



Research paper

Perceived control and quality of life among recipients of implantable cardioverter defibrillator



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Background: Perceived control is strongly associated with health-related quality of life (HRQOL) among patients with chronic conditions, and it is possible to increase perceived control with appropriate intervention. Little is known about the relationship between perceived control and HRQOL in implantable cardioverter defibrillator (ICD) recipients.

Objectives: To determine the relationship of perceived control with quality of life in ICD recipients and to determine predictors of perceived control in this population.

Methods: A total of 263 ICD recipients (63% male, age 61 ± 14 years) completed the Control Attitude Scale-Revised to measure perceived control and completed self-reported measures on potential correlates of perceived control (i.e., depressive symptoms, anxiety, social support, and ICD concerns). The EuroQol-5D was used to measure HRQOL. Regression analysis was used to determine predictors of perceived control and its relationship to HRQOL, controlling for covariates.

Results: Lower perceived control ($\beta = 0.30, p < .01$), and higher levels of depression ($\beta = -0.30, p < .01$) and anxiety ($\beta = -0.18, p < .05$) predicted lower levels of HRQOL. Higher anxiety ($\beta = -0.17, p < .05$), higher depression ($\beta = -0.23, p < .05$), lower social support ($\beta = 0.26, p < .01$), and higher ICD-related concerns ($\beta = -0.16, p < .05$) independently predicted lower perceived control.

Conclusions: Interventions targeting patients' ICD concerns and psychosocial factors before, and continuing after, ICD insertion are needed to improve ICD recipients' perceived control and, in turn, their HRQOL.

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1. Introduction

The implantable cardioverter defibrillator (ICD) is standard treatment for life-threatening ventricular arrhythmias and prevention of sudden cardiac death.¹ Although the ICD has reduced mortality,^{2–4} patients' psychological responses and adaptation to the ICD implant are not simple. Patients' lives change after ICD implantation,^{5,6} and ICD recipients often are overwhelmed and live with fears related to the unpredictability of ICD shocks and the possibility of device failure.^{7,8}

Feelings of fear and uncertainty can reduce confidence and lead to decreased engagement in social and leisure activities.^{9,10} These changes in lifestyle can lead to anxiety and depressive symptoms, feelings of powerlessness, and loss of control.^{7,11} About one-quarter of ICD recipients experience symptoms of anxiety and/or depression that result in decreased health-related quality of life (HRQOL).^{6,12,13} Psychological distress and impaired HRQOL are associated with adverse outcomes, such as increased rates of sustained lethal arrhythmias and higher risk of sudden cardiac death.^{14–18} To develop strategies to improve patients' HRQOL, it is paramount to identify factors underlying and influencing HRQOL in ICD recipients.

Perceived control—the belief that one is able to cope with negative events and exert control over one's life and health, and achieve positive outcomes—is essential for successful adaptation to stressful events and improvement in HRQOL among patients with chronic cardiac diseases.^{19–21} A positive relationship between perceived control and HRQOL was found in heart failure (HF) patients and among female heart transplant recipients.²² However, predictors of perceived control and its relationship with HRQOL have not been studied in ICD recipients. Therefore, the aims of this study were to (1) determine whether perceived control is an independent predictor of HRQOL in ICD recipients and (2) identify predictors of perceived control in ICD recipients.

2. Methods

2.1. Design

This cross-sectional study involved ICD recipients recruited from the United States and Australia. Before conducting the study, the appropriate institutional review board approvals were obtained from the two largest universities and two tertiary hospitals in Kentucky, United States, (13-0993; 13.0666) and two hospital sites and one university in Melbourne, Australia, (HREC/15/Alfred31; Eastern Health SERP 42-2015; 2015-162R). Data were collected between July 2015 and July 2016.

2.2. Participants

Participants were recruited from outpatient cardiology clinics located in four regional tertiary care referral facilities. Patients were invited to participate if they had an ICD inserted more than a year ago and were able to speak and read in English. Patients who had severe cognitive impairment, coexisting terminal illness, or a left ventricular assist device were excluded. Furthermore, patients who were on the heart transplant waiting list or institutionalised in nursing homes were excluded.

