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Exploratory and Confirmatory Factor Analysis of the Decision Regret Scale in Recipients of Internal Cardioverter Defibrillators

Ronald L. Hickman Jr., PhD, RN, ACNP-BC, Melissa D. Pinto, PhD, RN, Eunsuk Lee, PhD(c), RN, and Barbara J. Daly, PhD, RN, FAAN
Case Western Reserve University

Abstract

The Decision Regret Scale (DRS) is a five-item instrument that captures an individual's regret associated with a healthcare decision. Cross-sectional data were collected from 109 cardiac patients who decided to receive an internal cardioverter defibrillator (ICD). Exploratory and confirmatory factor analyses, assessments of the internal reliability consistency ($\alpha = .86$), and discriminant validity established the DRS as a reliable and valid measure of decision regret in ICD recipients. The DRS, a psychometrically sound instrument, has relevance for clinicians and researchers vested in optimizing the decisional outcomes of ICD recipients. Future research is needed to examine the reliability and validity of the DRS in a larger and more diverse sample of ICD recipients.

Keywords

decision regret; internal cardioverter defibrillators; exploratory and confirmatory factor analysis; decision making

The decision to receive or forego the implantation of an internal cardioverter defibrillator (ICD) represents a complex healthcare decision for cardiac patients who are at risk for a life-threatening arrhythmia or have a reduced left ventricular ejection fraction (Hunt et al., 2005). Clinicians routinely provide patients with informational and decisional support about the risks and benefits of an ICD to facilitate an informed decision. However, the evaluation of the patient's informational and decisional needs must extend beyond the point at which the patient provides the clinician with an informed decision. In the post-decision stage, patients may experience intense negative reactions to their ICD decision. These negative reactions are thought to have a significant longstanding impact on their future decision making involvement and level of self-management activation.

Due to a lack of and reliable and valid measures, the evaluation of cardiac patients' perceptions of their decision to receive an ICD has not been previously investigated. This is an area of critical importance due to the steadily increasing number of cardiac patients who will be presented with the decision to receive an ICD (Swindle, Rich, McCann, Burroughs,

& Hauptman, 2010; Zhan, Baine, Sedrakyan, & Steiner, 2008). Recipients of an ICD could benefit from post-decision screening and tailored decision support to mitigate the negative psychological consequences, such as the regret associated with their decisions. However, without reliable and valid measures of decision regret, it is unclear how the appraisal of decision regret impacts the psychological states and health behaviors of ICD recipients.

Therefore, the purpose of this psychometric evaluation was to examine the underlying factor structure of the DRS using an exploratory factor analysis (EFA), report the internal reliability and discriminant validity of the Decision Regret Scale (DRS), and evaluate the construct validity of the instrument's factor structure using confirmatory factor analysis (CFA) among recipients of an ICD.

CONCEPTUAL FRAMEWORK

Conceptual Overview of Decision Regret

Decision regret is a negative emotion that focuses on outcomes of an option and the decision making process. Joseph-Williams and colleagues (2010) point out that decision regret is not a unified concept and has been inconsistently defined and measured. For the intent of this psychometric evaluation, there are two features of decision regret which differentiate this emotional state. The first feature is a sense of remorse perceived by the decision maker as result of a decision or option that failed to yield an anticipated outcome. The second feature of decision regret is the decision maker's sense of responsibility and self-blame regarding the selection of the option. With this, it is the appraisal of disappointment and self-blame that differentiates decision regret from other closely related emotions.

Regret Theory and Healthcare Decision Making

Regret theory proposes that decision makers will employ counterfactual reasoning to make a decision that is the most averse to evoking decision regret. Decision regret theory differs from descriptive models of decision making, such as prospect theory and expected utility theory, in that the decision maker employs counterfactual reasoning and the formulation of a decision based on hypothetical events (Plous, 1993). Counterfactual reasoning, a hallmark characteristic of the two most widely cited decision regret theories, is a cognitive process that the decision maker uses to evaluate the consequences of set of alternatives (Bell, 1982, 1985; Zeelenberg & Pieters, 2007; Zeelenberg et al., 1998). With this, the construct of decision regret provides conceptual linkages between the cognitive process of counterfactual reasoning, decision making behavior, and emotional reaction to outcomes of a health-related decision.

