

Impact of Near-Death Experiences on Dialysis Patients: A Multicenter Collaborative Study

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Background: People who have come close to death may report an unusual experience known as a near-death experience (NDE). This study aims to investigate NDEs and their aftereffects in dialysis patients.

Study Design: Cross-sectional study.

Setting & Participants: 710 dialysis patients at 7 centers in Taipei, Taiwan.

Predictor: Demographic characteristics, life-threatening experience, depression, and religiosity.

Outcomes: NDE and self-perceived changes in attitudes or behaviors.

Measurements: Greyson's NDE scale, Royal Free Questionnaire, 10-Question Survey, Ring's Weighted Core Experience Index, and Beck Depression Inventory.

Results: 45 patients had 51 NDEs. Mean NDE score was 11.9 (95% confidence interval, 11.0 to 12.9). Out-of-body experience was found in 51.0% of NDEs. Purported precognitive visions, awareness of being dead, and "tunnel experience" were uncommon (<10%). Compared with the no-NDE group, subjects in the NDE group were more likely to be women and younger at life-threatening events. Both frequency of participation in religious ceremonies and pious religious activity correlated significantly with NDE score in patients with NDEs ($P < 0.01$ and $P = 0.01$, respectively). The NDE group reported being kinder to others ($P = 0.04$) and more motivated ($P = 0.02$) after their life-threatening events than the no-NDE group.

Limitations: Determining the incidence of NDEs is dependent on self-reporting. Many NDEs occurred before the patient began long-term dialysis therapy. Causality between NDE and aftereffects cannot be inferred.

Conclusions: NDE is not uncommon in the dialysis population and is associated with positive aftereffects. Nephrology care providers should be aware of the occurrence and aftereffects of NDEs. The high occurrence of life-threatening events, availability of medical records, and accessibility and cooperativeness of patients make the dialysis population very suitable for NDE research.

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INDEX WORDS: Death; dialysis; near-death experience.

Individuals who have encountered a life-threatening condition may report some sort of vivid and unusual experience known as a near-death experience (NDE).¹ NDEs have garnered scientific interest recently.²⁻⁶ The majority of published NDE studies were retrospective and sporadic. Only a few prospective surveys were performed, and most focused on individuals who experienced cardiac ar-

rest or other cardiovascular events.⁴⁻⁶ However, NDE after cardiac arrest is relatively rare, making identification of sufficient numbers of NDE cases challenging.⁵ Moreover, only a small fraction of patients with cardiac arrest are resuscitated successfully and thus able to communicate after the event. Therefore, use of cardiac arrest survivors to study NDE has limitations.

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The dialysis population is a unique group. During the past 3 decades, dialysis patients have become increasingly elderly and have multiple debilitating medical illnesses. These patients are susceptible to such life-threatening conditions as uremic coma before dialysis therapy, as well as intradialytic hypotension and/or consciousness change, cardiovascular comorbidity, and increased risk of sepsis. Dialysis patients also may be rescued repeatedly from these life-threatening events. Therefore, more than 1 episode of NDE may occur in a single dialysis patient. However, to our knowledge, NDE in dialysis patients was not studied.

The annual mortality rate of dialysis patients in the United States is 207 per 1,000 patient-years.⁷ One- and 5-year survival probabilities of incident dialysis patients are 79.2% and 35.2%, respectively.⁷ The prevalence of depression in the dialysis population is high and is associated with increased mortality.⁸⁻¹¹ Patients with end-stage renal disease were more likely to commit suicide than the general population.^{12,13} NDE researchers consistently described such affirmative transformations as decreased fear of death, enhanced zest for life, and the pursuit of more altruistic careers in individuals with NDEs.^{4,14,15} The impact of NDE on dialysis patients is not known and deserves investigation.

The objective of this cross-sectional study is to investigate the frequency and characteristics of NDEs in patients on long-term dialysis therapy. Additional aims are to identify predisposing physiological or psychosocial factors and evaluate the aftereffects of NDE in this population.