2.3. Procedures

Participants were referred to the study by nurses working at the recruitment sites. A trained research assistant approached the potential participants who were attending the clinic for routine ICD

follow-up visits, screened them for eligibility, explained the purpose and details of the study, invited them to participate, and obtained written informed consent. Participants were provided with a signed copy of their consent form and a hard copy of the study questionnaires with a prepaid addressed envelope to take the questionnaires home, complete, and return at their convenience. Participants also had the option to complete the questionnaires online using the REDCap system or in the clinic if they chose to do so. More than 90% of participants chose to take the questionnaires home to complete and return by mail. Participants' response rate was 82% in Australia and 94% in the United States (Fig. 1).

2.4. Measures

2.4.1. Sociodemographic and clinical characteristics

Data about age, gender, ethnicity, level of education, and whether recipients had received ICD shocks were collected using the study survey.

2.4.2. Health-related quality of life

HRQOL was assessed using the EuroQol-5D (EQ-5D) self-report questionnaire.²³ The EQ-5D consists of five dimensions of health: mobility, self-care, usual activities, pain/discomfort, and anxiety/depression. Each dimension is rated on three levels of severity (1 = none, 2 = moderate, and 3 = extreme problems). Scores on the EQ-5D index value can range from 1.0 (best quality of life), to –0.11 (worst quality of life). Reliability and validity of the instrument have been supported in patients with cardiovascular disease²⁴ and in medical patients with human immunodeficiency virus, chronic hepatic diseases, and cancer.^{25–28}

2.4.3. Perceived control

Perceived control was assessed using the Control Attitudes Scale-Revised (CAS-R).²⁹ The CAS-R consists of eight items rated on a 1 (totally disagree) to 5 (totally agree) scale. Total scores can range from 8 to 40, and lower scores reflect lower levels of perceived control. The reliability and validity of the CAS-R have been supported in patients with cardiac diseases.²⁹ In the present study, Cronbach's alpha was good (0.87).

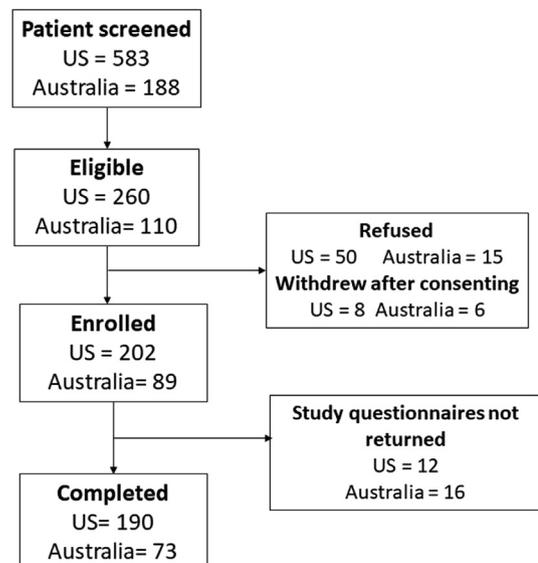


Fig. 1. Flowchart of patients enrollment into the study.

2.4.4. Social support

Social support was assessed using the Multidimensional Perceived Social Support Scale (MPSSS).³⁰ The MPSSS assesses one's perception of levels of social support received from family, friends, or/and significant others. The MPSSS is a 12-item instrument rated on a 7-point scale from 1 (very strongly disagree with the item) to 7 (very strongly agree). Individual item ratings are added to form a total score ranging from 12 to 84; higher total scores indicate higher levels of perceived social support. The validity and reliability of the MPSSS have been supported in healthy individuals^{31,32} and in patients with HF and coronary heart disease.³⁰ In the present study, Cronbach's alpha was very good (0.97).

