Development, validation, and results of a survey to measure understanding of cardiopulmonary resuscitation choices among ICU patients and their surrogate decision makers

Michael E Wilson1*, Abbasali Akhoundi2, Artur K Krupa3, Richard F Hinds4, John M Litell5, Ognjen Gajic1 and Kianoush Kashani2

Abstract

Background: Shared-decision-making about resuscitation goals of care for intensive care unit (ICU) patients depends on a basic understanding of cardiopulmonary resuscitation (CPR). Our objective was to develop and validate a survey to assess comprehension of CPR among ICU patients and surrogate decision-makers.

Methods: We developed a 12-item verbally-administered survey incorporating input from patients, clinicians, and expert focus groups.

Results: We administered the survey to 32 ICU patients and 37 surrogates, as well as to 20 resident physicians to test discriminative validity. Median (interquartile range) total knowledge scores were 7 (5-10) for patients, 9 (7-12) for surrogates, and 14.5 (14-15) for physicians (p <.001). Forty-four percent of patients and 24% of surrogates could not explain the purpose of CPR. Eighty-eight percent of patients and 73% of surrogates could not name chest compressions and breathing assistance as two components of CPR in the hospital. Forty-one percent of patients and 24% of surrogates could not name a single possible complication of CPR. Forty-three percent of participants could not specify that CPR would be performed with a full code order and 25% of participants could not specify that CPR would not be performed with a do-not-resuscitate order. Internal consistency (Cronbach’s alpha = 0.97) and test-retest reliability (Pearson correlation = 0.96, p < .001) were high.

Conclusions: This easily administered survey, developed to measure knowledge of CPR and resuscitation preference options among ICU patients and surrogates, showed strong face validity, content validity, internal consistency, test-retest reliability, and discriminative validity. A substantial proportion of ICU patients and surrogates decision-makers have poor knowledge of CPR and basic resuscitation options.

Keywords: Cardiopulmonary resuscitation, Questionnaires, Health knowledge, Intensive care unit

Background

Health care providers should discuss cardiopulmonary resuscitation (CPR) preferences with patients who are at risk of requiring CPR, in order to ensure that this intervention is in accordance with the patient’s goals of care [1,2]. Nevertheless, such code status discussions occur with varying frequency, even for hospitalized and critically ill patients [3-6]. Discussions regarding resuscitation preferences can be difficult and confusing for patients, surrogates, and providers [7]. While conversations about resuscitation preferences should optimally occur prior to the development of critical illness, this is often not the case and discussions occur in the context of acute critical illness and emotional distress. In addition, discussions about CPR are often unnecessarily obscured by medical jargon and do not contain the elements suggested by professional societies and bioethicists [8].
Knowledge of CPR and resuscitation choices is one key component of shared medical decision making [9]. While previous survey instruments have been utilized to measure knowledge of CPR components and success rates [3,4,10-16], their measurement of resuscitation choices and other CPR-related terminology, as well as validation and testing in intensive care unit (ICU) populations, is limited. For this study our objectives were to: 1) Develop and validate a survey to measure patient and surrogate decision-maker understanding of resuscitation terminology and resuscitation options, and 2) Use the validated survey to measure the understanding of resuscitation terminology and resuscitation options in a cohort of ICU patients and surrogates. We hypothesized that patients and surrogates would have limited knowledge of CPR and CPR choices in the hospital, and that surrogates’ understanding would be comparatively better.

Methods
Survey development
A list of possible survey items regarding CPR and resuscitation preferences was generated from interviews with patients, surrogates, internal medicine resident physicians, ICU nurses, ICU attending physicians, palliative care physicians, patient education specialists, as well as a literature review of existing resuscitation surveys [3,4,10-16]. This comprehensive list was then refined based on item content and usability by expert consensus of a group of five ICU physicians, five ICU nurses, and three patient education specialists. This group determined that, due to critical illness, ICU patients and their surrogates would best be served by a verbally administered questionnaire. The survey instrument assessed knowledge of the possible components of CPR in the hospital, the definition of CPR related terms and acronyms, as well as the various resuscitation preference options for hospitalized patients (see Figure 1). The survey assessed patients’ core level of knowledge of CPR (such as “What is the purpose of CPR” and “What treatments are used in CPR?”) as well as the meaning of commonly used medical terms (such as “What does intubation mean?”). The survey consisted of 12 questions with one point being awarded for each correct response. Question four had a total of four possible correct answers. Thus the score survey ranged from 0–15 points, with higher scores representing increased knowledge.

