

# Ignorance of Hedonic Adaptation to Hemodialysis: A Study Using Ecological Momentary Assessment

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Healthy people generally underestimate the self-reported well-being of people with disabilities and serious illnesses. The cause of this discrepancy is in dispute, and the present study provides evidence for 2 causes. First, healthy people fail to anticipate hedonic adaptation to poor health. Using an ecological momentary assessment measure of mood, the authors failed to find evidence that hemodialysis patients are less happy than healthy nonpatients are, suggesting that they have largely, if not completely, adapted to their condition. In a forecasting task, healthy people failed to anticipate this adaptation. Second, although controls understated their own mood in both an estimation task and a recall task, patients were quite accurate in both tasks. This relative negativity in controls' estimates of their own moods could also contribute to their underestimation of the moods and overall well-being of patients.

In the same year that Brickman, Coates, and Janoff-Bulman (1978) published the famously counterintuitive result that persons with paraplegia are not that much less happy than lottery winners, Sackett and Torrance (1978) demonstrated that there are other serious health conditions that do not seem to be as badly experienced by the people living with them as healthy people would expect. For example, patients on dialysis rated their quality of life as .56 (on a scale from 0 to 1), whereas healthy people estimated that the quality of life of a patient on dialysis would be just .39. Similar discrepancies have been demonstrated for other serious health conditions (Boyd, Sutherland, Heasman, Tritcher, & Cum-

mins, 1990; Buick & Petrie, 2002) and for some less serious health conditions (Baron et al., 2003).

Although the existence of the discrepancy is well established at this point, its cause is not (Ubel, Loewenstein, & Jepson, 2003). The most common explanation for the discrepancy is that it reflects bias on the part of healthy people—that is, that healthy people think that health impairments are worse than they are. Research in diverse domains has documented a general tendency for people to underestimate their own and others' speed of adaptation to negative as well as positive outcomes (Gilbert, Pinel, Wilson, Blumberg, & Wheatley, 1998; Sieff, Dawes, & Loewenstein, 1999). A related mechanism is the focusing illusion (Schkade & Kahneman, 1998; Wilson, Wheatley, Meyers, Gilbert, & Axsom, 2000): When estimating the impact of any one life event on their overall well-being, people tend to focus disproportionately on aspects of life that would change as a result of the event and to ignore aspects that would remain the same, thus exaggerating the impact of the event (but see Ubel et al., 2001, and Baron et al., 2003, for evidence that this latter account is less plausible).

Other kinds of explanations implicate the self-reports of chronically ill or disabled patients themselves, rather than just the judgments of healthy respondents. For a variety of reasons, patients may exaggerate their well-being, reporting a high quality of life even though they experience more moments of misery and fewer moments of joy than healthy people do. Patients may be in the habit of exaggerating their reports of well-being for the benefit of those who provide care for them (Diener, Suh, Lucas, & Smith, 1999), or they may simply need to avoid being perceived as complainers so as to ensure continued support from family, friends, and professional caregivers. They may also have developed a manner of coping with their situation whereby they tend to focus on the more positive aspects of their experiences.

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Even if these motivational factors do not lead to exaggeration, basic memory processes may have the same effect. In general, summary reports of extended experiences tend to overweight certain salient features, such as the peak, end, or trend (for reviews, see Ariely & Carmon, 2002; Kahneman, 1999, 2000), and they tend to be insensitive to duration. Patients may experience frequent, lengthy periods of moderately negative mood, but these periods may not be well represented in an overall happiness judgment if, say, the patients experience normal, positive peak moods. Evidence suggests that the peak moods, however brief, will have a disproportionate weight in an overall judgment (Kahneman, Fredrickson, Schreiber, & Redelmeier, 1993), leading to exaggerated reports of well-being.

If, for any of these reasons, patients do exaggerate their well-being, then the low well-being ratings that healthy people estimate for patients could correctly reflect the difference in day-to-day mood experienced by patients and healthy people. The discrepancy in well-being ratings would reflect reality.

A related explanation for the discrepancy comes from evidence that healthy people tend to underestimate their own past moods. Thomas and Diener (1990) have suggested that people may generally tend to recall negative times more readily than positive times. Indeed, they found that (healthy) people tend to underestimate the percentage of time that they are in positive relative to negative moods. Patients may not have this tendency; a coping strategy that leads them to focus on positive aspects of life may also make them less likely than healthy people to remember their more negative moments. The tendency of healthy people to recall more negative experiences could make them more likely than patients to understate their own well-being. If healthy people understate their own well-being, then they would be likely to understate the well-being of other people (including patients) as well, and this could contribute to the discrepancy.

The cause of the discrepancy matters. If healthy people misperceive the quality of life associated with different health conditions, they are likely to make suboptimal decisions both when it comes to protecting their health and when it comes to deciding between treatments. For example, someone suffering from a gastrointestinal disorder who overestimates how miserable he or she would be after having a colostomy would be likely to be too reluctant to obtain one. The discrepancy could also lead policymakers to misallocate scarce health care funds if different conditions are subject to different degrees of bias. To make informed decisions, laypersons and policymakers need to form accurate perceptions of how various health conditions would affect subjective well-being.