2.4.5. Anxiety and depression

Anxiety and depression symptoms were assessed using the Hospital Anxiety and Depression Scale (HADS).³³ The HADS is composed of 14 items that result in two subscales, anxiety and depression. Each item is rated on a 4-point Likert scale from 0 to 3. Responses are summed to form a total score ranging from 0 to 21 for both anxiety and depression; higher scores indicate more symptoms of anxiety or depression. A cut-off point of 8 on both subscales has been recommended to identify patients with clinical symptoms of anxiety and depression.³³ The reliability and validity of the HADS have been supported in somatic, psychiatric, medical, cardiac, and primary care patients and in the general population.^{34–36} In the present study, Cronbach's alpha was good (0.79).

2.4.6. ICD-related concerns

ICD-related concerns were assessed using the ICD Concerns (ICDC) questionnaire.³⁷ The ICDC questionnaire consists of eight self-report items rated on a 5-point Likert scale from 0 (not at all) to 4 (very much so); higher scores indicate a greater number of concerns. Reliability and validity of the ICDC have been supported.^{37,38} In the present study, Cronbach's alpha was very good (0.94).

2.4.7. ICD knowledge

ICD knowledge was assessed using the End-of-Life Issues in ICD (EOL-ICD) Questionnaire.³⁹ The EOL-ICD is a self-rated questionnaire, consisting of three subscales that measure experiences (10 items), attitudes (18 items), and knowledge (11 items) of EOL or related issues in ICD patients. The 11 items in the knowledge subscale measure ethical aspects of treatment (three items), how the ICD works (two items), and the significance of ICD deactivation (six items). Each item of the knowledge subscale is scored as 0 (false) or 1 (true). Responses are summed to form a total score ranging from 0 to 11. The EOL-ICD Questionnaire has demonstrated sound psychometric properties.³⁹ In the present study, the knowledge subscale Cronbach's alpha was acceptable (0.78).

2.5. Data analysis

Data were analysed using IBM SPSS for Windows (version 24.0, Armonk, NY: IBM Corp.); an alpha level of 0.05 was used throughout. Descriptive statistics, including means and standard deviations or percentages, were used to summarise sociodemographic and clinical characteristics, depending on the level of measurement of the variables. Sociodemographic and HRQOL of ICD recipients in the US versus Australia were compared using chi-square tests or independent sample t-tests, as appropriate.

Linear regression modeling was used to examine the relationship between perceived control and HRQOL. A univariate linear regression model was used to examine the association between perceived control and HRQOL. Hierarchical multiple linear regression with simultaneous entry by block was used to determine whether perceived control predicts HRQOL, controlling for

covariates. The EQ-5D mean index value (dependent variable) was entered in the model as a continuous variable. Predictors were entered in blocks. The first block included the sociodemographic, clinical characteristics (age, gender, and whether recipients experienced ICD shocks), and psychosocial factors (anxiety, depression, ICD concerns, and social support). The second block included perceived control.^{40,41} The third block included all two-way interactions between perceived control and covariates to explore moderation effects. None were significant, so they were removed from the model, and results from the first two blocks were presented in Table 2.

The five dimensions of the EQ-5D (i.e., mobility, self-care, usual activities, pain, and anxiety/depression) have been shown to be highly correlated with HRQOL aspects of physical functioning, social functioning, and mental health.⁴² In addition to the index value, results of the EQ-5D can be presented as a health profile presenting proportion of reported problems/no problems in each dimension in a tabulated form. After determining whether perceived control predicts the overall HRQOL using the index value, we used five separate binary logistic regression models to examine whether perceived control predicts each of the HRQOL dimensions in the EQ-5D questionnaire (i.e., pain, mobility, self-care, usual activity, and anxiety/depression), controlling for covariates. Gender and age were included in all models as they were considered of theoretical interest, despite being nonsignificant predictors of HRQOL in this cohort of ICD recipients. The outcome variable in each dimension of EQ-5D was dichotomised to “no problem/problem”.

Hierarchical multiple linear regression analysis was used to determine predictors of perceived control, after adjusting for covariates. Predictors were identified from the literature and entered in two blocks. The first block included the sociodemographic and clinical characteristics (i.e., age, gender, and whether recipients experienced ICD shocks). The second block included the psychosocial (i.e., anxiety, depression, ICD concerns, and social support) factors and ICD knowledge score. These grouped predictors were entered in blocks to determine the contribution by each group to the explanation of the variance in perceived control. Model assumptions were evaluated and were not violated.