The translation of regret theory to healthcare decision making is hindered by the lack of decision regret measures that are reliable and valid among decision-makers faced with a healthcare decision. In a systematic review of decision regret measures, Joseph-Williams and colleagues (2010) identified 10 published measures of decision regret. Of these decision regret measures, only three are applicable to healthcare decision making: Regret Scale (Clark et al., 1997; Clark, Wray, & Ashton, 2001), Anticipatory Regret Questionnaire (Godin et al., 2005), and Decision Regret Scale (Brehaut et al., 2003). Of these four scales,

the two versions of the Regret Scale are reliable and valid measures of regret, but are specific to men with metastatic prostate cancer. The Anticipatory Regret Questionnaire is also a reliable measure of a subtype of decision regret that aims to capture a future-oriented sense of regret. Unfortunately, anticipatory regret, measured by the Anticipatory Regret Questionnaire, does not capture the appraisal of an actual experience of making a decision or the consequences of that decision. Moreover, only the Decision Regret Scale (DRS) has established reliability and validity as a measure of decision regret for across clinical populations and across healthcare decisions (Brehaut et al., 2003).

Scale Construction and Validation

Scale Construction—According to Brehaut et al. (2003), the construction of the DRS was guided by the conceptual definition of decision regret, but solely captures the emotional distress over a decision that failed to achieve an expected outcome. Brehaut et al. (2003) developed the DRS to focus on decision regret that manifest from ‘the knowledge of an option made was nonoptimal’ and avoided inclusion of items that capturing the second feature of decision regret, self-blame. The decision to exclude the dimension of self-blame from the DRS was justified by Brehaut et al. (2003) with empirical evidence from three studies that concluded decision regret could result without self-blame. To construct the DRS, Brehaut et al. (2003) assembled a panel of multidisciplinary experts to review and modify items to fit their conceptual definition of decision regret. Thus, the DRS was constructed as a five-item unidimensional measure of decision regret as a function of the subjective outcome of a healthcare decision.

Validation—The initial validation of the DRS was conducted across four clinical samples of women faced with varying healthcare decisions. In the initial validation study, the psychometric properties of the DRS were examined in four independent samples of individuals who were faced with one of the following health care decisions: hormone replacement therapy, adjuvant therapy after surgical intervention for breast cancer, choice of surgical intervention for breast cancer or prostate cancer treatment. In the three female samples, Brehaut et al. (2003) found the DRS to have sufficient internal consistency reliability coefficients (.84–.92) and discriminant validity with measures of decisional conflict, satisfaction with doctor’s visit, and health-related quality of life. In comparison, there were no differences in the internal reliability consistency or discriminant validity of the DRS among men faced with a prostate treatment decision. Based on the initial validation study, several studies report the DRS as a reliable measure in oncology patients faced with treatment decisions and participation in clinical trials (Sheehan, Sherman, Lam, & Boyages, 2007a; Sheehan, Sherman, Lam, & Boyages, 2007b; Stryker, Wray, Emmons, Winer, & Demetri, 2006; Whalen, Shin, Somerville, & McLean, 2002).

Description, Administration, and Scoring of Instrument

The Decision Regret Scale (DRS) is a five-item paper and pencil self-report measure that asks subjects to reflect on a particular decision and then rate each item on a Likert scale from 1 (strongly agree) to 5 (strongly disagree). A mean score for the DRS is calculated by reverse scoring the two negatively phrased items and dividing by five. The mean scores are converted to a score ranging from 0 to 100 by subtracting 1 and multiplying by 25 and

higher scores represent increases in the severity of decision regret. The DRS has established face validity with decision scientists and healthcare professionals and limited convergent validity with measures of health outcomes, satisfaction, and decision conflict. Internal consistency reliability ($\alpha = .81-.92$) of the DRS has been reported for menopausal women, oncology female patients, and men with prostate cancer (Brehaut et al., 2003; Davison & Goldenberg, 2003).

