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Evidence of Cognitive Bias in Decision Making around Implantable-Cardioverter Defibrillators: A Qualitative Framework Analysis

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Abstract

Background—Prior studies have demonstrated that patients with primary prevention implantable cardioverter-defibrillators (ICD) often misunderstand the ICD. Advances in behavioral economics demonstrate that some misunderstandings may be due to cognitive biases. We aimed to explore the influence of cognitive bias on ICD decision making.

Methods and Results—We used a qualitative framework analysis including 9 cognitive biases: affect heuristic, affective forecasting, anchoring, availability, default effects, halo effects, optimism bias, framing effects, and state dependence. We interviewed 48 patients from 4 settings in Denver: The majority were male (n=32). Median age was 61.

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Disclosures

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We found frequent evidence for framing, default, and halo effects; some evidence of optimism bias, affect heuristic, state dependence, anchoring and availability bias; and little or no evidence of affective forecasting. Framing effects were apparent in overestimation of benefits and downplaying or omitting potential harms.

Conclusions—We found evidence of cognitive bias in decision making for ICD implantation. The majority of these biases appeared to encourage ICD treatment.

Keywords

Catheter Ablation and Implantable Cardioverter-Defibrillator; Sudden Cardiac Death; Heart Failure; Quality and Outcomes; Health Services

1. Introduction

The implantable cardioverter-defibrillator (ICD) involves complex trade-offs. Balanced against a their ability to abort some sudden cardiac death,¹ ICDs come with a host of potential risks including a lower quality of life if shocked,² more hospitalizations,³ and potential suffering at the end of life if they are not properly deactivated.⁴ Further, sudden cardiac death can occur as “dying in your sleep”, which is not necessarily an adverse event in all situations. Prior studies have suggested that physicians use very strong language in how they present the benefits of ICD therapy to patients.⁵ A survey of cardiologists suggested that mortality data and guidelines were more important than patient preferences or patient knowledge in their recommendations for ICDs.⁶ A review of studies of patients’ perceptions suggested that physicians generally employed a paternalistic approach to the decision to receive an ICD and patients often felt uninformed.⁷

In order to improve upon decision making for ICDs, we need a deeper understanding of what influences patients’ decisions. The fields of cognitive psychology and behavioral economics have gained recent mainstream popularity through the publication of books such as *Nudge*⁸ and *Thinking Fast and Slow*.⁹ These scientific fields have demonstrated that people deviate from rational decision making (i.e. decisions that would be predicted by expected utility theory) in predictable ways - termed cognitive biases. For example, Prospect Theory states that people tend to be risk averse when faced with gains and risk seeking when faced with losses. These cognitive biases can have a significant influence on the decisions that people make. Herein, we employed a qualitative framework analysis to assess for a set of salient cognitive biases within qualitative interviews of patients who had made decisions regarding ICDs. The goal was to explore whether these biases could better explain ICD decision making.

2. Methods

2.1 Study Design

Within a social constructionist epistemology we used explanatory qualitative content analysis specifically guided by the Framework Method.¹⁰ This maximizes a deliberately multidisciplinary team of lenses through which to socially locate the context of complex decision making. In this study, we combined data from two qualitative studies exploring

patients' experiences around ICD decision making. We conducted in-depth, one-on-one interviews primarily with patients who had experienced ICD decision making for primary prevention (with some decliners with a secondary prevention indication). We chose a qualitative study design because the complexities of factors potentially involved in decision making are difficult to measure quantitatively, particularly given the limited previous literature exploring decision making around ICDs. Both studies were approved by the institutional review board at the University of Colorado. Informed consent was obtained from all study participants. Compensation was provided in the form of a \$25 gift card.