3. Results

3.1. Sample characteristics

The study sample consisted of 263 ICD recipients (190 participants from the US and 73 participants from Australia; Table 1). The mean age of participants was 61 ± 14 years. Most of the participants were men and were either married or living with someone. The majority of participants (85%) self-identified as a Caucasian. More than a third of the study sample had a history of receiving an ICD shock. Using the reported scores of HADS (≥ 8), 25% of the participants in this study had symptoms of anxiety and 18% had depression.

3.1.1. Differences between participants recruited from the US and Australia

Participants recruited from Australia were all Caucasian (100%) and reported slightly higher level of HRQOL (0.84 ± 0.16) than those recruited from the US (0.79 ± 0.18). No other significant differences on sociodemographic or clinical variables between the two study sites were found. Therefore, we combined all patients' data collected from the US and Australia to analyse our specific aims.

3.1.2. Relationship between perceived control and HRQOL

In univariate linear regression, perceived control explained 13% of the variance in HRQOL ($\beta = 0.37$; p -value $< .001$). In hierarchical

Table 1
Participants' sociodemographic and clinical characteristics (N = 263).

Characteristics	Mean ± SD or n (%)	Median (25th percentile, 75th percentile)
Age, years	61 ± 14	63 (53, 71)
Male gender	190 (73)	
Caucasian	217 (85)	
Married or living with partner	162 (63)	
Education, years	11 ± 5	12 (6.7, 14)
Received ICD shock	95 (37)	
Hospital Anxiety and Depression Scale		
Anxiety subscale score	5 ± 3.8	5 (2, 8)
Depression subscale score	4.3 ± 3.5	3 (2,6)
Multidimensional Perceived Social Support Scale score	68 ± 20	76 (61, 84)
Control Attitude Scale-Revised score	30.7 ± 6.5	31 (27,36)
ICD Concerns Questionnaire score	15.4 ± 14.8	11 (4, 24)
EQ-5D-3L	0.81 ± 0.17	0.83 (0.77,1.00)
Knowledge of End-Of-Life Issues in ICD score	6.0 ± 3.0	7 (4,8)

ICD, implantable cardioverter defibrillator; SD, standard deviation.

multiple linear regression analysis (Table 2), the model explained 27% of the variance in HRQOL [$R^2 = 0.27$, $F(1,191) = 8.82$, $p < .01$]. Higher levels of depression ($\beta = -0.30$, $p < .01$), anxiety ($\beta = -0.18$, $p < .05$), and lower perceived control ($\beta = 0.30$, $p < .01$) predicted lower levels of HRQOL. Adding perceived control to the model explained an additional 7% of the variance in HRQOL.

Logistic regression analysis was then performed to assess whether perceived control predicts each dimension of HRQOL, while controlling for covariates (age, gender, receiving shock). Five separate models were developed for each of the EQ-5D outcomes (Table 3).

3.1.2.1. Mobility. Patients with higher level of depression were 5.56 times more likely to have problems with mobility, while patients with low perceived control were 2 times more likely to report problems with mobility.

3.1.2.2. Self-care. Our model became insignificant when we included ICD concerns as a covariate, implying the presence of mediating relationships between the model variables. Therefore, we excluded ICD concerns from our model. Men were about 2.5 times more likely to report problems with self-care than women. Patients with low perceived control were almost four times more likely to report problems with self-care.

3.1.2.3. Usual activities. Patients who received ICD shock were three times more likely to have problems with performing usual

activities. Patients with higher level of depression were 4.66 times more likely to have problems with performing usual activities, while patients with low perceived control were two times more likely to report problems with performing usual activities.

3.1.2.4. Pain. Patients with higher level of anxiety were about 11.4 times more likely to report problems with pain, while those patients with lower perceived control were three times more likely to report pain.