METHODS

Patients and Survey

During a collaborative study of the psychological aspects of quality of life in dialysis patients between January 2001 and December 2002, all dialysis patients in 7 dialysis centers in Taipei, Taiwan, who were able to communicate were enrolled. We obtained ethics committee approval from the Research Ethics Committee of National Taiwan University Hospital. Written informed consent was obtained from all patients. All subjects were asked to complete 3 self-report questionnaires: (1) the Royal Free Questionnaire (spiritual scores),¹⁶ (2) 10-Question Survey (religious scores),¹⁷ and (3) Beck Depression Inventory (Beck Depression Inventory II, Chinese version; depression scores). The Royal Free Questionnaire was developed to measure spiritual beliefs, and the 10-Question Survey was designed to assess an individual's religious activity. The Beck Depression Inven-

tory is a standard self-administered questionnaire used to screen patients for depression and has been used frequently for the assessment of depression in patients with end-stage renal disease.⁸ All 3 questionnaires had acceptably high validity and reliability.¹⁶⁻¹⁸

In the Royal Free Questionnaire, there is the question "Some people have described intense experiences at a time when they almost died but were eventually revived. Has this ever happened to you?" If subjects answered "yes" or "probably," an NDE-specific questionnaire was used to inquire further. The NDE survey took place from September 2003 to January 2004. We used Greyson's NDE scale, a standardized 16-item multiple-choice instrument, to measure core components of the NDE. This reliable, valid, and easily administered scale is clinically useful to differentiate persons who experienced an NDE during a close brush with death from those who did not.¹⁹ One trained staff member made the NDE assessments by using open questions and the NDE scale questionnaire (see Supplementary Data with this article at www.ajkd.org for additional information). An individual is classified as having had an NDE if the score is 7 or higher.¹⁹ Patients were divided into the NDE and no-NDE groups. Patients' descriptions of the time and life-threatening events when the NDE occurred were recorded. Ring's Weighted Core Experience Index²⁰ also was applied. This index was developed by Ring as a measure of the depth of an NDE. Two researchers categorized patients' NDE features according to the 10 items of the Weighted Core Experience Index.

Linguistic validation of Chinese translations by 4 physicians fluent in both Chinese and English of the Royal Free Questionnaire and NDE scale was performed after obtaining permission from Dr King and Dr Greyson, respectively.

Patients also completed a life-change inventory that addressed changes in fear of death, kindness to others, optimism about the future, motivation, and overall life transitions. Participants answered these questions by using a 4-point scale (much improved, somewhat improved, no change, and much worse) to indicate whether and to what degree they had changed (see Supplementary Data with this article at www.ajkd.org for additional information).

Evaluation of Medical Records

We examined all available medical records of the NDE group to evaluate events associated with NDEs. All instances of consciousness change (measured by means of Glasgow Coma Scale), shock (defined as systolic blood pressure < 90 mm Hg), cardiac arrest, and cardiopulmonary resuscitation were recorded. The severity of each event was evaluated by using criteria published in the report by Owens et al²¹ to determine which constituted life-threatening events.

Statistical Analysis

We assessed associations of clinical factors with occurrence of NDE by using *t*-test for continuous variables and chi-square test for categorical variables. Because spiritual, religious, depression, and NDE scores were not normally distributed, nonparametric statistical methods were used. Differences in spiritual, religious, and depression scores between the NDE and no-NDE groups were analyzed using

Mann-Whitney test. Spearman rank correlation was used to measure the association between NDE score and other scores. Chi-square test was used to compare the occurrence of aftereffects between the NDE and no-NDE groups. Because many patients described more than 1 life-threatening event, all events were included and treated independently. All tests were 2 tailed with significance defined as *P* less than 0.05. Statistical Package for Social Sciences (SPSS Inc, Chicago, IL) for Windows software, version 12.0, was used for statistical analysis.

RESULTS

Seven hundred ten patients were included. Seventy patients who reported ever experiencing life-threatening events underwent additional NDE interviews. Demographic characteristics of the 70 patients are listed in Table 1. Ninety-one life-threatening events were described by these 70 patients. Mean age at the time of the life-threatening event was 45.5 ± 15.2 years, and 45 patients (64.3%) with a life-threatening event were women. The NDE group included 45 patients who experienced 51 NDEs with an NDE score of 7 or higher. Forty life-threatening events with an NDE score less than 7 were included in the no-NDE group. Mean NDE score for all

life-threatening events was 7.1 (95% confidence interval, 5.8 to 8.4), and mean NDE score of the NDE group was 11.9 (95% confidence interval, 11.0 to 12.9).