2.2 Sampling and Recruitment

We recruited patients from the internal medicine, cardiology, electrophysiology, and heart failure clinics at the University of Colorado Hospital, Denver Health Medical Center, Denver Veterans' Medical Center, and Kaiser Colorado. Patients were recruited through multiple strategies. Primarily, patients were referred to the study by clinicians working in the clinics. At Kaiser Colorado, potentially eligible patients were identified from a database and mailed an invitation letter with an opt-out post card followed by a phone call. Interested patients contacted study coordinators and an interview was arranged at a time and place convenient to them. We aimed to recruit both patients who had accepted and patients who had declined ICDs in order to represent a broad range of views surrounding ICDs. Additionally, through our recruitment at Kaiser, we aimed to enrich the sample with older patients and with women, preferentially sending them letters first. Given the difficulty in recruiting patients who had declined ICD therapy, we did interview some decliners who had secondary indications for ICDs. We also obtained permission to contact patients who had declined the ICD in a separate study. We excluded patients who could not provide informed consent.

2.3 Data Collection

In-depth, semi-structured interviews were conducted in person by multiple study coordinators. In line with established qualitative research methods,¹¹ we created open-ended questions to explore patient experiences with ICD decision making. The interview guides were based on the Ottawa Decision Support Framework and addressed domains of the decision such as the most important factors in making the decision, discussion with the doctor, sources of information for the decision, what might have been helpful to know prior to the decision, as well as their experience in living with the ICD. The interviews were digitally recorded, transcribed and reviewed for accuracy. Patients also completed a short demographic survey.

2.4 Qualitative Analysis

In the Framework Method, the investigators use the data to define a framework which is then applied broadly to all the interviews. The initial framework was based on both our reading and understanding of the major topics in cognitive psychology and *a priori* ideas of what potential biases might be present based on our prior work with ICD decision making. It included 15 elements: affect heuristic, risk perception and numbers, affective forecasting, choice overload, default effects (status quo), dual process theory: automatic and reflective, focusing effects—anchoring (on the fact that the ICD prevents SCD), framing effects: gain frame, framing effects: loss frame, optimism/confidence bias, present-biased preferences,

priming effects (related to implicit memory), prospect theory: loss aversion, prospect theory: state dependent and sunk cost bias. Subsequent review of transcripts by two team members (CN, DM) led to refinement of the elements most relevant to our interviews consistent with framework analytic methods, narrowing the list to nine salient cognitive biases (Online supplementary material). We then applied this framework to the two sets of qualitative interviews with patients who had experienced ICD decision making. Through an iterative process of coding and reviewing, two reviewers (DDM – a geriatrician and CTN a social worker and qualitative analyst) determined which cognitive biases appeared to be evident in patients' recollections of their ICD decision making. This process involved reviewing every quote identified for each code in our framework to confirm or disconfirm whether the participants' responses authentically represented the cognitive bias from the code, a process which took over 10 months of weekly meetings to complete. To ensure credibility and confirmability of the findings, we triangulated the data using a multidisciplinary study team, consisting of an advanced heart failure cardiologist (LAA) a geriatrician and palliative care physician (JSK), a nurse with expertise in qualitative methods (JJ), and senior research assistant with training in psychology (AJ). Throughout the data analysis, the team met periodically to discuss the analytic process and emergent findings.

3. Results

We interviewed 48 patients from the 4 settings in the Denver area at two time points: 2009 and 2013. Twenty patients participated in the 2009 cohort and 28 in the 2013 cohort. Of these, 38 had ICDs and 10 had declined ICDs. The majority were male (n=32) and the median age was 61 years. (Table 2)

Of the 9 cognitive biases or heuristics identified in our framework, some were clearly apparent in the decision making while others were either not present or were difficult to identify. We found frequent examples of evidence for framing, default, and halo effects; some evidence of optimism bias, affect heuristic, state dependence, anchoring and availability bias; and little or no evidence of affective forecasting.

3.1 1. Cognitive biases and heuristics consistently observed

A. Framing effects—Throughout the interviews, we found pervasive evidence of framing effects. Framing was apparent in what was included and excluded. Patients recollected conversations where the clinician provided overemphasis of benefits. Likewise, experiences such as battery changes and shocks appeared to be minimized. Deactivation was rarely discussed at all. While the majority of framing seemed to encourage the device, one outlier felt it was used to discourage him from getting the device. Table 3 provides several examples of framing effects observed.

