male have been related with higher risk of a cardiac event and poor HRQOL (American Heart Association, 2010), age and sex were introduced as controls in the selected LGM.

RESULTS

Skewness and kurtosis coefficients for all variables were below the cut-off values (between 2 and -2; Bandalos & Finney, 2010; Muthén & Kaplan, 1985a, 1985b). This allowed the use of the ML estimator. Means of Physical component of HRQoL varied across all time points (t_0 = 49.51; t_1 = 48.84; t_2 = 57.59; t_3 = 61; t_4 = 59.75). Stress and depression were positively correlated at t_0 (r_s = .56, p < .01, 95% CI [.42, .67]), and t_1 (r_s = .54, p < .01, 95% CI [.34, .69]). Correlations between stress and depression with HRQOL are displayed in Table 1.

The coefficients of LGM1, where depression at t_0 (hospitalization) predicted the slope of the Physical component of HRQoL from that time point, indicated that the model had a poor fit to the data (χ^2 (23, 177) = 251.07, p < .001; RMSEA = .23; TLI = .54). Conversely, all goodness of fit coefficients for the LGM2 resulted satisfactory (χ^2 (15, 177) = 26.40, p = .03; RMSEA = .065; TLI = .91). Thus, LGM2 was accepted over LGM1, as shown in Table 2.

The LGM2 (see figure 1) suggests that levels of depression (r = -.38, p < .01, 95% CI [-.55, -.22]) and stress

Table 1

Correlations between stress, depression and Health Related Quality of Life (HRQOL)

	HRQOL Time 1	HRQOL Time 2	HRQOL Time 3	HRQOL Time 4	Depression Time 1
HRQOL Time 2	.35				
HRQOL Time 3	.38	.79			
HRQOL Time 4	.33	.54	.69		
Depression Time 1	-.32	-.52	-.65	-.64	
Stress Time 1	-.26	-.42	-.42	-.46	-.55

Table 2

Linear Growth Models goodness of fit indexes

Model	χ^2	Df	p value	RMSEA	TLI
LGM1: t_0 to t_4	251.07	23	.001	.23	.54
LGM2: t_1 to t_4	26.40	15	.03	.065	.91

N = 177; ML estimator

(r = -.37, p < .01, 95% CI [-.56, -.17]) three months after discharge were negatively and significantly correlated with the Physical component of HRQoL at this time point (t_1). Furthermore, depressive symptoms negatively affected the slope of the Physical component of HRQoL from t_1 to t_4 (ß = -.74, p < .05, 95% CI [-1.25, -.22]). In addition, the results suggest that stress at t_1 (three months after discharge), in contrast to depression, did not have a statistically significant influence on the growth curve of Physical component of HRQoL (ß = -0.12, n.s, 95% CI [-.53, .29]). Finally, age and sex were introduced in the LGM2 as covariates of the slope and intercept of HRQoL. As a result, the negative effect of depression on the growth curve of Physical component of HRQoL continued to be statistically significant, and being men was found to have a positive effect and statistically significant relationship with psychical HRQoL (Figure 1).

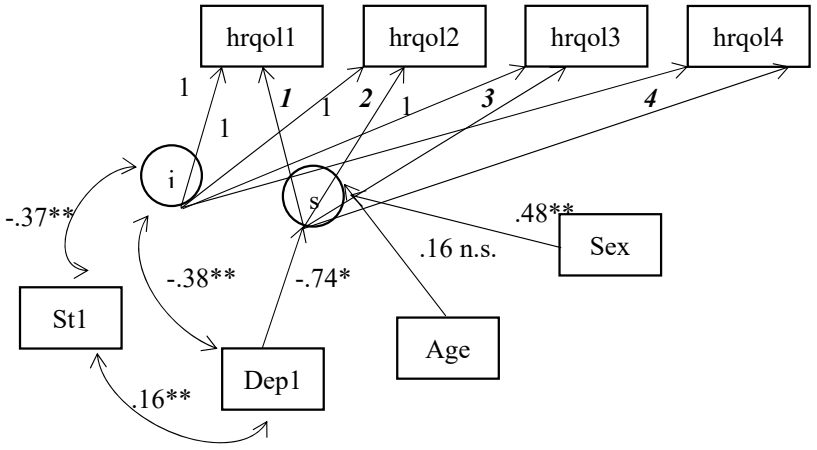

Figure 1. Linear Growth Model (LGM2) results and specification (standardized).
Note: n = *177; i = intercept of physical quality of life; s = slope of physical quality of life; Dep1 = depression three months after hospitalization; St1 = stress three months after hospitalization; hrqol from 1 to 4, physical quality of life measured every three months after hospitalization. Paths from the i to each hrqol measurement fixed at 1 as default in linear growth models. Paths from s to hrqol measurements were numbered from 1 to 4 to specify a linear growth model with equidistant time points. * significant at the p <.05 level; ** significant at the p <.01.*

DISCUSSION

The purpose of this study was to compare the effects of depression and stress measures at time of hospitalization and three months after discharge on the physical HRQoL trajectory in CHD patients. Stress and depression were correlated with the Physical component of HRQoL. Additionally, the results suggest that depressive symptoms measured three months after discharge were negatively related with physical HRQoL prognosis over the 15 months after hospitalization.