Face and content validity
Face validity (the extent to which the survey appeared to measure its intended domain) and content validity (the extent to which the survey measured all aspects of its intended domain) were assessed via two thirty minute focus group sessions with ICU physician and nurse participants. The focus groups assessed the items for accuracy, clarity, relevance, completeness, breadth, and usability in an ICU population. We then pilot tested this survey in a small group of ten ICU patients and ten surrogates, recording their answers and any misunderstandings about the questions. We then modified the survey questions based on this feedback.

Discriminative validity
Discriminative validity (the extent to which the survey distinguished between two groups of subjects who were expected to perform differently) was measured by comparing the survey results of the patients and surrogate cohorts to a cohort of internal medicine resident physicians, who were expected to demonstrate an increased knowledge.

Test-retest reliability
Test-retest reliability (the extent to which survey results were similar under different conditions or periods of time) was measured by repeating the survey in patients and surrogates 24 hours after the initial survey. Physician surveys were repeated two weeks apart.

Study participants
The revised survey (see Figure 1) was then verbally administered verbatim by a single survey administrator to patients and surrogates in one surgical ICU and one mixed medical/surgical ICU in a single medical center. The survey administrator was trained in survey administration and result interpretation. The survey administrator approached the medical team (physicians and nurses) of consecutive patients admitted to the ICUs in the previous 48 hours. If the medical team determined that patients were making their own medical decisions and were not delirious, then patients were approached to enroll in the study. Patient orientation to month, year, and place was then objectively verified and informed consent was obtained. If patients with decision making capacity were unavailable to participate (such as away at testing) on two occasions, then they were excluded from the study. If patients were disoriented or were assessed not to be making their own medical decisions, then the patients’ surrogate decision makers (as named by the medical team) were approached to enroll in the study. Excluded groups included minors, prisoners, pregnant women, and non-English speakers. For the purpose of testing discriminative validity, the survey was also administered to 20 internal medicine resident physicians after informed consent was obtained. The
Mayo Clinic Institutional Board of Review approved the study protocol.

**Statistical analysis**

Paired Student’s t-tests, the Wilcoxon’s rank-sum test, and the chi-square test were used as appropriate for univariate comparisons. Test-retest reliability was performed using a Pearson correlation for total knowledge scores. Internal consistency was measured using Cronbach’s alpha. P values < 0.05 were considered statistically significant. Statistical analysis was performed with JMP (JMP, Version 9, SAS Institute Inc.).

**Results**

One hundred four ICU patients were approached for participation in the study, of which thirty two met exclusion criteria (Figure 2). In total, the survey was verbally administered to 32 patients and 37 surrogate decision members, as well as to 20 internal medicine residents test discriminative validity (Table 1).

**Survey results and discriminative validity**

Median (interquartile range) total knowledge scores were 7 (5-10) out of 15 for patients, 9 (7-12) for surrogates, and 14.5 (14-15) for physicians with a p value of <0.001, representing excellent discriminative validity (Table 2).

Fifty six percent of patients and 76% of surrogates could explain the purpose of CPR. Only 12% percent of patients and 27% of surrogates could name chest compressions and breathing assistance as components of CPR. Forty one percent of patients and 24% of surrogates could not name a single possible complication of CPR. Similarly, 37% of patients and 49% of surrogates were unable to conclude that CPR would be performed if the patient chose to have a Full Code status and 31% of patients and 19% of surrogates were unable to conclude that CPR would not be performed if the patient
chose to have a Do Not Resuscitate code status. Two out of 20 internal medicine residents did not answer correctly the question “What do the letters CPR stand for?” and one out of 20 residents who had just started his/her training had not previously performed CPR.