B. Default effects—A strong default effect was seen in favor of performing the ICD implantation:

Briefly and honestly, it is a very nonchalant thing that they think this is. I think they think this is just par...par for the course. You do it and that's what you should

do.... I feel they have a one-track mind about it...I don't think that they see it as a 'yes' or 'no' issue. - ICD decliner, male age 46

I was basically told by two heart doctors I had to have it, so there you go. There ain't much thinking about it. Just get it done. - ICD acceptor, male age 54

C. Halo effects—Halo effects were clearly evident in these data. The participants appeared to impart a halo effect in two places. First, around the clinician:

Dr. ____ was down there and of course I think he practically walks on water...so I felt very comfortable doing that [ICD]... - ICD acceptor, female age 72

Second, participants also appeared to perceive a halo around the technology itself:

So this [ICD] to me is as close as having God help you with man's help as you're going to get. -ICD acceptor, female age 72

3.2 2. Cognitive biases and heuristics intermittently observed

A. Optimism bias—Optimism bias was most prevalent among younger decliners who often saw themselves as healthier and less likely than others to need the device:

Anyway, there is a lot they don't know...and they can't say with any certainty whether I need it or not. I don't fall within the parameters of when I should have it or not and historically there has been no evidence that I need it. And so you know, medicine is an art too and doctors sometimes guess. – ICD decliner, male age 59

B. Affect heuristic—While the data contained evidence of emotion at the time of decision making, it was difficult to determine to what degree the emotion influenced the decision making. For example, some participants said things where it was difficult to distinguish if there was a framing effect, an affect heuristic, or something else influencing the decision making:

I mean I remember her saying you could be walking across the parking lot to your car and just die. And so...And I was already so freaked out and I trusted her very much. We had already been through a year together at that time and it was a no brainer to me. – ICD acceptor, female age 43

C. State dependence—While it is challenging to make strong statements about the state dependence from these retrospective interviews, it was clear in some interviews that participants' perceptions of their state influenced their decisions.

Among patients who accepted ICDs, the majority appeared to see themselves in a worsened state and who expressed the desire to receive the ICD as a way of improving their quality of life or avoiding death (view of current state as vulnerable, had already lost ground with their health, did not wish to die).

...at the time that I was going through the decision, my life was already very limited. So I was in hopes that the ICD would give me more of a chance to live...

my heart was so bad...I couldn't live without help...so the ICD was my chance. – ICD acceptor, female age 72

One in this group had become increasingly frustrated in his state of wearing a life vest, or external defibrillator. He viewed the ICD as a “gain” as it would eliminate the need for the burdensome Life Vest.

I had been using the life vest prior to this and I had to lug that thing everywhere and wear it and it was just kind of getting old. So finally, you know, the second time I was in the hospital and uh, I had been slipping a little bit and we decided we should put this ICD in. – ICD acceptor, male age 43

Among decliners, many saw themselves as healthy and viewed the ICD as unnecessary and a “risk” they didn’t wish to experience.

[I'm] Probably in far better shape than the average 58 year old. Probably in better shape than the average 30 year old...I've never had any symptoms that I'm aware of...and I'm borderline as to whether or not I need a defibrillator. Then it's kind of like 'Why am I going to do this?' -ICD decliner, male age 59

One unique decliner was a patient who saw his quality of life as extremely poor and did not wish to prolong his suffering by having the ICD implanted.

Going into my decision is also the fact that I can't work because of my medical condition. That was a big part of my life. I can't work at the hospital; I can't work at the church. My life is sitting here and watching TV... that's why I didn't have the Defibrillator put in. – ICD decliner, male age 61

D. Anchoring heuristic—Some patients anchored or relied heavily on the first piece of information they heard about the ICD, making their decision based on this “anchor.” In the case of one decliner, this bias took the form of a “horror” story about someone being shocked by the device.