Our goal in the research reported here is to test for the three possible sources of the discrepancy discussed above: misestimation of the impact of illness or disability by healthy people, overstatement of mood experiences by patients, and understatement of mood experiences by healthy people. This is accomplished by measuring the moods of patients and controls and by comparing these measured moods with various estimates and recollections of mood. To measure mood, we use the method of ecological momentary assessment (EMA; Kahneman, 1999; Stone, Shiffman, & DeVries, 1999).

In EMA, subjects are given personal digital assistants (PDAs; e.g., Palm Pilots) to carry with them wherever they go for a period of several days or more. The method is designed to minimize the influence of biased recall. The PDA prompts the subject to answer

questions at random times throughout the day. In studies of well-being, subjects are asked how they feel at that very moment. Robinson and Clore (2002) found that subjects are faster to answer questions about their immediate mood than about moods in the past. Robinson and Clore argued that momentary mood reports are thus less likely to reflect biases of episodic or semantic memory. In this sense, momentary mood questions, asked repeatedly and in the subject's normal environment, are less likely to be edited by a subject who wants to represent himself or herself in a certain way. By asking people to make such momentary assessments several times a day on a PDA, researchers can then aggregate these assessments to get an overall picture of an individual's experience in a way that avoids the biases of the individual's own recall or aggregation process.

In this study, we compared mood estimates (made during interviews) and EMA mood responses (made over the course of a week on a PDA) reported by a sample of chronically ill hemodialysis patients and a sample of healthy controls. If the discrepancy in well-being ratings occurs because patients tend to exaggerate their own mood, then their mood estimates given at the beginning of the week and their mood recollections made at the end of the week should overstate their measured mood experience, as indicated by their aggregated EMA responses. If this effect is large, then we would expect the estimates and recollections of the patients to be similar to those of the controls, but their measured mood should be significantly lower. And the controls' estimates of patients' moods may accurately reflect this lower mood.

Alternatively, if it is controls' underestimation of their own well-being that accounts for the discrepancy, then we would expect their estimations and recollections of mood to underestimate their measured mood. Patients, in contrast, may be quite accurate.

However, if patients have largely adapted to their condition, then we would expect their aggregated EMA responses to be high (higher scores indicating more positive mood), perhaps as high as those of controls. If the discrepancy results from controls' inability to appreciate this adaptation, then the controls' estimates of the mood they would experience as hemodialysis patients should understate the patients' measured mood experience (as measured by EMA).

Finally, to the extent that adaptation does occur, we hoped to assess the extent to which patients have insights into its occurrence. We did so by asking them to estimate how happy they would be if they had never had kidney trouble and had never needed hemodialysis treatment. If patients have adapted and are aware that they have adapted, then they should not expect good health to have made them any happier than they are now. Also, their estimates of "happiness if healthy" should not reflect a higher level of happiness than that measured among healthy nonpatients.

## Method

### *Subjects*

Subjects were 49 end-stage renal patients receiving hemodialysis treatment three times per week and 49 healthy controls who were matched to the patients on age, race, sex, and education. Subjects in 32 of the matched

pairs were paid \$30 to participate. The other subjects were paid \$50 to participate.<sup>1</sup>

End-stage renal disease is a condition in which the kidneys fail to perform their normal function of cleaning and filtering the blood. Treatment consists of a procedure called hemodialysis in which a patient's blood is filtered through a machine. Most patients require treatment three times per week for about 3 hr each time. Although discomfort and nausea are possible, they are usually minor and the patient can read, write, talk, eat, sleep, or watch TV during treatment. The patient's lifestyle can include most normal activities, including work, exercise, and leisure; however, the patient will feel fatigued after missing treatment for several days. Also, the patient must follow a strict diet that usually involves reducing sodium intake, consuming relatively little meat, and drinking only small amounts of fluids.

Patients were selected from a pool of 299 hemodialysis patients at nine dialysis centers in the Ann Arbor, Michigan, area. Forty-five patients were deemed ineligible because records or a preliminary interview showed that they were either blind, deaf, or illiterate or that they did not speak English or were experiencing dementia. The remaining patients were approached at the centers while they were undergoing the treatment. After hearing the description of the study, 90 of the remaining patients (35%) agreed to participate.

Of the 90 patients who began the study, 82 completed all three phases (described later). Sixty-nine of these patients responded to at least 40% of the prompts during the EMA phase of the study. Healthy, matched controls were sought for these 69 patients. Control subjects were recruited from advertisements placed in a local newspaper. Individuals responding to the advertisements were first screened in a telephone interview to ensure that they did not have any major health conditions. Controls were sought to match individual patients on sex, race, age (within 6 years), and years of education (within 4 years). Fifty-six controls were recruited. Seven did not complete all phases of the study (including 2 whose response rate during the EMA phase of the study was less than 40%). Forty-nine were successfully matched to a patient.