Twenty-one patients experienced 2 life-threatening events. Eight of these 21 patients had only 1 NDE during their 2 life-threatening events, and 7 patients had no NDE. Six patients had NDEs during both their life-threatening events. Of these 6 patients, 5 were women and 5 practiced religions; mean age at NDE was 37.8 years. They contributed 12 NDEs with a mean score of 13 to the NDE group. One of these patients had similar experiences (entering a garden and grassland in a pleasant mood) during both NDEs. Another patient saw 2 different supreme beings in her 2 NDEs.

In the NDE group, 7 NDEs (13.7%) occurred at home or outside the hospital, which precluded the availability of medical records. Forty-four NDEs occurred in the hospital; medical charts were available for 31 (70.5%). For 11 NDEs, charts were not available because of the long time between the event and study interview, and

Table 1. Demographic Data for Patients Reporting a Life-Threatening Event

	NDE Group; NDE Score ≥ 7 (N = 45)	No-NDE Group; NDE Score < 7 (N = 25)	<i>P</i>
Women	33 (73.3; 60.4-86.3)	12 (48.0; 28.4-67.6)	0.04
Mean age at interview (y)	52.7 (48.7-56.7)	53.8 (47.7-59.8)	0.8
Having a religious belief	44 (97.8; 93.5-100)	21 (84.0; 69.6-98.4)	0.05
Religion			
Buddhism	30 (66.7)	16 (64.0)	
Taoism	9 (20.0)	3 (12.0)	
Christian	3 (6.7)	2 (8.0)	
Catholic	2 (4.4)	0 (0)	
None	1 (2.2)	4 (16.0)	
College education	11 (24.4, 11.9-37.0)	10 (40.0, 20.8-59.2)	0.2
Age at life-threatening event (y)*	42.5 (38.4-46.5)	49.3 (44.3-54.2)	0.04
Mean time between life-threatening event and interview (y)*	9.8 (6.8-12.8)	5.8 (3.6-7.9)	
Renal replacement modality during life-threatening event*			
Not on dialysis yet	33 (64.7)	14 (35.0)	
Hemodialysis	17 (33.3)	19 (47.5)	
Peritoneal dialysis	1 (2.0)	3 (7.5)	
Transplantation	0 (0)	4 (10.0)	

Note: Values expressed as number (percent; 95% CI for percent), mean (95% CI), or number (percent) unless otherwise indicated. Categorical variables were compared using chi-square test, and continuous variables were compared using *t*-test. Patients who had only 1 NDE in 2 life-threatening events were assigned to the NDE group.

Abbreviations: NDE, near-death experience; CI, confidence interval.

*Presented as number (percent) of events (total 91 events; NDE group, 51 events; no-NDE group, 40 events). Because some patients had 2 life-threatening episodes, all events were treated independently.

for 2 NDEs, charts were not available for unknown reasons. Twenty-four of 31 NDEs (77.4%) with available charts had a documented life-threatening event with altered consciousness status (Fig 1). There was no difference between the proportion of documented life-threatening events in the NDE and no-NDE groups ($P = 0.3$). Causes of life-threatening events are listed in Table 2 and include conditions related to and those not related to uremia.

In the NDE group, patients' descriptions of any memory during NDE were categorized according to Greyson's NDE scale and the Weighted Core Experience Index^{20,21} (Table 3). Purported precognitive visions, awareness of being dead,

and tunnel experience were uncommon findings (<10%). An experience in which a person seemed to have "left his or her own body and existed outside of it" is defined as an out-of-body experience and was found in 26 NDEs (51.0%). In 6 NDEs (11.8%), subjects described seeing doctors and nurses performing resuscitation. In 3 NDEs (5.9%), subjects experienced entering hell. Five NDEs (9.8%) were unpleasant. Three subjects felt afraid, and the other 2 felt suffering. Fourteen NDEs (27.5%) observed supreme beings. Four saw Bodhisattva, 5 saw other Asian deities, 1 saw Jesus Christ, 1 saw angels, and 3 simply mentioned seeing unspecified supreme beings. No patient reported seeing a supreme