3.1.2.5. Anxiety/depression. Anxiety and depression measured using HADS were not included as covariates in this model because our outcome was anxiety and depression measured using EQ-5D scale. Patients with lower perceived control were three times more likely to report symptoms of anxiety and depression.

3.1.3. Predictors of perceived control

In the whole sample, the model explained 30% of the variance in perceived control ($p < .001$), with 28% of the variance explained by the psychosocial variables ($p < .001$). Higher anxiety scores ($\beta = -0.17$, $p < .05$), higher depression scores ($\beta = -0.23$, $p < .05$), lower social support ($\beta = -0.26$, $p < .01$), and higher ICD concerns scores ($\beta = -0.16$, $p < .05$) were independently associated with lower levels of perceived control (Table 4).

4. Discussion

The main finding of our study was that perceived control predicted overall HRQOL and greater prevalence of self-reported problems in every dimension of HRQOL (i.e. mobility, self-care, usual activity, pain, and symptoms of anxiety and/or depression). The addition of perceived control explained 7% more variance in HRQOL than a model containing only demographic, clinical, and psychological covariates. These findings imply the importance of targeting perceived control and psychological variables to improve ICD recipients' HRQOL. Our findings are consistent with prior HF studies,^{40,41} in which perceived control was significantly associated with HRQOL, controlling for sociodemographic, clinical, and psychological factors. However, this is the first study to assess the underlying importance of perceived control among ICD recipients and therefore makes a unique contribution to the literature.

While psychological distress in ICD recipients has been reported in multiple studies,^{7,13,43} prior studies of HRQOL in ICD recipients mostly addressed sequelae of anxiety, depression, and ICD shocks. ICD recipients who received shocks revealed higher levels of anxiety and depression, decreased adaptation to living with the device, and worse HRQOL.^{44–48} Therefore, this is the first study to consider

Table 2
Summary of hierarchical regression analysis for variables predicting health-related quality of life (N = 200).

Variable	Model 1			Model 2		
	B	SE B	β	B	SE B	β
Age	0.00	0.00	-0.02	0.00	0.00	-0.00
Gender	-0.02	0.03	-0.04	-0.01	0.03	-0.03
Received ICD shock	-0.00	0.01	-0.02	-0.00	0.01	-0.01
Depression	-0.10	0.02	-0.35**	-0.08	0.02	-0.30**
Anxiety	-0.05	0.02	-0.20*	-0.05	0.02	-0.18*
Social support	0.00	0.00	0.01	-0.00	0.00	-0.06
ICD concerns	0.00	0.00	0.03	0.00	0.00	0.11
Perceived control	–	–	–	0.10	0.02	0.30**
Adjusted R^2		0.17			0.24	
F for change in R^2		6.91**			8.82**	

B, unstandardised regression coefficient; ICD, implantable cardioverter defibrillator; SE B, standard error for the unstandardised regression coefficient; β , standardised regression coefficient.

* $P < .05$.

** $P < .01$.

Table 3
Logistic regression analysis of the relationship between Perceived Control and Quality of Life.

Variables	^a Mobility OR (95% CI)	^b Self-Care OR (95% CI)	^c Usual Activities OR (95% CI)	^d Pain/Discomfort OR (95% CI)	^e Anxiety/Depression OR (95% CI)
Male gender	0.83 (0.42–1.6)	1.64 (0.58–4.61)	0.87 (0.42–1.80)	0.78 (0.38–1.61)	1.24 (0.57–2.70)
Age	1.02 (0.99–1.05)	1.00 (0.99–1.02)	1.00 (0.99–1.01)	1.01 (0.98–1.03)	1.00 (0.99–1.01)
Received shocks	0.97 (0.67–1.4)	1.24 (0.47–3.30)	3.08 (1.35–7.04)*	1.29 (0.59–2.84)	1.15 (0.53–2.52)
Anxiety	1.85 (0.49–6.95)	1.16 (0.23–5.84)	1.56 (0.38–6.41)	11.43 (1.33–98.24)*	Excluded
Depression	5.56 (1.41–21.85)*	3.15 (0.86–11.63)	4.66 (1.11–19.52)*	1.89 (0.51–7.02)	Excluded
ICD concerns	1.00 (0.98–1.03)	Excluded	0.98 (0.95–1.01)	0.99 (0.97–1.02)	1.03 (1.01–1.06)*
Social support	1.01 (0.99–1.02)	1.03 (1.001–1.06)	1.01 (0.99–1.03)	0.99 (0.98–1.01)	0.99 (0.97–1.003)
Low perceived control	2.05 (1.05–3.99)*	3.97 (1.42–11.07)*	3.79 (1.88–7.62)**	2.93 (1.49–5.72)**	3.09 (1.45–6.58)**