I had heard stories and my wife had heard stories about um...malfunctions. But I understand that is like 1 in a million times now. I don't know...but when it hits close to home, 'cause it was a friend of her father's...his pacemaker went haywire and just kept zapping him and by the time they got to him he had passed...[so] she [spouse] was pretty strongly against it. Because of those things she had heard. – ICD decliner, male age 62

Several patients who chose to have the device implanted anchored on the large size of the early devices. In comparison, the newer, smaller devices seemed more acceptable.

...over a period of years it changed. The technology got better and it got down to almost the size of a silver dollar as they call it. All the things they can do and the longevity and the battery, so they said you are coming in to a good time with the medicine advances. So the changes were even better then. – ICD acceptor, male age 70

E. Availability heuristic—Some patients readily recalled friends/family who had died from cardiac events which appeared to influence the patients' estimates of how likely they, too, might suffer a heart-related incident.

I mean I've had friends who have died in the middle of their sleep from a heart attack. And you can't do that with this [ICD]. It will keep you alive....it just keeps people alive. – ICD acceptor, male age 70

On the other hand, a patient who declined the ICD spoke of a family member who suffered a complication during his ICD surgery. Though surgical complications are rare, he was deterred from implantation by this single event.

My brother-in-law had an incident. He has a defibrillator - not a pacemaker - and they had to change the leads on him for I'm not sure what reason and he nearly died in that procedure. – ICD decliner, male age 60

3.3 3. Cognitive biases and heuristics not observed

A. Affective forecasting—We found little evidence of this bias in our interviews, likely due to the retrospective nature of our interviews. One exemplar, however, nicely illustrated the concept of errors in affective forecasting:

I think it would have been helpful if I would have known that I would be ok with it, when I got it 2 years later. You know? Well, of course I had apprehension before I got it in. And of course, now, it really is not a factor. – ICD acceptor, male age 46

4. Discussion

Patient perspectives about their ICD decision-making experience revealed evidence of cognitive bias. Many of the biases appeared repeatedly throughout the interviews. One frequent scenario described by participants involved patients' attribution of a halo effect to clinicians, who then presented a default to implant an ICD (a therapy to which patients also attribute a halo) using influential framing techniques. These participants were often in a state of feeling close to death, where the ICD was seen as a tremendous gain. Likewise, with only one exception, decliners were in a state where they thought they were too healthy for the ICD and they seemed to report an optimism bias that they weren't actually at a high risk for SCD.

This study has several important strengths. First, participants in this study came from a variety of clinical settings including both capitated and fee-for-service reimbursement systems. Second, this study deepens our understanding of decision making surrounding ICDs. Prior studies have suggested that clinicians weigh guidelines and mortality data to be more important than patients' preferences in their recommendations for ICDs.⁶ In a related study, physicians also used very strong language in their recommendations for ICDs,⁵ and as a consequence, patients often did not feel fully informed.⁷ Our findings expand upon this prior work by using contemporary theories from psychology to provide depth and specificity regarding mechanisms behind how varying communication strategies can influence decisions. Third, the majority of work on cognitive bias takes place in artificial experiments. This work explores cognitive bias in a real world decision with significant implications.

Three of the strongest biases in our data were framing effects, default effects, and halo effects. With only one exception where framing appeared to discourage a patient from getting an ICD, all of these biases appeared to work together to encourage patients to accept the treatment. These biases are interrelated. For example, our prior research interviewing physicians demonstrated that the guidelines created a professional norm to which the physicians felt they must adhere.¹² The fact that ICDs are a Class I recommendation in the guidelines may help create a default effect which then leads physicians to use strongly positive framing in order to be guideline adherent. Further, some authors have written about a technological imperative and a treatment imperative where we as a culture have both a strong societal preference to intervene and a strong societal preference for technology.¹³ It is no wonder we saw strong halo effects for both the physician and the technology itself. The biases we observed in our data not only encouraged treatment, but it appeared that many of the decliners did not entirely understand what they were declining and that a more informed, less emotional approach to ICD decision making may have led some of those participants to choose an ICD.