Of the 49 matched pairs, 31 were women, 30 were Caucasian, 18 were African American, and 1 was Hispanic. The average patient age was 49.3 years ( $SE = 2.2$ ) and the average control age was 49.0 years ( $SE = 2.0$ ). The average education level was 14.1 years ( $SE = 0.36$ ) for the patients and 15.0 years for the controls ( $SE = 0.29$ ). For the patients, the average number of years on dialysis was 3.3 ( $SE = 0.52$ ). As intended, the controls' self-reported health ( $M = 2.2$ ,  $SE = 0.18$ ) was better than that of the patients ( $M = 3.8$ ,  $SE = 0.16$ ), as rated on a 5-point scale from 1 (*excellent*) to 5 (*poor*),  $t(29) = 6.8$ ,  $p < .001$ ,  $d = 1.7$ .<sup>2</sup>

### Procedure

#### Nonparticipant Questionnaire

To test for the possibility of selection bias among the patients, we gave the *nonparticipants* (i.e., patients who were asked to participate but declined) a questionnaire to assess their average mood. Specifically, they were asked to rate their average mood during a typical week on a 5-point response scale with the following response options: 2 = *very pleasant*, 1 = *slightly pleasant*, 0 = *neutral*, -1 = *slightly unpleasant*, and -2 = *very unpleasant*.

The questionnaire was given to 126 of the 164 nonparticipants (because of an administration error, the questionnaire was not given to the first 38 nonparticipants). These patients were invited to complete the questionnaire while they were at the center and undergoing treatment, and many reported being simply too tired from the (concurrent) treatment to complete the questionnaire. The response rate was nonetheless quite high (79%).

#### Three Stages

There were three stages to the study: (a) the entry interview, (b) the EMA week, and (c) the exit interview. The mood estimation tasks used in

the entry and exit interviews were designed to allow direct comparison to the EMA responses.

#### Entry Interview

During the entry interview, subjects first answered several sample questions on the PDA to familiarize themselves with how the screen could be tapped to enter responses. They were also shown how the PDA could be "put to sleep" so that it would not disturb them at night or at other inappropriate times (e.g., while attending a movie).

Next, subjects completed a questionnaire in which they were asked to estimate their typical mood. Subjects estimated the percentage of time during a typical week that they would experience each of five mood levels. The percentages were to add up to 100. The mood levels were the same ones that would be offered as response options during the EMA session, and they were the same ones that were used in the nonparticipant questionnaire (i.e., from 2, *very pleasant*, to -2, *very unpleasant*).

#### EMA

Subjects carried the PDAs for 7 days, beginning immediately after the entry interview.<sup>3</sup> The first 7 pairs of subjects received PDAs scheduled to beep randomly once within each 2-hr interval of the day (between 8:00 and 10:00, 10:00 and 12:00, etc.). The remaining 42 pairs received PDAs that beeped once randomly within each 90-min period.

The first question was a single-item mood measure, instructing subjects to think back to the mood they were feeling just before the PDA beeped and to tap the button on the screen that best described that mood. Five response buttons represented the same five mood levels described previously (i.e., from 2, *very pleasant*, to -2, *very unpleasant*).

There were nine additional mood measures for which subjects indicated the extent to which they were experiencing specific emotions (happy, joyful, pleased, enjoyment/fun, depressed/blue, unhappy, frustrated, angry/hostile, worried/anxious) on a 0 to 6 scale anchored at *not at all* and *extremely much*, respectively (cf. Thomas & Diener, 1990). Two additional questions (using the same scale) asked subjects about the extent to which they were feeling (a) pain or physical discomfort and (b) tired or fatigued.

Finally, on 10% of the prompts, an additional question was asked: On these trials, this additional question was presented first, before the 12 questions described above. This was an overall life satisfaction question, and because all other trials began with the momentary mood question, trials beginning with the life satisfaction question opened with a brief introduction screen to emphasize the difference between the two kinds of questions. The introduction screen said, "The next question will ask you about how you feel about your life as a whole." The question on the following question screen was then simply, "How do you feel about your life as a whole?" The seven response buttons corresponded to a 7-point scale

<sup>1</sup> The increased payment was intended to increase recruitment rates, but it had no effect.

<sup>2</sup> Only the first 30 pairs were asked this health question. In an effort to reduce participant burden, a questionnaire pertaining to health that was administered at the end of the study was cut partway through the study. This question was part of that questionnaire. Our recruiting methods were similar for the remaining pairs, so there is no reason why this very large difference in health would not also be observed for the remaining pairs.

<sup>3</sup> The PDA was a Palm Pilot Model IIIxe. It ran a program called ESP Blue, which was developed by Chip Jensen. The program can be downloaded at <http://www.med.umich.edu/pihcd/esp/esp.htm>. ESP Blue is based on a program called ESP, which was developed at Boston College by Lisa Feldman Barrett and programmed by Daniel J. Barrett. While the program was running, users were not able to use the PDA's other programs or functions.

ranging from 3 to  $-3$  and were anchored at *very satisfied* and *very unsatisfied*, respectively.