METHODS

Research Design

A cross-sectional research design was used to examine the incidence of decision regret and evaluate the psychometrics of the DRS.

Sample and Setting

This study used a clinical database to recruit a convenience sample of 109 participants who were implanted with an ICD at an academic medical center in Northeast Ohio. Patients who were eligible to participate were age 18 years or older, first-time recipients of an ICD, had a valid domestic telephone number and postal address, and the ability to understand and speak English.

Procedures

Prior to conducting this research, we obtained institutional review board approval to access an administrative list of patients and to contact potential participants via postal mail to introduce the study. Eligible patients had the opportunity to opt out of this study by returning a postcard or refusing when the investigators contacted them by telephone. Eligible patients who did not return the opt-out postcard were contacted by telephone to participate in this study and complete the study questionnaires. Data collection was conducted over an eight month period. Structured telephone interviews were used to complete the study questionnaires, and a retrospective review of each patient's electronic medical records was conducted to obtain pertinent clinical data.

Measures

Profile of Mood States (POMS)-Short Version—This measure was used to assess the ICD recipients' mood state. This 30-item adjective checklist has six subscales (anxiety, depression, anger, vigor, fatigue, and confusion). This instrument has established internal consistency reliability (.66–.85) in patients living with heart failure (Doering et al., 2004). To score this instrument, subjects are asked to reflect on their mood during the last week and score each item on a Likert scale from 1 (not at all) to 5 (extremely). A total mood disturbance score was calculated by first summing the mean score for each subscale and subtracting the mean subscale score of the positive mood state (vigor). Higher total mood disturbance scores indicate higher amounts of negative mood. The POMS is a reliable (alpha coefficient = .89) and valid measure of mood disturbance in samples of ICD recipients (Carroll, Hamilton, & Kenney, 2002). The total mood disturbance score of POMS was used in the statistical analyses to assess discriminant validity of the DRS.

Medical Outcomes Study Short-Form Health Survey (SF-12)—This self-report measure was used to capture the participants' appraisals of their post-decision mental and physical health status. This questionnaire consists of 12 items, eight subscales, and two aggregate scales (physical and mental health). This study used the aggregate subscales for mental and physical health status in the statistical analyses to examine discriminant validity of the DRS. In a general sample of adults, the SF-12 has an internal consistency reliability of .90–.93 and confirmed concurrent, convergent, predictive, and content validity (Ware & Gandek, 1998).

Approaches to Reliability and Validity

Data were managed and analyzed using the Statistical Package for Social Sciences (SPSS; version 19, Chicago, IL) and the Analysis of Moment Structures (AMOS; version 19, Chicago, IL). In preparation for the psychometric evaluation of DRS, the randomized split function of SPSS was used to randomly sort the sample of 109 participants who completed the DRS into an EFA subsample ($n = 54$) and a CFA subsample ($n = 55$). After randomization, there were no statistically significant differences in the sample characteristics between the EFA and CFA subsamples. The sample sizes for each analytic subsample exceeded the minimum number of subjects per item (10:1) ratio needed to sufficiently conduct an exploratory and confirmatory factor analysis of the DRS (DeVon et al., 2007; Hatcher, 2006; Kline, 2011; Nunnally, 1978). Additionally, measures of sample adequacy (Kaiser-Myer-Olkin [KMO] = .75; Bartlett's test of sphericity: $\chi^2 = 141$, $df = 10$, $p < .001$) established adequate sample size for the conduct of an EFA.