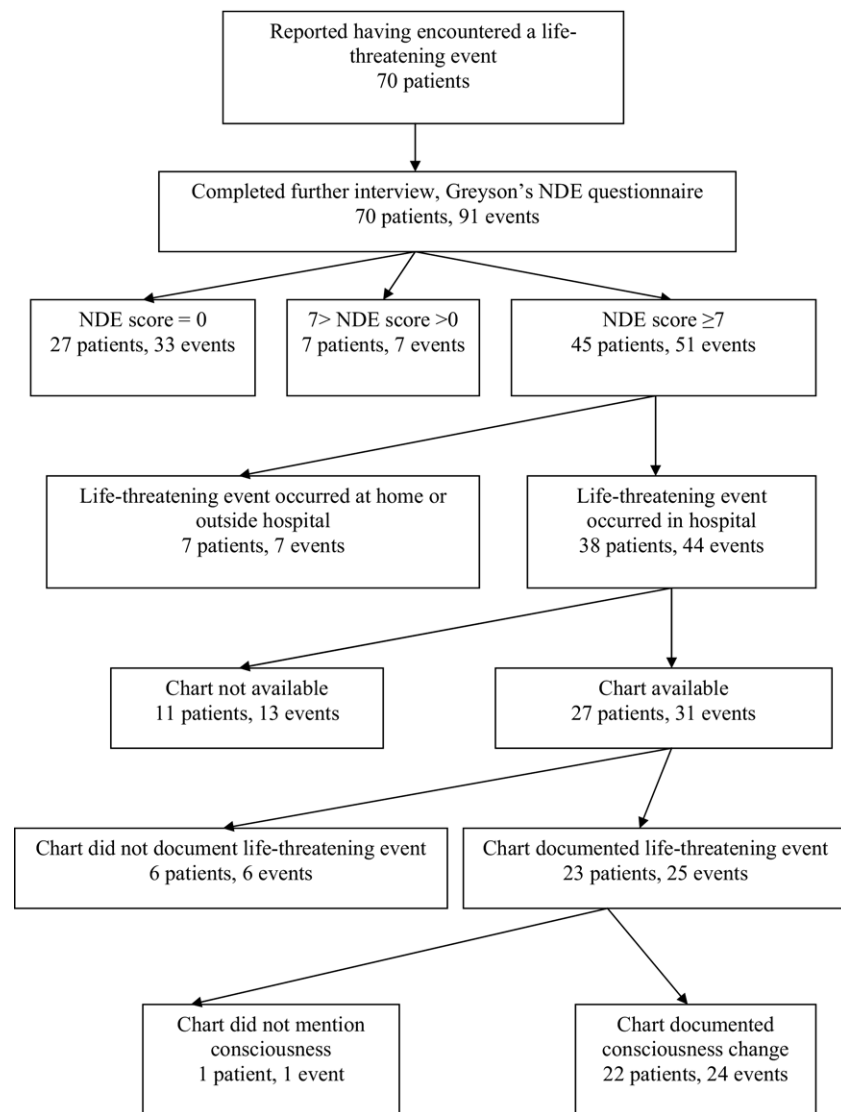


Figure 1. Corroborating claims of life-threatening events based on medical charts. Of the 70 patients, 49 had 1 event and 21 had 2 events. In rows 3 and 6, numbers of patients add up to more than 70 and 27 because for some patients with 2 events, the events are shown in different boxes, respectively. Abbreviation: NDE, near-death experience.