### Exit Interview

At the end of the EMA week, subjects made several mood estimates in the same format as that used during the entry interview (i.e., estimates of the percentage of time spent in each of the five mood levels). The instructions for each estimate are described below.

*Recall.* Subjects estimated the percentage of time spent in each mood level during the previous week (during which they had carried the PDA).

*Typical.* Subjects estimated the percentage of time spent in each mood level during a typical week. This was identical to the estimation task given at the entry interview.

*Hemodialysis.* Subjects were presented with a scenario describing the experience of a hemodialysis patient. Patients and controls alike were asked to imagine that they were the patient in the scenario. Controls were asked to imagine that they had been hemodialysis patients for either 1 year or for as long as their matched patient had been on hemodialysis (whichever was greater). All subjects then estimated the amount of time they would spend in each mood level if their experience were the same as that of the patient in the scenario.

*Healthy.* Patients estimated the percentage of time they would spend in each mood level if they had never had kidney problems and had never needed hemodialysis treatment.

## Results

Analyses are reported for the 49 pairs of matched patients and controls. All  $t$  tests are paired, unless otherwise specified.<sup>4</sup>

### Measured Mood: EMA Responses

The average EMA response to the overall mood question (on the 2 to  $-2$  scale) was 0.70 ( $SE = 0.07$ ) for the patients and 0.83 ( $SE = 0.07$ ) for the controls. This difference is not significant,  $t(48) = 1.4, p = .16$ . With this sample size and a critical value of .05, we had the statistical power (.80) to detect a difference of 0.23 (on the 5-point scale) between the groups. It appears likely, then, that if there is a difference in mood between the groups, the difference is small. This supports the suggestion that the patients have adapted quite well to their condition.

Further evidence of a lack of difference in mood comes from responses to other EMA questions. For each subject, responses to the four positive emotion questions (i.e., happy, joyful, pleased, enjoyment/fun) were averaged, as were responses to the five negative emotion questions (i.e., depressed/blue, unhappy, frustrated, angry/hostile, worried/anxious). The positive averages were not significantly different between groups ( $M = 3.1, SE = 0.17$ , for patients;  $M = 3.3, SE = 0.16$ , for controls),  $t(48) < 1$ , nor were the negative averages ( $M = 0.9, SE = 0.13$ , for patients;  $M = 1.0, SE = 0.12$ , for controls),  $t(48) < 1$ . There were also no significant differences between groups on any of the nine individual emotions.

There were no significant differences between patients and controls in their responses to the questions about pain ( $M = 1.4, SE = 0.19$ , and  $M = 1.1, SE = 0.19$ , respectively),  $t(48) < 1$ ; tiredness ( $M = 2.1, SE = 0.19$ , and  $M = 2.1, SE = 0.17$ , respectively),  $t(48) < 1$ ; or overall life satisfaction ( $M = 1.1, SE = 0.18$ , and  $M = 1.3, SE = 0.16$ , respectively),  $t(45) < 1$ .

The response rates for both groups were high. Patients responded to 72% of the PDA prompts ( $SE = 2.1$ ) for an average of 39 responses over the 7 days, whereas the controls responded to

78% ( $SE = 2.1$ ) for an average of 43 responses. These response rates were significantly different,  $t(48) = 2.3, p = .025, d = 0.43$ ; however, EMA response rate was not correlated with average EMA response,  $r(97) = .02, ns$ . Furthermore, when average EMA response was regressed on EMA response rate, the group variable (i.e., patient vs. control), and the interaction term, the interaction term was not significant,  $\beta < .001 (t < 1)$ . This does not support the suggestion of a reporting bias whereby nonresponses occurred during periods of better mood for one group than for the other.

For the patients, the number of years spent on hemodialysis was not correlated with average EMA response,  $r(48) = -.06, ns$ . All patients had been on hemodialysis for at least 3 months, so considerable time had already passed for adaptation to have occurred. Furthermore, many patients would have had symptoms of kidney disease for months or years before hemodialysis was required, so the period of adaptation to their health condition could have been considerably longer than the months or years since they began hemodialysis treatment.

Because our ultimate patient sample was not randomly selected, we examined the possibility that patients were not representative, with respect to mood, of the hemodialysis population. First, we compared them with the nonparticipants from the dialysis centers. That questionnaire was on the same 2 to  $-2$  scale as the EMA mood question. The average questionnaire response was 0.74 ( $SE = 0.11$ ), which is similar to the EMA average reported by the 49 matched patients ( $M = 0.70, SE = 0.07$ ),  $t(146) < 1$ . Furthermore, the 20 patients who responded to at least 40% of the EMA prompts but who were not matched with a control subject were very similar in EMA average to the 49 matched patients ( $M = 0.69, SE = 0.08$ , and  $M = 0.70, SE = 0.07$ , respectively),  $t(67) < 1$ . Finally, of the 21 patients who did not complete the study, 17 had at least one EMA response, and their EMA average ( $M = 0.69, SE = 0.12$ ) was also similar to that of the 49 matched pairs,  $t(64) < 1$ . Among all patients, response rate was not correlated with EMA average,  $r = -.04, ns$ . None of these results support the hypothesis that the matched patients were unrepresentative of the hemodialysis population.