Factors associated with lower knowledge scores for patients and surrogates include: advanced age, male sex, widowed or divorced marital status, and lower education level. Patients with lower self-perceived health literacy and lack of prior health care experience also had lower total knowledge scores. There was no observed association between total knowledge scores and race, prior experience performing CPR, primary ICU service, Acute Physiology and Chronic Health Evaluation III (APACHE III) score, or admission code status order (Table 3).

Internal consistency and test-retest reliability
Cronbach’s alpha for the total knowledge score was 0.97, with values > 0.7 representing acceptable internal consistency. Test-retest reliability was performed on 36 study participants. The correlation between pretest and posttest total knowledge scores was high with a Pearson correlation of 0.96 with a 95% confidence interval of 0.92-0.99 (p < .001).

Discussion
This survey was developed to measure CPR knowledge in critically ill patients and their surrogate decision makers. The survey showed strong face and content validity, as well as internal consistency, test-retest reliability, and discriminative validity. The survey was easily administered to a cohort of ICU patients and surrogates by a survey administrator who read the survey verbatim. Initial survey results showed that patients and surrogate decision makers had relatively poor knowledge of CPR terminology, components, complications, and available preference options. While our results confirm prior studies that have shown patients’ limited understanding of the definition of CPR and its components [3,4,10-16], our survey showed these results in a validated format in an ICU population and incorporated additional questions to extend the assessment of knowledge of resuscitation preferences (ie Full Code, Do Not Resuscitate, and Do Not Intubate).

In the hospital, patient instruction regarding CPR and resuscitation preference options occurs primarily during code status discussions. These circumstances of these discussions—often brief, laden with medical jargon, occurring under stressful circumstances with providers at various levels of training—may actually contribute to poor knowledge among patients and their families [8]. Furthermore, code status discussions also occur with varying frequency [3-6] and contain variable content [17]. The impact of critical illness, age, and patients’ perceived health literacy may also contributed to limited comprehension. Additionally, some patients may avoid discussing CPR with their health care providers, delaying complex decision making and potentially impairing knowledge acquisition [4]. It should be noted that code status discussions should not occur in isolation, and are part of a larger assessment of the patients’ preferences, values, and goals of medical treatment. Discussions about resuscitation preferences should ideally occur as part of advance care planning in the outpatient setting.

As we hypothesized, surrogate decision makers had somewhat higher total knowledge scores than did patients. Potential reasons to explain this observed difference include, surrogates were younger, predominantly female, had more health care experience, and had greater perceived health and self-reported health literacy. Although having a family member hospitalized in the ICU has been associated with high rates of psychologic distress and
burnout among surrogate decision makers [18,19]. Our survey was not designed to determine if this impacted surrogates’ knowledge scores. In addition, cognitive factors such as emotional distress, pain, anxiety, and depression in ICU patients with decision making capacity may impact decision making about complex and sensitive issues such as resuscitation preferences.

Although nearly all internal medicine resident physician participants answered every survey question correctly, some physicians did not know what the letters CPR stood for, could not name all of the components of CPR in the hospital, or had not previously performed CPR on a patient. These findings reveal that some physicians in training have a degree of unfamiliarity with CPR. In a system where a majority of code status discussions occur between patients and physicians in training, physician unfamiliarity may impact patient knowledge and decision making [20]. Code status discussions should occur with clinicians who have received sufficient training and experience in resuscitation decision making.