Table 2. Description of Life-Threatening Events

Event Type	NDE Group; NDE Score ≥ 7 (N = 51 events)	No-NDE Group; NDE Score < 7 (N = 40 events)
Events related to uremia		
Shock during dialysis	3 (0)	4 (4)
Respiratory failure due to lung edema or severe metabolic acidosis	10 (7)	3 (1)
Uremic encephalopathy	9 (6)	5 (1)
Dialysis disequilibrium syndrome	2 (2)	1 (0)
Other	3 (1)	2 (0)
Events unrelated to uremia		
Sepsis	4 (3)	1 (1)
Intraoperative process	7 (2)	1 (0)
Trauma	3 (0)	1 (0)
Systemic diseases (hepatic coma, central nervous system lupus, hypoglycemia, diabetes ketoacidosis, drug adverse reaction/intoxication)	7 (5)	1 (1)
Cardiovascular disease (stroke, myocardial infarction, arrhythmia, syncope)	3 (1)	1 (1)
Pulmonary hemorrhage with respiratory failure	1 (1)	4 (3)
Other	3 (1)	1 (0)

Note: Data expressed as numbers of events according to patients' subjective descriptions (numbers of events documented in charts). Three events had 2 causes and 1 event had 3 causes.

Abbreviation: NDE, near-death experience.

being who was not part of his or her own religion. Veridical perceptions, which occur when individuals apparently accurately perceive earthly events during NDEs, were reported by 9 patients. Six of these 9 patients had out-of-body experiences.

Compared with the no-NDE group, patients in the NDE group were more likely to be women and younger at life-threatening events (Table 1). In analyzing event characteristics associated with NDE, none of the following factors was significantly different between the NDE and no-NDE groups: documented Glasgow Coma Scale of 7 or less, duration of consciousness change longer than 1 day, and presence of shock. Table 4 lists associations of patient characteristics with NDEs, and differences between groups were not significant. In the NDE group, we found a trend of negative correlation, which was not statistically significant, between depression score and NDE score ($r = -0.277$; $P = 0.07$). Spiritual and religious scores did not correlate with NDE score ($P = 0.9$ and $P = 0.1$, respectively). However, frequency of participation in religious ceremonies and pious religious activities (such as worshipping, praying, and meditation), ranked by means of the first and second questions of

the 10-Question Survey, showed significant correlations with NDE scores ($r = 0.483$; $P < 0.01$; $r = 0.39$; $P = 0.01$, respectively). On further inquiry in 40 of 45 NDE patients, 27 subjects (67.5%) participated in the same religious activity before NDE as after. Twelve subjects (30%) increased their religious activity after the NDE, whereas 1 subject (2.5%) decreased.

Aftereffects of NDE also were evaluated. The magnitude of self-reported life change, ranked by using the 18th question of the Royal Free Questionnaire, showed a significant correlation with NDE score in the NDE group ($r = 0.434$; $P < 0.01$). In addition, people with an NDE showed a significantly greater frequency of reporting being kinder to others and more motivated after their life-threatening events than people without NDE (Table 5). However, other effects, such as being less afraid of death, being more optimistic about the future, and changing to a better life, were not significantly different. Five people become more fearful of death after life-threatening events, and that effect was not different between the 2 groups. Thirty patients described the reasons for their decreased fear of death. Thirteen patients (43.3%) answered that they were not

Table 3. Frequency of NDE Features

Features	No. (%) (N = 51 events)
Greyson's NDE scale	
1. Altered sense of time	21 (41.2)
2. Accelerated thought process	26 (51.0)
3. Life review	10 (19.6)
4. Sense of sudden understanding	18 (35.3)
5. Feeling of peace	38 (74.5)
6. Feeling of joy	30 (58.8)
7. Feeling of cosmic unity/oneness	12 (23.5)
8. Seeing/feeling surrounded by light	21 (41.2)
9. Preternaturally vivid sensations	44 (86.3)
10. Purported extrasensory perception	9 (17.6)
11. Purported precognitive visions	2 (3.9)
12. Sense of being out of or losing awareness of the physical body	37 (72.5)
13. Sense of an "otherworldly" environment	34 (66.7)
14. Sense of a mystical entity	17 (33.3)
15. Sense of deceased/religious spirits	38 (74.5)
16. Sense of a border/"point of no return"	32 (62.7)
Ring's WCEI	
1. Awareness of being dead	2 (3.9)
2. Positive emotions	38 (74.5)
3. Out-of-body experience	26 (51.0)
4. Tunnel experience	3 (5.9)
5. Communication with light	21 (41.2)
6. Observation of colors	6 (11.8)
7. Celestial landscape	8 (15.7)
8. Meeting with deceased persons	8 (15.7)
9. Life review	10 (19.6)
10. Presence of border	32 (62.7)

Abbreviations: NDE, near-death experience; WCEI, Weighted Core Experience Index.

afraid of death because they had almost been dead once. Thirteen patients (43.3%) said their belief in "life after life" (reincarnation) was the main reason they did not fear death.