### Average Mood Estimates

For each of the estimation tasks (i.e., entry, recall, typical, hemodialysis, healthy), subjects estimated five mood percentages. For some subjects, these percentages did not add up to 100, so they were scaled accordingly. These scaled percentage estimates corresponded to a scalar estimated average mood, and those averages are shown in Table 1. The averages were computed by dividing each scaled percentage by 100 and multiplying the quotient by the respective mood level (i.e., 2, 1, 0,  $-1$ , or  $-2$ ). The sum of these five values was the estimated average mood for that particular estimation task.

### Estimation of One's Own Mood

For each subject, the difference between the entry estimate and average EMA mood was computed. Patients' entry estimates slightly overestimated their EMA average mood ( $M = 0.08, SE =$

<sup>4</sup> None of the results change if, instead, the analyses compare the 49 controls with the full sample of 69 eligible patients (i.e., those who responded to at least 40% of EMA prompts).

Table 1  
Means of Measured and Estimated Mood for Hemodialysis Patients and for Healthy Controls

Mood	Patients ( <i>n</i> = 49)	Controls ( <i>n</i> = 49)
Measured mood (average EMA response)	0.70	0.83
Estimated mood		
Typical week (at entry)	0.78	0.67
Recall of EMA week	0.70	0.60
Typical week (at exit)	0.61	0.67
Imagining hemodialysis scenario	0.63	-0.38
Imagining never having had kidney disease	1.16	

Note. All means are on a 2 to -2 scale. EMA = ecological momentary assessment.

0.08), although not significantly,  $t(48) = 1.0$ ,  $p = .32$ , whereas controls did significantly underestimate their EMA average ( $M = -0.16$ ,  $SE = 0.08$ ),  $t(48) = 2.1$ ,  $p = .042$ . These estimation errors were significantly different,  $t(48) = 2.1$ ,  $p = .042$ ,  $d = 0.44$ .

A similar pattern was observed for the recall estimates. Although the patients' recall estimates accurately reflected their average EMA response ( $M = 0.0$ ,  $SE = .06$ ), the controls showed significant underestimation ( $M = -0.23$ ,  $SE = 0.07$ ),  $t(48) = 3.3$ ,  $p = .002$ . Again, these errors were different between groups,  $t(48) = 2.7$ ,  $p = .009$ ,  $d = 0.49$ , suggesting that different processes underlie patients' and controls' recall of their own moods.<sup>5</sup>

An alternative explanation of these findings is that recall errors are due not to memory differences but to biases in EMA reporting. Because the subjects did miss some EMA prompts during the week, an apparent recall error could occur if subjects accurately recalled their actual mood and EMA was a biased representation of actual mood. For such a bias to account for the data, the EMA bias would have had to have been different for patients and controls, with patients missing relatively more EMA prompts when they were in bad moods and controls missing prompts when they were in good moods. This interpretation seems unlikely given that, as reported earlier, the relationship between response rate and average EMA response was not different for the two groups. Also, response rate was not correlated with recall error,  $r(97) = -.07$ ,  $ns$ , and when recall error was regressed on response rate, group, and the interaction term, the interaction term was not significant,  $\beta < .001$  ( $t < 1$ ). This does not support the alternative explanation attributing the recall error difference between patients and controls to different biases in EMA response. The differences between groups in recall error, then, can more readily be attributed to differences in memory and evaluation processes.

In sum, there was little indication that patients exaggerate their mood. In fact, their expectations and recollection were quite accurate. However, the controls' expectations were worse than their measured experiences, and, consistent with prior research (Thomas & Diener, 1990), their memories showed the same pattern.

### Imagining Hemodialysis

For control subjects, the average estimate of mood while imagining life under the hemodialysis scenario was  $-0.38$  ( $SE = 0.11$ ). This was a very large and significant underestimation of the EMA average mood of the hemodialysis patients ( $M = 0.70$ ,  $SE = 0.07$ ),  $t(48) = 7.6$ ,  $p < .001$ ,  $d = 1.7$ , and of the patients' own estimation

of the hemodialysis scenario ( $M = 0.63$ ,  $SE = 0.12$ ),  $t(48) = 5.6$ ,  $p < .001$ ,  $d = 1.3$ .<sup>6</sup> The controls' estimates were significantly negative,  $t(48) = 3.43$ ,  $p < .001$ , whereas the patients' reported experience was significantly positive,  $t(48) = 9.95$ ,  $p < .001$ . It is important to note that patients' mood estimates of a typical week (at exit,  $M = 0.61$ ,  $SE = 0.10$ ) and of the hemodialysis scenario ( $M = 0.63$ ,  $SE = 0.12$ ) were similar,  $t(48) < 1$ , suggesting that the scenario was a fair representation of their condition.