Our study has several limitations. The survey instrument did not attempt to measure respondents’ understanding of CPR survival rates, which has been shown to be an important factor in patient and surrogate CPR decision making [6,12,13,15]. We did not control for participant recollection of occurrence or content of CPR discussions with health care providers, which may have impacted knowledge scores. We did not control for socioeconomic status. Patient race has been shown to introduce variability in ICU decision making, and our study participants were mostly Caucasian and entirely English speaking [21]. We also did not measure patient/surrogate satisfaction with the survey. The survey was tested in a single center with a limited number of

| Characteristic                              | Patients (n = 32) | Surrogates (n = 37) | Physicians (n = 20) |
|--------------------------------------------|-------------------|--------------------|---------------------|
| Age, years, median (IQR)                   | 62(50–71)         | 49(41–63)          | 29(27–32)           |
| Female gender, n (%)                       | 8(25)             | 23(62)             | 7(35)               |
| Non-Caucasian race, n (%)                  | 0(0)              | 11(30)             | 0(0)                |
| Marital status, n (%)                      |                   |                    |                     |
| Single                                     | 2(6)              | 7(20)              | 11(55)              |
| Married                                    | 23(72)            | 25(71)             | 9(45)               |
| Widowed                                    | 4(13)             | 0(0)               | 0(0)                |
| Divorced                                   | 3(9)              | 3(9)               | 0(0)                |
| Education, n (%)                           |                   |                    |                     |
| Eighth grade or less                       | 0(0)              | 1(3)               | 0(0)                |
| High school                                | 7(22)             | 9(24)              | 0(0)                |
| Some college                               | 10(31)            | 12(32)             | 0(0)                |
| College graduate                           | 5(16)             | 12(32)             | 0(0)                |
| Postgraduate                               | 6(19)             | 3(8)               | 20(100)             |
| Unknown                                    | 4(12)             | 0(0)               | 0(0)                |
| Religious preference, n (%)                |                   |                    |                     |
| Christian, non-Catholic                    | 22(69)            | 16(44)             | 10(50)              |
| Catholic                                   | 10(31)            | 11(31)             | 4(20)               |
| Jewish                                     | 0(0)              | 1(3)               | 0(0)                |
| Muslim                                     | 0(0)              | 0(0)               | 1(5)                |
| Other                                      | 0(0)              | 3(8)               | 2(10)               |
| None                                       | 0(0)              | 5(14)              | 3(15)               |
| Self-reported health status, n (%)          |                   |                    |                     |
| Excellent                                  | 2(6)              | 7(19)              | 10(50)              |
| Very good                                  | 3(9)              | 17(46)             | 9(45)               |
| Good                                       | 4(13)             | 11(30)             | 1(5)                |
| Fair                                       | 11(34)            | 2(5)               | 0(0)                |
| Poor                                       | 12(38)            | 0(0)               | 0(0)                |
| Health literacy, n (%)                     |                   |                    |                     |
| Extreme                                    | 13(41)            | 17(46)             | 14(70)              |
| Quite a bit                                | 5(16)             | 11(30)             | 5(25)               |
| Somewhat                                   | 6(19)             | 4(11)              | 1(5)                |
| A little bit                                | 3(9)              | 1(3)               | 0(0)                |
| Not at all                                 | 5(16)             | 4(11)              | 0(0)                |
| Prior health care experience, n (%)         | 6(19)             | 14(38)             | 20(100)             |
| Has previously performed CPR on somebody else, n (%) | 2(6)              | 4(11)              | 19(95)              |
| Has had CPR previously performed on themselves, n (%) | 2(6)              | 2(5)               | 0(0)                |
| Medical patient, n (%)                     | 18(56)            | 14(44)             | NA                  |
| Surgical patient, n (%)                    | 27(73)            | 10(27)             | NA                  |
| ICU admission APACHE III score, median (IQR)| 53(44–71)         | 53(49–72)          | NA                  |
According to the current prevailing paradigm of patient-centered care, treatment decisions are ideally made using a shared decision-making model between patients, their surrogate decision makers, and their medical providers. Patient education regarding CPR and available CPR options is an essential step in this shared decision making process. This study confirms that patients and surrogates have a limited understanding of CPR in the hospital and highlights the need to develop interventions that can improve CPR knowledge and decision making, especially since prior interventions such as information leaflets have shown limited impact [22,23].