DISCUSSION

The prevalence of NDE is estimated to be 4% to 5% in the Western general population and 22% to 48% in people who have come close to death.²²⁻²⁴ Recent studies found that the incidence of NDE was 6.3% to 12.0% in cardiac-arrest survivors who were able to communicate.^{4,5} In this study, 51 of 91 life-threatening events (56.0%, described by patients as coming close to death) were accompanied by an NDE. Although 33 NDEs occurred before the initiation of renal replacement therapy, 16 NDE-associated life-threatening events were associated with uremia (uremic encephalopathy or lung edema) and occurred just before dialysis therapy initiation. The other 6 NDEs occurred within 5 years before dialysis therapy initiation in the setting of chronic kidney disease. Forty-five of 710 prevalent dialysis patients (6.3%) had NDEs.

Previous NDE studies that were prospective in nature were limited to survivors of cardiac arrest.⁴⁻⁶ Because NDE after cardiac arrest is relatively rare and a large portion of patients receiving cardiopulmonary resuscitation either do not survive or are unable to communicate, long periods were required to accumulate data from enough patients for analysis.^{4,5} Within a 1-year study period, Greyson⁶ reported only 4 cardiac arrest survivors having NDEs.

We found many advantages to studying NDEs in the dialysis population. First, NDE is not uncommon in the dialysis population. We were able to complete the NDE survey in only 7 months. Twenty-one patients experienced more than 1 life-threatening event, and 6 of these patients had 2 NDEs. Second, life-threatening events can be verified readily in a dialysis popu-

Table 4. Association of Patient Characteristics With NDE

	NDE Group; NDE Score \geq 7 (N = 45)		No-NDE Group; NDE Score < 7 (N = 25)		P
	Data	No. Available*	Data	No. Available*	
Belief in life after life	17 (56.7; 35.8-70.4)	30	5 (28.6; 9.5-57.2)	14	0.1
Spiritual score†	33.3 (27.7-8.9)	45	32.0 (25.6-38.4)	22	0.7
Religious score†	43.3 (36.6-50.1)	45	35.6 (23.9-47.4)	24	0.2
Depression score†	14.3 (10.9-17.8)	44	12.6 (8.2-17.0)	25	0.5

Note: Values expressed as number (percent; 95% CI for percent) and mean (95% CI).

Abbreviations: NDE, near-death experience; CI, confidence interval.

*Number of patients who completed the questionnaire.

†Comparisons made using chi-square test for belief in life after life and Mann-Whitney test for spiritual, religious, and depression scores.

Table 5. Aftereffects in People With or Without NDE

Aftereffect	NDE Group; NDE Score ≥ 7 (N = 44)*	No-NDE Group; NDE Score < 7 (N = 22)†	P
Less afraid of death	33 (75.0; 62.2-87.8)	13 (59.1; 38.5-79.6)	0.3
Kinder to others	27 (61.4; 47.0-75.8)	7 (31.8; 12.4-51.3)	0.04
More optimistic about the future	26 (59.1; 44.6-73.6)	8 (36.4; 16.3-56.5)	0.1
More motivated	27 (61.4; 47.0-75.8)	6 (27.3; 8.7-45.9)	0.02
Life change for the better	31 (70.5; 57.0-83.9)	15 (68.2; 48.7-87.6)	1.0

Note: Values expressed as number (percent; 95% CI for percent). Chi-square test used to test variables difference between groups.

Abbreviations: NDE, near-death experience; CI, confidence interval.

*Of 45 patients with NDE, 44 completed the survey.