Choosing whether or not to have a resuscitation device implanted inside your body is a complicated decision. The trade-offs are related to whether one desires prevention of sudden cardiac death or not, an inherently difficult topic to think about. Some clinicians do not think this should even be a discussion and they have proposed that the rate of ICD implantation should be a measure of quality.¹⁴ Proponents of this view might argue that, similar to encouraging a patient to stop smoking, we should encourage patients to get an ICD and that the framing we observed in our study was entirely appropriate. This raises the question regarding what is the correct decision. Many have argued that getting an ICD is a decision that should be based on patients' informed preferences.¹⁵ While it is potentially life-saving, there are those (such as one of our decliners) who may elect to not prevent sudden death. Our system of decision making should make room for these patients who choose to make decisions in a manner discordant to the guidelines.

There are several limitations to our study that should be considered when interpreting our data. First, there are many cognitive biases and there are likely additional biases that we may not have identified. Second, a limitation of retrospective, qualitative interviews is that we had difficulty isolating some biases. For example, when a participant told us about a friend or family member who did well or did poorly with their ICD implantation experience, it is difficult to say if this should be identified as availability or anchoring. Furthermore, the retrospective timing could bias the results as the patients would be influenced by their subsequent experiences. Future work could explore the effects of these biases prospectively. Lastly, themes from qualitative research may reflect the perspectives of the investigators. To minimize bias we employed several methods to assure credibility and dependability including using primary interviewers and an analyst with no clinical relationship and triangulating our findings among the multidisciplinary team. Additionally, we have presented these findings to multiple groups and they were able to easily re-contextualize these findings to their various clinical situations, further arguing to the authenticity of these results.

Unfortunately, a body of research suggests that patients are not adequately informed when receiving medical interventions.¹⁶ Perhaps even more concerning is the literature that patients often receive care that they would not want were they adequately informed.¹⁷ While the legal and ethical theories surrounding informed consent are clear, our data highlight how understanding the behavioral theories that guide patients to make decisions can help us better understand why true informed consent is not always occurring. At a minimum, we need to recognize the reality of these biases and start adjusting our approaches to informed decision making accordingly. A challenge for the fields of shared decision making and patient-centered care is learning how to build a bridge between the legal and ethical mandates to inform our patients and the behaviors we as humans use to make decisions.

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Highlights

- Cognitive biases can influence decisions in a non-normative way.
- Implantable Cardioverter-Defibrillators (ICDs) are a challenging decision.
- Retrospectively, we found indications of cognitive bias in ICD decision making.
- On the whole, the biases appeared to encourage ICD treatment.

Table 1Participant characteristics, *n* (%)

Characteristic	Study 1 (n = 20)	Study 2 (n = 28)	Total (n = 48)
Gender			
Male	12 (60%)	20 (74.2%)	32 (66.6%)
Female	8 (40%)	8 (25.8%)	16 (33.3%)
Race/ethnicity			
Native American	1 (5%)	1 (3.6%)	2 (4.2%)
Asian	—	—	—
Black	5 (25%)	6 (21.4%)	11 (22.9%)
White	13 (65%)	18 (64.3%)	31 (64.6%)
Hispanic/Latino	1 (5%)	1 (3.6%)	2 (4.2%)
Other	—	1 (3.6%)	1 (2.1%)
Age, y, range (median)	34–72 (61.5)	27–79 (61.5)	27–79 (61.5)
Educational status			
Less than HS	3 (15%)	1 (3.6%)	4 (8.3%)
HS graduate	4 (20%)	12 (42.8%)	16 (33.3%)
Some college	6 (30%)	4 (14.3%)	10 (20.8%)
College graduate	3 (15%)	6 (21.4%)	9 (18/6%)
Any postgraduate	4 (20%)	4 (14.2%)	8 (16.6%)
NYHA functional class			
I	No data	5 (17.8%)	
II		5 (17.8%)	
II–III		1 (3.6%)	
III		11 (39.3%)	
III–IV		1 (3.6%)	
IV		1 (3.6%)	
Median time since implant, y	4	3	4
Accepted ICD	14 (70%)	23 (82.1%)	37 (77.1%)
Declined ICD	6 (30%)	5 (17.9%)	11 (22.9%)
Ever shocked? *			
Yes	5 (35.7%)	9 (39.1%)	14 (37.8%)
No	9 (64.3%)	14 (60.8%)	23 (62.2%)

* Percentage are of patients with an ICD.