Overall, the statistical analyses were conducted in three stages. The first stage consisted of an exploratory factor analysis (EFA), the second stage conducted an analysis of the internal consistency reliability and then examined correlation coefficients to establish discriminant validity, and the third stage employed confirmatory factor analysis (CFA) to evaluate the validity of the DRS in ICD recipients. Prior to conducting these statistical analyses, we confirmed that our data met the major statistical assumptions for each statistical test and an alpha level (p) of .05 or less was used as the criterion to reject the null hypothesis.

Exploratory Factor Analysis—In the first stage of the statistical analysis, the primary aim of the exploratory factor analysis (EFA) was to produce the most parsimonious factor structure for the five-item DRS among ICD recipients (Byrne, 2001; Costello & Osborne, 2005; Fabrigar, Wegener, MacCallum, & Strahan, 1999). The following analytic methods were used in the EFA to determine the most parsimonious factor structure of the DRS.

Extraction of Factors: Principal axis factoring (PAF) was selected as the extraction method with an orthogonal rotation (varimax). The five-item DRS was constructed as a unidimensional measure of decision regret (Brehaut, et al., 2003). The selection of PAF with orthogonal rotation is a robust analytic method that evaluates an underlying structure that can reveal a unidimensional factor structure for DRS in this sample (Costello & Osborne, 2005).

Determination of Factors: The determination of the number of factors or dimensionality of the DRS was guided by the interpretation of the scree plot, a graphic representation of each factor with eigenvalues (Hatcher, 2006). Inspection of the scree plot identifies factors that provide substantial variance and indicates the presence or absence of dimensionality (Costello & Osborne, 2005; Fabrigar et al., 1999; Hatcher, 2006). Consistent with the recommendation of Costello and Osborne (2005), the number of factors above the break or elbow of the scree plot indicated the number of factors to be retained.

Item Reduction: Items of the DRS were retained based on the following criteria: those with primary factor loadings $>.40$ and secondary factor loadings $<.30$ (Pai, Millins, Burant, Wagner, & Chaney, 2006). Items that did not meet these criteria were individually removed and the EFA repeated until all remaining items of the DRS met these criteria for item retention.

Estimation of Internal Consistency Reliability: The estimation of internal consistency reliability accounts for the influence of all items included in the measure, and provides evidence that supports the conceptual fit of the measure (DeVon et al., 2007). In this study, an internal consistency coefficient (α) of $.70$ for a factor was deemed reliable (Cortina, 1993; DeVon et al., 2007). Data from the EFA subsample were used to estimate the internal consistency reliability of the DRS.

Discriminant Validity—Discriminant validity, the extent to which measures of different constructs correlate with each other, was assessed with a set of correlates (POMS total mood disturbance scores and the SF-12 mental and physical health scores). The conventional criterion correlation coefficient ($|r|$) $<.45$ was used to establish discriminant validity of the DRS with this set of correlates (DeVon et al., 2007). Discriminant validity of the DRS was evaluated using data from the EFA subsample.

Confirmatory Factor Analysis: Testing the Validity of the Factor Structure—A first-order confirmatory factor analysis (CFA) was conducted using Analysis of Moment Structures (AMOS, version 19.0) to investigate the construct validity of the factor structure of the DRS confirmed by the EFA. This test of construct validity was conducted with the remaining 55 participants randomly assigned to the CFA subsample. The following goodness-of-fit indices were used to assess the model and the sample: χ^2 , Tucker Lewis Index (TLI; $>.90$ acceptable, $>.95$ excellent), the Comparative Fit Index (CFI; $>.90$ acceptable, $>.95$ excellent), and Root Mean Square Error of Approximation (RMSEA; $<.08$ acceptable, $<.05$ excellent) (Bentler, 1990; Bentler & Bonnett, 1980; Brown & Cudeck, 1995; Tucker & Lewis, 1973). In addition to the interpretation of the goodness-of-fit indices, modification indices were used to guide the addition of paths between error terms to enhance the fit of the structural equation model (SEM) to these data (Byrne, 2001).