### Table 2 CPR knowledge scores and discriminative validity

| Question (%) | Patients (n = 32) | Surrogates (n = 37) | Physicians (n = 20) | P value |
|--------------|------------------|---------------------|---------------------|---------|
| What do the letters CPR stand for? | 41% | 57% | 90% | .002 |
| What is the purpose of CPR? | 56 | 76 | 100 | .002 |
| When would members of the medical team start performing CPR? | 75 | 84 | 95 | .17 |
| What treatments are used in CPR? | Chest compressions 81 | 92 | 90 | .38 |
| Breathing assistance | 56 | 76 | 95 | .008 |
| Defibrillation | 23 | 35 | 75 | <.001 |
| Medications or fluids | 9 | 24 | 90 | <.001 |
| Could correctly identify chest compressions and breathing assistance as components of CPR | 12 | 27 | 85 | <.001 |
| What does intubation mean? | 37 | 57 | 100 | <.001 |
| What does mechanical ventilation mean? | 34 | 68 | 100 | <.001 |
| What are some possible complications of CPR? | 59 | 76 | 100 | .004 |
| What do the letters "DNR" stand for? | 41 | 59 | 100 | <.001 |
| What do the letters "DNI" stand for? | 34 | 49 | 100 | <.001 |
| Response to full code | 63 | 51 | 100 | <.001 |
| Response to DNR | 69 | 81 | 100 | .02 |
| What does code status mean? | 22 | 8 | 95 | <.001 |
| Total knowledge score, 0–15 points (IQR) | 7(5–10) | 9(7–12) | 14.5(14–15) | <.001 |

CPR, cardiopulmonary resuscitation; DNR, do not resuscitate; DNI, do not intubate; IQR, interquartile range.

### Table 3 Predictors of higher knowledge scores in patients and surrogates

| Characteristic | Total knowledge score, median (IQR) | P value |
|---------------|-------------------------------------|---------|
| Age, years    |                                     | .03     |
| ≥ 60          | 7(5–9)                              |         |
| < 60          | 9(7–12)                             |         |
| Sex           |                                     | .05     |
| Female        | 9(7–12)                             |         |
| Male          | 7(5–10)                             |         |
| Race          |                                     | .23     |
| Non-Caucasian race | 8(5–10)                  |         |
| Caucasian     | 10(8–12)                            |         |
| Marital status|                                     | .02     |
| Single        | 10(8–13)                            |         |
| Married       | 8(5–10)                             |         |
| Widowed       | 5.5(2–6)                            |         |
| Divorced      | 7(5–8)                              |         |
| Education     |                                     | .03     |
| ≥ college graduate | 7(5–10)                  |         |
| < college graduate | 10(7–12)               |         |
| Self-reported health status | 7(5–10) | .07 |
| Fair or poor  | 7(5–10)                             |         |
| Good or better| 9(7–12)                             |         |
| How confident are you in filling out medical forms by yourself? (health literacy) | 7(5–10) | .01 |
| Somewhat confident or less | 7(5–10) |         |
| Extremely or quite a bit confident | 9(7–11) |         |
| Prior health care experience | 10(7–13) | .002 |
| Yes           | 10(7–13)                            |         |
| No            | 7(5–10)                             |         |
| Have you performed CPR on somebody else? | 11(7–13) | .17 |
| Yes           | 11(7–13)                            |         |
| No            | 8(5–10)                             |         |
| Has CPR been performed on you? | 52(2–7) | .03 |
| Yes           | 52(2–7)                             |         |
| No            | 8(6–11)                             |         |
| Primary ICU service | 7(5–12) | .84 |
| Medical patient | 7(5–12)                       |         |
| Surgical patient | 8(6–10)                  |         |
| ICU admission APACHE III score | 7(4–10) | .19 |
| ≥ 70          | 7(4–10)                             |         |
| < 70          | 8(7–11)                             |         |
| Code status on ICU admission | 8(6–10) | .27 |
| Full code     | 8(6–10)                             |         |
| DNR           | 6(2–10)                             |         |

IQR, interquartile range; CPR, cardiopulmonary resuscitation; ICU, intensive care unit; DNR, do not resuscitate.
Conclusions
A verbally administered survey to measure CPR knowledge among critically ill patients and their surrogate decision makers showed strong face and content validity, as well as internal consistency, test-retest reliability, and discriminative validity in an ICU population. Results from our initial survey administration showed relatively poor knowledge of CPR as well as CPR preference options among both ICU patients and their surrogates. This survey instrument can be used in intervention studies seeking to improve knowledge of CPR and CPR resuscitation choices in the ICU.