### Mood if Healthy

For patients, the mood estimates when imagining that they had never had kidney trouble or needed hemodialysis treatment ( $M = 1.16$ ,  $SE = 0.09$ ) were higher than their mood estimates for a typical week (at exit,  $M = 0.61$ ,  $SE = 0.10$ ),  $t(48) = 5.8$ ,  $p < .001$ ,  $d = 0.84$ , and higher than their EMA response average ( $M = 0.70$ ,  $SE = 0.09$ ),  $t(48) = 4.9$ ,  $p < .001$ ,  $d = 0.82$ . Furthermore, their healthy estimate was higher than the controls' estimate of mood during a typical week (at exit,  $M = 0.67$ ,  $SE = 0.09$ ),  $t(48) = 4.0$ ,  $p < .001$ ,  $d = 0.79$ , and higher than the controls' EMA response average ( $M = 0.83$ ,  $SE = 0.07$ ),  $t(48) = 3.1$ ,  $p = .003$ ,  $d = 0.58$ . These findings support the suggestion that patients are themselves not aware of the extent to which they have adapted to their condition.

### Discussion

In this study, we sought to determine the source of the commonly observed discrepancy whereby quality-of-life ratings of people who are sick or living with a disability are much higher than healthy people expect. We did so by comparing measured and estimated moods of hemodialysis patients and healthy controls. Replicating earlier findings using different methods, we failed to find evidence that patients experienced lower moods than healthy controls did. Both patients and controls, however, predicted that the difference in mood experienced under health versus illness would be large. We also failed to find evidence that patients exaggerate their mood, although we did find that healthy people understate their own mood. Implications of these findings are discussed below.

It appears that hemodialysis patients do, largely at least, adapt to their condition. Although they report their health as being much worse than that of healthy controls, they do not appear to be much, if at all, less happy than people who do not have kidney disease or any other serious health condition. The EMA procedure greatly

<sup>5</sup> In an alternate test, EMA average was regressed simultaneously on entry average and on group and then, separately, on recall average and on group. In both cases, the group coefficient was significant,  $\beta = .09$ ,  $t(95) = 2.0$ ,  $p = .046$ , and  $\beta = .09$ ,  $t(95) = 2.7$ ,  $p = .008$ , respectively, consistent with the results of the  $t$  tests. This rules out the possibility that the significant  $t$  tests were artifacts of the use of difference scores. The significant group coefficients also suggest that the lack of difference between patients and controls in EMA average cannot be attributed to low power.

<sup>6</sup> For the hemodialysis estimate, 7 of the 49 control subjects were not asked to imagine that they had had the condition for a period of time. They were asked only to imagine that they were hemodialysis patients. When these 7 controls are left out, the hemodialysis average for the 42 remaining controls is  $-0.35$  and the differences are still significant.

reduced the likelihood of response biases. Subjects were asked about their mood repeatedly, at different times of the day, throughout the normal routine of their lives. If the patients really did spend a great deal of time in a depressed mood, then this procedure should have picked it up. The previously observed tendency of healthy people to underestimate the reported quality of life of people with various health conditions does seem to be due, in large part, to their misperception of the extent to which people can adapt to such conditions.

We cannot rule out the possibility of scale renorming, that is, the possibility that the EMA response options meant something different to the patients than to the healthy controls. For example, what a patient reports as a “very pleasant” feeling may be reported as only “slightly pleasant” by a healthy person, because the patient’s standards may have lowered. We doubt very much, however, that this is the case. We have investigated the same possibility in quality-of-life evaluations and, contrary to the scale renorming hypothesis, have found that the discrepancy between the evaluations of a particular condition by those who suffer from that condition and by those who do not is actually greater when quality of life is measured with scales that have well-defined demarcations (Baron et al., 2003). We have also found the discrepancy to persist even when scales that are unsusceptible to recalibration are used (Lacey et al., 2004).

Headey and Wearing (1992) argued that people have a baseline mood level to which they return after events move them temporarily above or below that baseline. Supporting this account are findings from a twins study suggesting that genetic variation, not variance in life circumstances, accounts for most of the variance in well-being across individuals (Lykken & Tellegen, 1996). The current finding is also consistent with this baseline account. Although we do not have measures of well-being for people who recently became sick, we do find that hemodialysis patients who have endured illness and uncomfortable circumstances for months or years are experiencing normal (or at least close to normal), positive mood levels.

It is interesting that the hemodialysis patients themselves seem unaware of the extent to which they have adapted. They believe they would be happier if they had never been sick, yet they appear to be incorrect in this belief, as they are already about as happy as healthy people are. In imagining a life that had always been free of illness, they may instead imagine the initial mood increase that would follow the transition from their current state to one of good health (Kahneman, 1999), and they may assume that the feeling from such a transition would result not from the transition but from the better quality of experience in the healthy state.