OR= Odds Ratio; CI = Confidence Interval; ICD = Implantable Cardioverter Defibrillator.

*P < .05. **P < .01.

^a χ^2 (df = 11, n = 200) = 27.024, p < .01. Cox and Snell R² = 0.12, Nagelkerke R² = 0.17. The model correctly classified 65% of cases. Hosmer and Lemeshow test (X² (df = 8, n = 200) = 4.889, p = .769).

^b χ^2 (df = 10, n = 234) = 22.040, p = .02. Cox and Snell R² = 0.09, Nagelkerke R² = 0.16. The model correctly classified 88% of cases. Hosmer and Lemeshow test (X² (df = 8, n = 234) = 13.855, p = .086).

^c χ^2 (df = 10, n = 234) = 49.123, p < .001. Cox and Snell R² = 0.19, Nagelkerke R² = 0.25. The model correctly classified 71% of cases. Hosmer and Lemeshow test results confirmed that the model was a good fit for the data, X² (df = 8, n = 234) = 7.478, p = .52.

^d χ^2 (df = 11, n = 200) = 38.936, p < .001. Cox and Snell R² = 0.18, Nagelkerke R² = 0.24. The model correctly classified 67% of cases. Hosmer and Lemeshow test (X² (df = 8, n = 200) = 3.183, p = .922).

^e χ^2 (df = 7, n = 207) = 39.714, p < .001. Cox and Snell R² = 0.18, Nagelkerke R² = 0.25. The model correctly classified 71% of cases. Hosmer and Lemeshow test (X² (df = 8, n = 207) = 50.144, p = .742).

perceived control and identify the key role it plays in improving HRQOL in patients with cardiac diseases. Our model explained 27% of the variance in HRQOL. This finding may be explained because of the effect of uncontrolled confounders in observational studies. In addition, the scope of this study did not extend to measuring other potential predictors that may affect HRQOL in ICD recipients, such as body image concerns,⁴⁹ personality type,⁵⁰ influence on the relationship with one's partner,⁵¹ sexual activity,⁵² spiritual well-being,⁵³ and driving restrictions.⁵⁴ Although we did not directly examine the mechanism through which perceived control is associated with HRQOL in ICD recipients, we hypothesised that perceived control affects HRQOL through its impact on psychological status, symptoms, and functional status.^{19,22,55–57} However, It is also possible that HRQOL affects perceived control, but we could not examine this relationship due to the cross-sectional study design. In support of this hypothesis, we found that patients with lower perceived control reported more problems with mobility, self-care, usual activity, pain, anxiety and depression. Compared with patients with higher perceived control, Dracup et al.¹⁹ found that HF patients with lower perceived control walked shorter distances by 211 feet (1241 vs. 1452 feet) on the 6-min walk and had higher emotional distress. Similarly, among patients with HF and

other cardiac diseases, Moser et al.^{20,29} and Heo et al.⁴¹ found that patients with lower perceived control had higher levels of depressive symptoms compared with those with higher perceived control. In other studies,^{19,22,56,57} lower level of perceived control was associated with worse HRQOL and more reported symptoms of anxiety and depression. Doerfler et al.⁵⁸ reported that after recent myocardial infarction, patients with lower perceived control had higher scores of post-traumatic stress disorder symptoms.