Key messages
- ICU patients and surrogates have poor understanding of basic resuscitation choices and knowledge of CPR.
- Our validated survey can be utilized in future studies to measure patient and surrogate understanding of CPR and resuscitation choices.

Abbreviations
CPR: Cardiopulmonary resuscitation; ICU: Intensive care unit; APACHE III: Acute physiology and chronic health evaluation III; DNR: Do not resuscitate; DNI: Do not intubate.

Competing interests
The authors declare that they have no competing interests.

Authors’ contributions
MW participated in study design, survey distribution, statistical analysis, and drafted the manuscript. AK and RH participated in survey distribution, study coordination, and statistical analysis. JL participated in study design and manuscript preparation. OG and KK participated in study design, oversight, and manuscript review. All authors read and approved the final manuscript.

Acknowledgements
The authors would like to thank David Eton, PhD, Division of Health Care Policy & Research, Department of Health Sciences Research, Mayo Clinic, Rochester, Minnesota for his thoughtful review and guidance. Financial Support was provided by Mayo Clinic and Mayo Foundation, which did not participate in the collection, analysis, or interpretation of data, in the writing of the manuscript or in the decision to submit the manuscript for publication.

Author details
1Department of Medicine, Division of Pulmonary and Critical Care Medicine, Mayo Clinic, 200 First Street SW, Rochester, MN 55905, USA. 2Department of Medicine, Divisions of Nephrology and Critical Care Medicine, Mayo Clinic, Rochester, MN 55905, USA. 3Department of Critical Care Medicine, University of Hawaii, John A. Burns School of Medicine, Honolulu, Hawaii, USA. 4Anesthesia Critical Care Research Unit, Mayo Clinic, Rochester, MN 55905, USA. 5Department of Emergency and Critical Care Medicine, Beth Israel Deaconess Medical Center, Boston, Massachusetts, USA.