†Of 25 patients with no NDE, 22 completed the survey.

lation. In our study, adequate medical records were available for most (70.5%) in-hospital NDEs. Among them, critical conditions could be documented in 77.4% of events. These results were much higher than those in the report of Owens et al²¹ (44.6% and 48.3%, respectively). Because NDE is a subjective experience, the accuracy of self-reported life-threatening events may be questionable. Because all dialysis centers need to monitor vital signs during dialysis sessions, the availability of medical records renders the NDE study in dialysis populations more accurate. Additionally, the close relationship between dialysis patients and staff members facilitates inquiry about personal experiences. Patients with NDE often receive negative reactions from health care providers when they describe their experiences, which discourages them from seeking further help in understanding the experience.^{15,25} Patients undergoing long-term dialysis therapy spend several hours 3 times a week in dialysis centers. The staff-patient relationship is very intimate. Opportunities for repeated inquiry also ensure that the information is precise and reliable.

This study, the largest on NDEs in the Asian population, could allow for comparisons between 2 distinctly different cultures. Preternatural sensation seems more common in this population, whereas feelings of cosmic unity, purported precognitive visions, awareness of being dead, and tunnel experiences were less common in our patients than in Westerners.^{4-6,19} Tunnel experience was reported infrequently in Asia-Pacific areas^{26,27} and was in our findings (5.9%), as well. In our study, 27.5% of patients with an NDE met supreme beings. No cross-religious supreme beings were reported. One Christian

with NDE believed in life after life before the occurrence of the NDE. Conversely, the other 2 Christians with NDE did not believe in life after life, even after NDE. Two Catholics did not convey their opinion about life after life.

In this cross-sectional study, age and sex were associated with the occurrence of NDE in life-threatening events. We did not find other predisposing factors for NDE, including the common belief in life after life in the Chinese. However, the frequency with which patients participated in religious ceremonies and the frequency of pious religious activities that require mind concentration correlated with high NDE scores. This suggests that the intensity of NDE might be related to religious factors.

Positive aftereffects of NDE were described previously.^{4,14,15} Patients having NDEs in our study reported being kinder to others and more motivated than those without an NDE. In addition, we found a trend of negative correlation between intensity of NDE and depression symptoms. However, decrease in the fear of death was no different in the NDE and no-NDE groups. About half the patients reported less fear of death because they believed they had already experienced dying once. It seems that a life-threatening event per se, rather than an NDE, decreased the fear of death in some patients.

Our study has some limitations. First, because this study is derived from self-reported experiences, the precise incidence of NDE in the dialysis population is not known. Second, recall bias or false memories may have occurred because of the long time between the NDE and interview. However, unlike nonspecific stress responses or false memory, NDE is vivid and specific.¹⁹ Selecting patients with NDE by using Greyson's scale

may minimize the potential bias. Previous studies also found that NDE could be recalled 8 to 11 years after life-threatening events.^{4,28} Third, we cannot assume causal relationships between NDEs and the reported changes in religious activity or depression. Furthermore, aftereffects of NDEs were self-reported and could not be objectively verified.

This study brings perspective for further NDE research. Dialysis patients can be screened quickly, and their medical charts are readily available. It will allow comparisons to be made between different cultures for NDE. In addition, prospective studies may be conducted in dialysis populations with an adequate sample size so that the mechanism of NDE and out-of-body experience could be looked at in detail. Furthermore, patients with NDE can be followed up long term in dialysis centers. This makes the in-depth investigation of NDE aftereffects and its predictive role for patient outcomes, as found in cardiac-arrest survivors,⁴ more practical.

Because NDE is not uncommon in the dialysis population, its clinical implications need to be emphasized. Society's negative response to NDE often makes patients ashamed to talk about their experiences.^{15,29} Thus, health care professionals should be more knowledgeable about NDE and the impact that it has on the lives of those who experience it. Because nephrologists have a crucial role in the emotional perception of dialysis patients,³⁰ they should consider this issue in their practice.

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SUPPLEMENTARY DATA

Actual Surveys and Interview

During a collaborative study of the psychological aspects of quality of life in dialysis patients between January 2001 and December 2002, all dialysis patients in 7 dialysis centers in Taipei, Taiwan, who were able to communicate were enrolled. All subjects were asked to complete 3 self-report questionnaires: (1) the Royal Free Questionnaire to measure spiritual beliefs,¹⁶ (2) 10-Question Survey to assess an individual's religious activity,¹⁷ and (3) Beck Depression Inventory (Beck Depression Inventory II, Chinese version) to assess symptoms of depression. In the Royal Free Questionnaire, there is the question "Some people have described intense experiences at a time when they almost died but were eventually revived. Has this ever happened to you?" If subjects answered "yes" or "probably," a near-death experience (NDE)-specific questionnaire was used to inquire further. The NDE survey took place from September 2003 to January 2004.