Healthy people are clearly unaware of the extent to which adaptation to hemodialysis occurs. Their estimates of the moods that they would experience if they were on hemodialysis were much lower than the measured moods reported by the patients actually on hemodialysis. In fact, healthy controls estimated negative average moods if they were on hemodialysis, whereas the patients themselves actually reported positive average moods. This is a rare case where people incorrectly estimate even the valence of a different life circumstance (Wilson & Gilbert, 2003). The discrepancy in well-being ratings reported by other researchers (e.g., Sackett & Torrance, 1978) thus does not seem to be a mere artifact of different response processes used by patients and healthy people when answering questions about their well-being. The surprisingly high ratings that are often given by patients seem, at least in the

case of hemodialysis patients, to reflect a genuinely high frequency and intensity of positive mood. To our knowledge, this is the first study to show that healthy people grossly underestimate sick people’s measured quality of emotional experience.

That said, we do find some evidence that part of the discrepancy may be accounted for by differences in the manner in which patients and healthy people make summary reports of well-being. Consistent with prior research (Thomas & Diener, 1990), healthy people tended to slightly underestimate their own average mood. This was the case for the mood estimates (of a typical week) and for the recall estimate of the past week. However, patients did not underestimate their own average mood. It is possible that in coping with their hardship, patients have developed a tendency to focus more on positive experience. This may be a crucial part of the adaptation process and should be an area of future investigation.

This difference in recall tendencies could account for some of the discrepancy between patients’ self-reports of well-being and healthy persons’ predictions of patients’ well-being. If healthy people tend to recall past experiences as having been more negative than they were, then this should lead them to give slightly deflated judgments of well-being. If their judgments of their own well-being are deflated in this sense, then it is likely that their estimations of others’ well-being would be deflated as well. This may contribute to their underestimation of the well-being of patients. Still, although significant, the recall difference effect was not large. Most of the discrepancy appears to be due to healthy people simply not recognizing how positive the mood of hemodialysis patients can be.

There are undoubtedly some circumstances to which people cannot adapt (see Frederick & Loewenstein, 1999, for a discussion of what conditions people do and do not adapt to), but people seem to overestimate the range of circumstances falling into this category. For most of us, it would take a lot more than we think to make us permanently miserable. The current study provides what is, to date, the most convincing demonstration of this fact. Healthy people expect hemodialysis to lead to a much more miserable life than it actually does. But this misperception will be a difficult one to correct. Even hemodialysis patients who have themselves experienced adaptation seem not to appreciate the extent of their own adaptation. Getting others to appreciate it will surely be more difficult.

### Concluding Comments

Ignorance of adaptation can have negative consequences for decision making. It can cause individuals to opt for unnecessarily risky surgeries and policymakers to invest in programs that have a minimal impact on people’s well-being, possibly at the expense of programs that really do prevent misery. This is not to say that research and treatment of kidney disease should not continue to be priorities. Indeed, hemodialysis treatments keep kidney patients alive. But in making difficult policy decisions, consideration of the moods experienced by patients may influence priorities between serious conditions such as, for example, paraplegia and depression.

Further investigation of the relationship between mood and retrospective reports of well-being is warranted. The relationship seems to differ between different national populations. For example, Oishi (2002) found that when American and Asian subjects had similar levels of mood, the Americans tended to recall more positive levels of mood than did the Asians (see also Riis,

Schwarz, & Kahneman, 2004). Our finding that mood recall is more accurate among hemodialysis patients than among healthy patients is the first evidence that the relationship between mood and retrospective reports may differ for different health populations as well. This line of research will be aided by developments in EMA aimed at reducing subject burden (Kahneman, Krueger, Schkade, Schwarz, & Stone, 2004) and at improving and validating its accuracy (Kahneman & Riis, in press).

When evaluating their quality of life and when making decisions about how to improve that quality of life, people certainly think about dimensions other than mood (Fredrickson, 2000). Meaning, achievement, and identity are some of the other things that people value, and these may be quite independent of mood. Healthy people may fear illness not just because of its influence on mood but because of its influence on these other dimensions. But insofar as mood is an important dimension of quality of life, healthy people's apparent exaggeration of the influence of illness on mood will lead to incorrect perceptions of how illness will influence quality of life.