Received: 2 January 2014 Accepted: 26 February 2014 Published: 8 March 2014

References
1. Guidelines for the appropriate use of do-not-resuscitate orders. Council on Ethical and Judicial Affairs, American Medical Association. JAMA 1991, 265:1866–1871.
2. 2005 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care. Circulation 2005, 112(1–2):e310–e375.
3. Gehlbach TG, Shinkunas LA, Forman-Hoffman VL, Thomas KW, Schmidt GA, Kaldjian LC: Code status orders and goals of care in the medical ICU. Chest 2011, 139(5):802–809.
4. Heyland DK, Frank C, Groll D, Pickova D, Dodd P, Rocker G, Gafni A: Understanding cardiopulmonary resuscitation decisions: perspectives of seriously ill hospitalized patients and family members. Chest 2006, 130:419–428.
5. Hofmann JC, Wengen NS, Davis RB, Teno J, Connors AF Jr, Desbiens N, Lynn J, Phillips RS: Patient preferences for communication with physicians about end-of-life decisions. SUPPORT Investigators. Study to Understand Prognoses and Preference for Outcomes and Risks of Treatment. Ann Intern Med 1997, 127:11–12.
6. Kaldjian LC, Erekson ZD, Haberle TH, Curtis AE, Shinkunas LA, Cannon KT, Forman-Hoffman VL: Code status discussions and goals of care among hospitalized adults. J Med Ethics 2009, 35:338–342.
7. von Gunten CF, Ferris FD, Emanuel LL: The patient-physician relationship. Ensuring competency in end-of-life care: communication and relational skills. JAMA 2000, 284:3051–3057.
8. Anderson WG, Chase R, Pantilat SZ, Tulsky JA, Auerbach AD: Code status discussions between attending hospitalists and medical patients at hospital admission. J Gen Intern Med 2011, 26:359–366.
9. Charles C, Gafni A, Whelan T: Decision-making in the physician-patient encounter: revisiting the shared treatment decision-making model. Soc Sci Med 1999, 49:651–661.
10. Kerridge IH, Pearson SA, Rolfe IE, Lowe M, McPhee JR: Impact of written information on knowledge and preferences for cardiopulmonary resuscitation. Med J Aust 1999, 171:239–242.
11. Miller DL, Jahnigen DW, Gorbien MJ, Simbartl L: Cardiopulmonary resuscitation: how useful? Attitudes and knowledge of an elderly population, Arch Intern Med 1992, 152:578–582.
12. Murphy DJ, Burrows D, Santilli S, Kemp AW, Tenner S, Krelling B, Teno J: The influence of the probability of survival on patients’ preferences regarding cardiopulmonary resuscitation. N Engl J Med 1994, 330:545–549.
13. Schonwetter RS, Teasdale TA, Taffet G, Robinson BE, Luchi RJ: Educating the elderly: cardiopulmonary resuscitation decisions before and after intervention. J Am Geriatr Soc 1991, 39:372–377.
14. Schonwetter RS, Walker RM, Kramer DR, Robinson BE: Resuscitation decision making in the elderly: the value of outcome data. J Gen Intern Med 1993, 8:295–300.
15. Thorevska N, Tiluckhanylo L, Tickoo S, Havasi A, Amoateng-Adjepong Y, Mantshous CA: Patients’ understanding of advance directives and cardiopulmonary resuscitation. J Crit Care 2005, 20:26–34.
16. Yamada R, Galecki AT, Goodl JD, Hogikyan RV: A multimedia intervention on cardiopulmonary resuscitation and advance directives. J Gen Intern Med 1999, 14:559–563.
17. Deep KS, Griffith CH, Wilson JF: Communication and decision making about life-sustaining treatment: examining the experiences of resident physicians and seriously-ill hospitalized patients. J Gen Intern Med 2008, 23:1877–1882.
18. Azoulay E, Pochard F, Kentsh-Barnes N, Chevret S, Aboab J, Adrie C, Annane D, Bleichner G, Bollaert PE, Darmon M, Fassier T, Galliot R, Garrouste-Orgeas M, Goulenok C, Goldberg-Toledano D, Haydon J, Jourdain M, Kaidoar M, Laplace C, Lariche J, Lioteur J, Papiol J, Pozson C, Reigner J, Saidi F, Schlemmer B, FAMIREA Study Group: Risk of post-traumatic stress symptoms in family members of intensive care unit patients. Am J Respir Crit Care Med 2005, 171:987–994.
19. Cock D, Rocker G, Marshall J, Jokvist P, Dodek P, Griffith L, Freitag A, Varon J, Bradley C, Levy M, Finfer S, Hamelec C, McMillin J, Weaver B, Walter S, Guyatt G, for the Level of Care Study Investigators and the Canadian Critical Care Trials Group: Withdrawal of mechanical ventilation in anticipation of death in the intensive care unit. N Engl J Med 2003, 349:1123–1132.
20. Smith AK, Res AP, Zhang B, Tulsuka JA, Prigerson HG, Block SD: Resident approaches to advance care planning on the day of hospital admission. Arch Intern Med 2006, 166:1597–1602.
21. Muni S, Engelberg RA, Treece PD, Dotolo D, Curtis JR: The influence of race/ethnicity and socioeconomic status on end-of-life care in the ICU. Chest 2011, 139:1025–1033.

22. Gates RA, Weaver MJ, Gates RH: Patient acceptance of an information sheet about cardiopulmonary resuscitation options. J Gen Intern Med 1993, 8:679–682.

23. Sivakumar R, Knight J, Devlin C, Keir P, Ghosh P, Khan S: Communicating information on cardiopulmonary resuscitation to hospitalised patients. J Med Ethics 2004, 30:311–312.

doi:10.1186/1471-2253-14-15

Cite this article as: Wilson et al: Development, validation, and results of a survey to measure understanding of cardiopulmonary resuscitation choices among ICU patients and their surrogate decision makers. BMC Anesthesiology 2014 14:15.