One trained staff member made the NDE assessments by means of a standardized interview. After reading various reports and repeated discussions with the main researcher (T.-J.T.), she was familiar with NDE and the aim of this survey. Attitude and skills during the interview generally followed the suggestions of the International Association for Near-Death Studies.⁵¹ Interviews took between 30 and 60 minutes and included the following items: (1) data about the date and circumstances of life-threatening events, obtained by means of subject's descriptions, and their age and religion at that time; (2) subjects were asked to complete Greyson's NDE scale¹⁹ by themselves or with the aid of the interviewer; (3) using an open question, features of any memories during the life-threatening events were recorded; and (4) finally, patients were asked to complete a life-change inventory (discussed later).

Ring's Weighted Core Experience Index²⁰ also was used for comparison. This index was developed by Ring as a measure of depth of an NDE. Researchers C.F.L. and T.-J.T. categorized each subject's NDE features according to the 10 items of the Weighted Core Experience Index.

Of note, the reliability and validity of the Royal Free Questionnaire, Beck Depression Inventory,

and Greyson's NDE scale were tested to be acceptably high.^{16,18,19} The 10-Question Survey has good reliability and internal consistency.¹⁷ Although the Weighted Core Experience Index was not tested for reliability and is different from Greyson's NDE scale, both scoring systems strongly correlate ($\gamma = 0.90$).¹⁹ Linguistic validation of the Chinese translations of the Royal Free Questionnaire and NDE scale was performed by 4 physicians fluent in both Chinese and English, after obtaining permission from Dr King and Dr Greyson respectively.

Life-Change Inventory

The life-change inventory used in this study was developed by researcher T.-J.T. This inventory asked "Did you have any changes in the following thinking or behavior after getting through the experiences? (1) fear of death; (2) kindness to others; (3) optimism about the future; (4) motivation; and (5) overall life transitions." Participants answered these questions by using a 4-point scale (much improved, somewhat improved, no change, and much worse) to indicate whether and to what degree they had changed after an NDE or life-threatening event. A positive aftereffect was indicated if the participant's response was "much improved" or "somewhat improved."

Internal reliability of the inventory was evaluated by means of Cronbach α coefficient and was 0.67. It should be noted that the formal construct validity of this inventory was not thoroughly determined because we did not have another population of NDE subjects with an acceptable sample size to perform model validation.

One additional question inquired whether the participant believed in "life after life" (reincarnation). If the answer was yes, the interviewer asked whether this belief had been held before or after the life-threatening event. For those who reported being less afraid of death after the life-threatening event, another enquiry into the reason for their decreased fear of death also was made.

Evaluation of Medical Records

We examined all available medical records of patients with an NDE to evaluate events associated with NDEs. Medical records came from many hospitals and varied greatly in the amount

of detail. We included all cases for which there seemed adequate information in the records to make a judgment about the severity of the patient's condition. The actual medical condition and vital signs were objectively recorded.

Severity of events was rated as 1 of the following categories, published in the study by Owens et al²¹: (1) no serious illness or injury; (2) serious illness or injury, but not in danger of dying; (3) serious illness that might have led to death without medical or surgical intervention; and (4) significant impairment of vital signs presaging death without medical intervention or surgical intervention. Events in categories 3 and 4 were classified as medical-record–documented

life-threatening events.²¹ In addition, if the patient's worst documented Glasgow Coma Scale was less than 15, the patient was defined to have consciousness change. Validation of life-threatening events was evaluated cooperatively by researchers C.F.L. and T.-J.T. They derived their evaluations of patients' physical conditions entirely from information contained in the medical records.

REFERENCE OF ONLINE SUPPLEMENT

S1. International Association for Near-Death Studies: Caring for the Near-Death Experiencer: Considerations for Caregivers. Available at: <http://iands.org/caregiver.html>. Accessed June 1, 2003