RESULTS

Sample Characteristics

Table 1 summarizes the demographic and clinical characteristics of our sample ($n = 109$) of ICD recipients. The sample consists predominantly of Caucasian (72%) males (76%) who

were married (59%), unemployed (80%), with an education level of high school or less (53%). The majority (88%) of the sample received an ICD for primary prevention and had not received a shock from the device. The mean duration of time elapsed since the implantation of the ICD for the sample was 1.5 years ($SD = .75$). More than one-half (52%) of the eligible patients contacted refused to participate in this study (Figure 1).

Exploratory Factor Analysis

The results of EFA confirm the DRS as a unidimensional measure of decision regret. Inspection of the scree plot was suggestive of a single factor structure for this five-item scale. A secondary method using the criterion of eigenvalues ≥ 1 further validated our interpretation of the scree plot. The single factor of the DRS accounted for almost two-thirds (65%) of the explained variance in decision regret. The factor loadings of the five items ranged from .61 (I would go for the same choice if I had to do it over) to .88 (The decision was a wise one). Therefore, all five items of the DRS met the criteria for retention with primary loadings on a single factor.

Estimation of Internal Consistency Reliability

The internal consistency reliability coefficient ($\alpha = .86$) of the DRS in the EFA and CFA subsamples established that the five-item DRS was a reliable measure of decision regret. Moreover, our analysis also indicated that the removal of an item would not significantly improve the internal consistency reliability of the measure (Table 2).

Evaluation of Discriminant Validity

Three bivariate correlations were assessed to evaluate the discriminant validity of the DRS with a select set of external correlates. The first bivariate correlation was conducted to examine discriminant validity between decision regret scores and mood disturbance scores of the POMS. According to DeVon et al. (2007), the small correlation coefficient between DRS total scores and the POMS' mood disturbance scores ($r = .11$) met the conventional criterion ($|r| \leq .45$) to confirm discriminant validity between these two measures. The second bivariate correlation assessed the association between the DRS total scores and the SF-12 mental health scores, and the third bivariate correlation examined the association between the DRS total scores and SF-12 physical health scores. Discriminant validity was established between the DRS total scores and the SF-12 mental and physical health scores ($r = -.001$, $r = -.08$, respectively).

Confirmatory Factor Analysis

A confirmatory factor analysis was conducted to evaluate the validity of the factor structure of the decision regret scale among ICD recipients (Figure 2). The model demonstrated excellent fit with these data ($\chi^2 = 3.5$, $df = 5$, $p = .62$, CFI = 1.0, TLI = 1.0, RMSEA = .00), which confirms the validity of the single factor structure of the DRS. The standardized path coefficients ranged from .50 (I regret the choice that was made) to .93 (I would go for the same choice if I had to do it over). A review of the modification indices was conducted to assess the possibility of improving the model's fit with these data; however, the modification indices did not support the addition of paths to improve the fit of the model. Therefore, we

concluded that the single factor structure of the DRS was a valid measure of decision regret in a sample of ICD recipients.

Discussion

For a steadily emerging population of cardiac patients, decisions to receive an ICD represent a complex healthcare decision that can result in decision regret. Decision regret is a proxy indicator of decision quality that can be used to inform clinicians and researchers to an individual's need for ongoing decision support and assess the efficacy of decision support interventions. Attention to enhancing decision quality through the assessment of decision regret in recipients of ICDs is an understudied area of research. The findings of this psychometric evaluation contribute to advances in the measurement of the post-decision consequences among cardiac patients who choose to receive an ICD. This study is the first to report a psychometric evaluation of the DRS as a reliable and valid measure of decision regret among ICD recipients.