Cardiac hospitalization events are stressful life events that can negatively affect patients' HRQoL (Allam, Nabih, & El-Missiry, 2018; Borowiak & Kostka, 2006; White & Groh, 2007). Patients' knowledge about their disease can affect their mental health and exacerbate depressive and anxious symptoms (Carney & Freedland, 2012a; Holahan, Moerkbak, & Suzuki, 2006). It has shown that the effects of these symptoms are not limited to the time frame when the cardiac event occurred, and their consequences go beyond the mental component (Dickens et al., 2006; Worcester et al., 2007); however, this study provides new evidence about the relation between stress, depression and the Physical HRQoL, measuring depressive symptoms three months after discharge.

The prevalence of depression in our sample at time of hospitalization is similar to that reported in other studies (Doyle et al., 2015; Thombs et al., 2006). However, only 38% of those who were depressed at the baseline remained depressed three months later. Our results suggest that not all CHD patients who have depressive symptoms concurrent to the cardiac event have a worse prognosis compared to patients without depression. Depressive symptoms comorbid with the cardiac event could be transient and might be conceptualized as part of an adjustment syndrome (Ski, Worrall-Carter, et al., 2015). Additionally, in these patients the hospitalization process could be a reason for being depressed (Navarro-García et al., 2011). This might help to explain the negative results that have been shown by some studies that have not found a relation between depression and HRQoL (Almeida et al., 2011; Dickens et al., 2007; Parakh et al., 2008).

Trajectories of depressive symptoms in CHD patients seem to be heterogeneous (Kaptein et al., 2006; Thombs et al., 2008). Only those patients with persistent symptoms or those with new depressive symptoms that appear after the event seem to have worse prognosis after a CHD event (de Jonge, van den Brink, Spijkerman, & Ormel, 2006; Kaptein

et al., 2006; Parker et al., 2008). This association could be related to reports of poor adherence to medical regimen and cardiac rehabilitation attendance in depressive CHD patients (Casey, Hughes, Waechter, Josephson, & Rosneck, 2008; Glazer, Emery, Frid, & Banyasz, 2002; Ziegelstein et al., 2000). Thus, measuring depressive symptoms three months after the event could be a better way to identify those patients with higher risk in order to give them professional attention. Similarly, another study indicates the importance of addressing depressive symptoms in the development of interventions that target HRQoL (Lee, Lennie, Wu, Biddle, & Moser, 2014; Ski, Jelinek, Jackson, Murphy, & Thompson, 2015)

Depression and stress have been associated with biological and behavioral CHD risk factors (Araujo-Moxoto & Novaes-Malagris, 2015; Everson & Lewis, 2005; Lichtman et al., 2008). These relationships have been found to be significant also in CHD patients (Lichtman et al., 2014). Reduced heart rate variability, HPA axis dysfunction, increased CRP, IL-6, and fibrinogen levels are some of the mechanism that relate stress and depression with CHD (Carney et al., 2007; Dowlati et al., 2010; Kendall-Tackett, 2009; Merz et al., 2002). These patients also are less likely to modify unhealthy habits like smoking, sedentary life style, high saturated fat food intake (Dickens et al., 2012; Everson & Lewis, 2005; Jacka et al., 2007). In stress specifically, a number of observational studies have reported an association between mental stress and adverse cardiac events or total mortality (Wei et al., 2014)2014.

According to our findings, stress three months after discharge is negatively and significantly correlated with the Physical component of HRQoL at this time point. These results are similar to those of previous studies showing that, after adjustment for demographic and clinical factors as well as depression, high stress was associated with a threefold increased risk of 30-day readmission (HR = 3.21, 95% CI = 1.13, 9.10) (Edmondson, Green, Ye, Halazun, & Davidson, 2014). A possible explanation for the not statistically significant influence of stress at time point 1 on the slope of the growth curve of Physical component of HRQoL could be that it is mediated by high levels of social support (León-Pérez, Wallston, Goggins, Poppendeck, & Kripalani, 2016; Volz et al., 2011). In our study, although this condition is not measured specifically, a proxy for this could be a marital status, so, in our sample, the majority of the participants (62.6%) were married or with a long-term partner.

The present study has some limitations that are important to consider. First, somatic symptoms of depression could be confounded with the physical HRQoL level. However, researchers have considered that measuring these symptoms is important in the diagnosis of depression, and that ignoring them could lead to biased results (Carney & Freedland, 2012a). Second, the study did not control for other conditions that could affect the physical HRQoL trajectory. Future studies should assess for the presence of other conditions to control for them. Finally, there remain important, unanswered questions about whether treating depression after CHD and other mental health conditions not only improves patient symptoms but also reduces subsequent mortality risk, and about the psychosocial and physiological mechanisms involved in such treatment (Williams, Ghose, & Swindle, 2014).

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