## References

- Ariely, D., & Carmon, Z. (2002). Summary assessment of experiences: The whole is different from the sum of its parts. In G. Loewenstein, D. Read, & R. Baumeister (Eds.), *Time and decision: Economic and psychological perspectives on intertemporal choice* (pp. 323–349). New York: Russell Sage Foundation.
- Baron, J., Asch, D. A., Fagerlin, A., Jepson, C., Loewenstein, G., Riis, J., et al. (2003). Effect of assessment method on the discrepancy between judgments of health disorders people have and do not have: A web study. *Medical Decision Making, 23*, 422–434.
- Boyd, N., Sutherland, H. J., Heasman, K. Z., Tritcher, D. L., & Cummings, B. (1990). Whose utilities for decision analysis? *Medical Decision Making, 10*, 58–67.
- Brickman, P., Coates, D., & Janoff-Bulman, R. (1978). Lottery winners and accident victims: Is happiness relative? *Journal of Personality and Social Psychology, 36*, 917–927.
- Buick, D. L., & Petrie, K. J. (2002). "I know just how you feel": The validity of healthy women's perceptions of breast cancer patients receiving treatment. *Journal of Applied Social Psychology, 32*, 110–123.
- Diener, E., Suh, E. M., Lucas, R. E., & Smith, H. L. (1999). Subjective well-being: Three decades of progress. *Psychological Bulletin, 125*, 276–302.
- Frederick, S., & Loewenstein, G. (1999). Hedonic adaptation. In D. Kahneman, E. Diener, & N. Schwarz (Eds.), *Well-being: The foundations of hedonic psychology* (pp. 302–329). New York: Russell Sage Foundation.
- Fredrickson, B. L. (2000). Extracting meaning from past affective experiences: The importance of peaks, ends, and specific emotions. *Cognition & Emotion, 14*, 577–606.
- Gilbert, D. T., Pines, E. C., Wilson, T. D., Blumberg, S. J., & Wheatley, T. P. (1998). Immune neglect: A source of durability bias in affective forecasting. *Journal of Personality and Social Psychology, 75*, 617–638.
- Headley, B., & Wearing, A. (1992). *Understanding happiness: A theory of subjective well-being*. Melbourne, Victoria, Australia: Longman Cheshire.
- Kahneman, D. (1999). Objective happiness. In D. Kahneman, E. Diener, & N. Schwarz (Eds.), *Well-being: The foundations of hedonic psychology* (pp. 3–25). New York: Russell Sage Foundation.
- Kahneman, D. (2000). Evaluation by moments: Past and future. In D. Kahneman & A. Tversky (Eds.), *Choices, values, and frames* (pp. 293–308). New York: Cambridge University Press and the Russell Sage Foundation.
- Kahneman, D., Fredrickson, B. L., Schreiber, C. A., & Redelmeier, D. A. (1993). When more pain is preferred to less: Adding a better end. *Psychological Science, 4*, 401–415.
- Kahneman, D., Krueger, A. B., Schkade, D. A., Schwarz, N., & Stone, A. A. (2004, December 3). A survey method for characterizing daily life experience: The day reconstruction method. *Science, 306*, 1776–1780.
- Kahneman, D., & Riis, J. (in press). Living, and thinking about it: Two perspectives on life. In F. Huppert, B. Keverne, & N. Baylis (Eds.), *The science of well-being*. Oxford, England: Oxford University Press.
- Lacey, H. P., Fagerlin, A., Loewenstein, G., Smith, D., Riis, J., & Ubel, P. A. (2004). *Unbelievably happy? Exploring whether scale recalibration accounts for the happiness gap*. Manuscript submitted for publication.
- Lykken, D., & Tellegen, A. (1996). Happiness is a stochastic phenomenon. *Psychological Science, 7*, 186–189.
- Oishi, S. (2002). The experiencing and remembering of well-being: A cross-cultural analysis. *Personality and Social Psychology Bulletin, 28*, 1398–1406.
- Riis, J., Schwarz, N., & Kahneman, D. (2004). *Some international differences in self-reported health are reality free: Implications for happiness*. Manuscript in preparation.
- Robinson, M. D., & Clore, G. L. (2002). Belief and feeling: Evidence for an accessibility model of emotional self-report. *Psychological Bulletin, 128*, 934–960.
- Sackett, D. J., & Torrance, G. W. (1978). The utility of different health states as perceived by the general public. *Journal of Chronic Diseases, 31*, 697–704.
- Schkade, D. A., & Kahneman, D. (1998). Does living in California make people happy? A focusing illusion in judgments of life satisfaction. *Psychological Science, 9*, 340–346.
- Sieff, E. M., Dawes, R. M., & Loewenstein, G. (1999). Anticipated versus actual reaction to HIV test results. *American Journal of Psychology, 112*, 297–311.
- Stone, A. A., Shiffman, S. S., & DeVries, M. W. (1999). Ecological momentary assessment. In D. Kahneman, E. Diener, & N. Schwarz (Eds.), *Well-being: The foundations of hedonic psychology* (pp. 26–39). New York: Russell Sage Foundation.
- Thomas, D. L., & Diener, E. (1990). Memory accuracy in the recall of emotions. *Journal of Personality and Social Psychology, 59*, 291–297.
- Ubel, P. A., Loewenstein, G., Hershey, J., Baron, J., Mohr, T., Asch, D., & Jepson, C. (2001). Do nonpatients underestimate the quality of life associated with chronic health states because of a focusing illusion? *Medical Decision Making, 21*, 190–199.
- Ubel, P. A., Loewenstein, G., & Jepson, C. (2003). Whose quality of life? A commentary exploring discrepancies between health state evaluations of patients and the general public. *Quality of Life Research, 12*, 599–607.
- Wilson, T. D., & Gilbert, D. T. (2003). Affective forecasting. In M. Zanna (Ed.), *Advances in experimental social psychology* (pp. 345–411). New York: Elsevier.
- Wilson, T. D., Wheatley, T., Meyers, J. M., Gilbert, D. T., & Axsom, D. (2000). Focalism: A source of durability bias in affective forecasting. *Journal of Personality and Social Psychology, 78*, 821–836.

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