In the present study, the underlying factor structure and its validity were evaluated in a sample of ICD recipients. Consistent with Brehaut and colleagues' (2003) construction of the DRS, the EFA revealed a single factor structure of the DRS that reliably captured the decision regret associated with the decision to receive an ICD. Discriminant validity of the DRS was supported by bivariate correlation coefficients between the DRS total scores and measures of general health status (SF-12 scores) and mood disturbance (POMS mood disturbance scores). These findings were consistent with existing literature on psychometric properties of the DRS by Brehaut et al (2003), Sheehan et al (2007a), and Sheehan (2007b). The evaluation of the construct validity of the DRS's factor structure was evaluated with a first-order confirmatory factor analysis (CFA). In this sample of ICD recipients, the single factor structure of the DRS was valid and the fit of structural model of DRS had an excellent fit to these data.

Limitations

There were several limitations in this study. First, the sample of participants was limited to ICD recipients and does not capture decision regret among patients who decided to forego the implantation of an ICD. Second, the rate of refusal to participate in this study poses some threat to the generalizability of the study results. Third, the evaluation of the incidence and psychometric properties of the DRS was based solely on cross-sectional data. Lastly, the sample consisted of mostly white, middle-aged men who received a high school education, which limits the generalizability of these findings to other subpopulations of ICD recipients, such as women and ethnic minorities.

Conclusion

This psychometric evaluation of the DRS provides evidence of its reliability and validity among ICD recipients. As a proxy measure of decision quality, the measurement of decision regret has implications for clinicians and researchers interested in the well-being of persons living with an ICD. The administration of the DRS may help nurses and other healthcare professionals screen patients who may benefit from evidence-based strategies to attenuate the psychological and physical consequences of their decisions (Davidson, 2010; Elwyn,

Frosch, Volandes, Edwards, & Montori, 2010). With limited measures of decision regret, descriptive and interventional research has neglected to evaluate decision regret in patients who choose to receive an ICD. However, results from this study provides evidence that the DRS is a reliable and valid measure of decision regret that can be used to evaluate the efficacy of decision support interventions designed to enhance the post-decision quality of ICD recipients. Future research is needed to investigate the psychometric properties of the DRS in larger, more diverse samples of ICD recipients.

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Figure 1.
Study disposition flowchart.

Figure 2. Standardized measurement model for confirmatory factor analysis ($n = 55$). The goodness-of-fit indices for this model were $\chi^2 = 3.5$, $df = 5$, $p = .62$, CFI = 1.0, TLI = 1.0, RMSEA = .00.

TABLE 1Demographic and Clinical Characteristics of Sample ($N = 109$)

Variable	No.	(%)
Age, year (Mean $\pm$ <i>SD</i>)	65.64	$\pm$ 13.58
Gender		
Male	83	(76.1)
Female	26	(23.9)
Race/ethnicity		
Caucasian	79	(72.5)
Non-Caucasian	30	(27.5)
Marital status		
Married	64	(58.7)
Not married	45	(41.3)
Current employment status		
Employed	22	(20.2)
Not employed	87	(79.8)
Annual household income ($n = 94$)		
\$20,000 or less	28	(29.8)
\$21,000–\$49,999	38	(40.4)
\$50,000 or greater	28	(29.8)
Credentials earned		
High school or less	58	(53.2)
2–4 years of college	41	(37.6)
Graduate studies	10	(9.2)
ICD diagnosis ($n = 105$)		
Primary prevention	92	(87.6)
Secondary prevention	13	(12.4)
ICD shock ($n = 84$)		
Yes	14	(16.7)
No	70	(83.3)

TABLE 2

Inter-item correlations, Item-total correlations, and Cronbach's α if item deleted

DRS Item/Total Score	1	2	3	4	5	6	α
1. It was the right decision		.46	.64	.48	.64	.68	.82
2. I regret the choice that was made			.54	.48	.54	.61	.84
3. I would go for the same choice if I had to do it over again				.49	.56	.68	.82
4. The choice did me a lot of harm					.56	.67	.83
5. The decision was a wise one						.76	.81
6. DRS Total Score							-

Note. $N=109$; DRS = Decision Regret Scale; α = Cronbach's α coefficient if item deleted.