Table 2

Participant characteristics, n=48

	Study 1 n=20	Study 2 n=28	Total n=48
Gender			
Male	12 (60%)	20 (74.2%)	32 (66.6%)
Female	8 (40%)	8 (25.8%)	16 (33.3%)
Race/ethnicity			
Native American	1 (5%)	1 (3.6%)	2 (4.2%)
Asian	–	–	–
Black	5 (25%)	6 (21.4%)	11 (22.9%)
White	13 (65%)	18 (64.3%)	31 (64.6%)
Hispanic/Latino	1 (5%)	1 (3.6%)	2 (4.2%)
Other	–	1 (3.6%)	1 (2.1%)
Age, years, range (median)	34–72 (61.5)	27–79 (61.5)	27–79 (61.5)
Educational status			
<HS	3 (15%)	1 (3.6%)	4 (8.3%)
HS graduate	4 (20%)	12 (42.8%)	16 (33.3%)
Some college	6 (30%)	4 (14.3%)	10 (20.8%)
College graduate	3 (15%)	6 (21.4%)	9 (18/6%)
Any post graduate	4 (20%)	4 (14.2%)	8 (16.6%)
NYHA			
I	No data	5 (17.8%)	
II		5 (17.8%)	
II–III		1 (3.6%)	
III		11 (39.3%)	
III–IV		1 (3.6%)	
IV		1 (3.6%)	
Median time since implant? (Years)	4	3	4
	14 (70%)	23 (82.1%)	37 (77.1%)
Accepted ICD	6 (30%)	5 (17.9%)	11 (22.9%)
Declined ICD			
Ever shocked?*	5 (35.7%)	9 (39.1%)	14 (37.8%)
Yes	9 (64.3%)	14 (60.8%)	23 (62.2%)
No			

n= of patients with an ICD

Table 3**Framing effects****1. Overestimation of benefits**

And then my doctor, the cardiologist I was seeing, was over there and explained to me that after a massive heart attack like that, your chances of having an event that can kill you is 15% a year. And he said that don't sound like much, but he says when you start going 3 or 4 or 5 years out, it's pretty high. And I figured ok, so they basically said ICD or you die. So I chose the ICD, of course. – ICD acceptor, male age 56

2. Downplaying of risks and challenges of living with an ICD**2a. Minimization of the effect of shocks**

(In response to "Is there anything you wish the doctor would have told you...?"): (laughing) I don't think so other than warning you that if this does go off it's going to be quite the jolt! I think that was the only thing. I mean I knew it would go off. I guess I just didn't expect the impact. And it is quite an impact when it goes off. – ICD acceptor, female age 64

2b. Omitting deactivation discussions

We never had that discussion with them. I've wondered if they would ever ask that...because they never brought it up, I didn't think I should worry about it too much then. – ICD acceptor, male age 40

2c. Less than full disclosure about battery changes

Because the battery [went] dead and they put one in...that wasn't explained to me either. That I was going to have to have...I mean I knew there was a certain length of battery life. I'm not that naive, but I never stopped to think, or it wasn't brought to my attention that this meant I had to go in and be cut open again. – ICD acceptor, female age 66

3. Framing used to discourage an ICD (n=1 in our sample).

The first doctor I had...kind of like put me in hospice and he said 'Why would you want to get a paperweight in your chest? Why don't you just go ahead and live the rest of your days comfortable.' And I was like...you know, he was really counting me out there. – ICD acceptor, male age 60