Numerous studies and reviews^{13,37,59–62} have shown an association among ICD shocks, age, gender, social support, ICD concerns, and HRQOL. ICD recipients who received shocks have been shown to exhibit higher levels of anxiety and depression, lower adaptation to living with the device, decreased physical and mental wellbeing, and worse HRQOL.^{44–48} In some studies, younger age, female gender, and lack of social support have also been associated with higher anxiety, depression, and worse HRQOL.^{46,59,62–64} In contrast, other studies have found no correlation between patient's age, experiencing ICD shocks, and HRQOL.^{65–68} Discrepancies in results are most likely due to heterogeneity between study populations, such as time since ICD implantation, sample size, and instruments used in measuring HRQOL constructs.^{43,47,59,60} Results of our study mostly parallel the findings that HRQOL was not correlated with ICD shocks, age, or social support, possibly because our participants had their ICDs implanted at least a year before joining the study. Previous studies showed that shock-related anxiety tends to lessen over time after implantation.^{43,59} However, to detect changes in HRQOL over time, further research is needed. In this study, ICD shocks were only correlated with pain, which is typically reported by ICD recipients.

The findings of the present study provide valuable information on factors affecting perceived control in ICD recipients. A significant proportion of our participants reported clinical symptoms of anxiety (25%) and/or depression (18%) which was consistent with other studies.^{12,43} In a systematic review from 2011, anxiety occurred in 15%–49% of ICD recipients during 6–12 months after implant, while depression occurred in 10%–33% of recipients.⁴³ Lower level of perceived control was predicted by higher levels of anxiety, depression, ICD concerns, and lower level of social support. Knowledge about ICD function was not related to perceived control. Similarly, in an HF study by Heo et al.⁴¹ knowledge was not associated with perceived control in multivariate regression analysis. These findings imply that delivering

Table 4
Summary of hierarchical regression analysis for variables predicting perceived control (N = 200).

Variables	Model 1			Model 2		
	B	SE B	β	B	SE B	β
Age	0.06	0.03	0.12	−0.01	0.03	−0.01
Gender	1.07	1.05	0.07	0.55	0.93	0.04
Received shocks	−1.18	0.55	−0.015*	−0.28	0.51	−0.04
Depression	−	−	−	−2.40	0.72	−0.23*
Anxiety	−	−	−	−1.75	0.75	−0.17*
Social support	−	−	−	0.08	0.02	0.26**
ICD concerns	−	−	−	−0.07	0.03	−0.16*
ICD knowledge	−	−	−	−0.00	0.15	−0.03
Adjusted R ²	0.03			0.27		
F for change in R ²	2.89*			10.44**		

B, unstandardised regression coefficient; SE B, standard error for the unstandardised regression coefficient; β, standardised regression coefficient; ICD, implantable cardioverter defibrillator.

*P < .05.

**P < .01.

interventions such as psychoeducational counselling are more important than delivering simple information to improve perceived control and, in turn, HRQOL in this population.^{69–71} Tullmann et al.⁷¹ delivered a structured education and counselling intervention to 115 patients with myocardial infarction, which resulted in higher perceived control and knowledge compared with patients in the control group. In asthma patients,⁷⁰ perceived control of asthma and quality of life significantly improved after completing the behaviour modification–based adult asthma education program.

Current education and information materials given to ICD patients generally focus on device–technical performance and patient's biophysical life as opposed to patients' perceived limitations to their own lifestyle, despite the fact that emotional, biophysical, intellectual, sociocultural, and spiritual life are all affected by ICD implantation.⁷² A review of 12 studies⁸ examining psychological adaptation in ICD recipients showed that recipients had fears of shock, isolation, driving restrictions, ICD failure, and fear of sexual or physical activity that may result in receiving shock. A conversation between patients and their providers about expected limitations and changes in physical, emotional, and social activities;^{8,46,73,74} and how to rapidly resume daily activities is highly needed and should be undertaken before and after ICD implantation.^{75,76} If such limitations are not addressed early, patients may avoid the activities they used to enjoy because of fear of ICD triggering an electric shock in connection to certain activities.¹⁰ With avoidance behaviours, recipients' self-control decreases, HRQOL worsens, and substantial proportion of patients will feel anxious and depressed.^{8,10,74,76} Heo et al.²¹ asked 20 HF patients to define HRQOL and reported that a good HRQOL meant being able to perform desired physical and social activities of daily livings, pursue happiness, and have fulfilling relationships with others. Patients' definitions reflected their active efforts to have a good HRQOL, a sense of control appeared to be the core component for having a good HRQOL.

Maintaining a good quality of life, psychosocial recovery, and adaptation to living with chronic cardiac illness depends more on psychological factors than on physical factors.²⁰ Therefore, the approach to treating ICD recipients should be holistic, and their families should be included to help them incorporate changes into their lifestyle.^{60,77,78}

Depression is common in ICD recipients.^{12,13,43,47,59} Guidelines exist for the screening and treatment of depression in patients with coronary heart diseases^{79,80} but not in ICD recipients. Given the impact of depression on outcomes in ICD recipients,⁸¹ clinicians should consider screening ICD recipients for depression during their follow-up visits and refer those who screen or report positive to psychiatric services for further assessment and appropriate therapies. For example, cognitive behavioural therapy (CBT) may contribute to reducing depression and anxiety in this population. In a small pilot study,⁸² 22 ICD recipients were randomised to a comprehensive 12-week cognitive behavioural rehabilitation program that incorporated both exercise and psychological training (n = 12) or no-treatment group (n = 10). The rehabilitation program group had significantly less anxiety and depression and better HRQOL. Kohn et al.⁸³ conducted a randomised controlled trial of CBT (n = 25) versus usual care (n = 24) and found that CBT significantly decreased depression and anxiety and increased overall adjustment for ICD, particularly in patients who had experienced ICD shocks. Despite the small number of participants involved in CBT trials targeting ICD recipients, statistically significant improvement in psychological and exercise ability outcomes were detected. This implies the importance of including CBT as a major component of cardiac rehabilitation program.

5. Summary and conclusion

Lower level of perceived control and higher HADS score (indicating symptoms of depression and/or anxiety) among ICD recipients were strongly associated with worse HRQOL, controlling for demographic, clinical, and other psychological factors. Perceived control was predicted by higher level of depressive symptoms, anxiety, ICD concerns; and lower level of social support. These results suggest that reducing psychosocial distress may be instrumental in improving perceived control and thereby increasing HRQOL in ICD recipients. Psychoeducational and counselling interventions are warranted to improve health outcomes in this population.

6. Future studies

The results of small pilot studies have shown that CBT had positive effects on levels of anxiety and depression in ICD recipients.^{82,83} Large-scale interventions focusing on CBT and psychoeducational programs that target psychosocial factors before and after ICD implantation are needed to identify its impact on symptoms of anxiety, depression, and HRQOL. These studies should include larger sample size and longer follow-up times.

In this study, lower levels of perceived control were strongly associated with more reported problems in self-care, but this relationship became insignificant after controlling for ICD concerns. Further studies are needed to examine possible mediating relationship among ICD concerns, perceived control, self-care, and HRQOL.

7. Limitations

There are limitations to note. (1) More than 70% of our participants were men; making comparisons of predictors of HRQOL and perceived control based on gender differences is difficult. (2) Our sample participants were mainly Caucasian, which limits generalisability of the findings to minority population. (3) We used a cross-sectional design. Therefore, we were unable to assess any cause and effect relationship between perceived control and HRQOL. (4) The study variables including HRQOL, perceived control, depression, and anxiety were measured using self-reported questionnaires, which may have resulted in bias depending on the emotional status the participants had while completing the questionnaire. However, self-report measures are widely used in research.

8. Clinical implications

Education is a critical strategy in empowering ICD recipients. Psychoeducational programs should be integrated as a major component of treatment to improve perceived control and, in turn, HRQOL in ICD recipients.

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Appendix A. Supplementary data

Supplementary data related to this article can be found at <https://doi.org/10.1016/j.aucc.2018.08.005>

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