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Clinical paper

Prognostication of patients in coma after cardiac arrest: Public perspectives



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Abstract

Aim: To elicit preferences for prognostic information, attitudes towards withdrawal of life-sustaining treatment (WLST) and perspectives on acceptable quality of life after post-anoxic coma within the adult general population of Germany, Italy, the Netherlands and the United States of America.

Methods: A web-based survey, consisting of questions on respondent characteristics, perspectives on quality of life, communication of prognostic information, and withdrawal of life-sustaining treatment, was taken by adult respondents recruited from four countries. Statistical analysis included descriptive analysis and chi2-tests for differences between countries.

Results: In total, 2012 respondents completed the survey. In each country, at least 84% indicated they would prefer to receive early prognostic information. If a poor outcome was predicted with some uncertainty, 37–54% of the respondents indicated that WLST was not to be allowed. A conscious state with severe physical and cognitive impairments was perceived as acceptable quality of life by 17–44% of the respondents. Clear differences between countries exist, including respondents from the U.S. being more likely to allow WLST than respondents from Germany (OR = 1.99, $p < 0.001$) or the Netherlands (OR = 1.74, $p < 0.001$) and preferring to stay alive in a conscious state with severe physical and cognitive impairments more than respondents from Italy (OR = 3.76, $p < 0.001$), Germany (OR = 2.21, $p < 0.001$), or the Netherlands (OR = 2.39, $p < 0.001$).

Conclusions: Over one-third of the respondents considered WLST unacceptable when there is any remaining prognostic uncertainty. Respondents had a more positive perspective on acceptable quality of life after coma than what is currently considered acceptable in medical literature. This indicates a need for a closer look at the practice of WLST based on prognostic information, to ensure responsible use of novel prognostic tests.

Keywords: Post-anoxic coma, End-of-life decisions, Quality of life, Withdrawal of life support, Public perspective, Prognostic tests

Introduction

The incidence of out of hospital cardiac arrest (OHCA) is about 1 in 1000 inhabitants in the Western world.¹ A recent meta-analysis concluded that the global average rate of survival to hospital admission is about 22%, and the rate of survival to hospital discharge is about 9%.² Withdrawal of life-sustaining treatment (WLST), based on out-

come prediction, is the cause of death in the majority of non-surviving comatose patients after OHCA.^{3–6}

For outcome prediction, multimodal testing is recommended.^{7–9} Available tests include somatosensory evoked potentials (SSEP) and the pupillary light reflex tests.^{9,10} These tests can be performed from 48 to 72 h after cardiac arrest and help in identifying about 20% of patients with a poor outcome.^{11,12} EEG within 24 h^{13–15} or beyond 24 h¹⁶ after cardiac arrest has recently been added to prognostic

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practices in various countries and can provide prognostic information in about half of the patient population.^{13,14}

Even though outcome prediction in patients with coma improves with multimodal testing,⁹ some concerns remain. When prediction of a poor outcome is followed by WLST, it is impossible to verify the prediction as a result of the self-fulfilling prophecy: if treatment is withdrawn because of a poor prognosis, the patient will almost always die.^{17,18} Although the likelihood of a false positive test is low, the consequences are devastating when life-sustaining treatment will be withdrawn. Also, the classification of poor and good outcome relies on a value judgment, which is currently made by clinical researchers.

In light of the far-reaching decisions on (dis)continuation of life-sustaining treatment based on predictive test outcomes, and the growing availability of tests to perform early outcome prediction of comatose patients after cardiac arrest, questions about desirability of outcome prediction have arisen. The objective of this study was to elicit public preferences for prognostic information, attitudes towards WLST and perspectives on acceptable quality of life after post-anoxic coma comparing four countries: Germany, Italy, the Netherlands and the U.S.

Methods

Study design

This study used a structured web-based survey with an expected duration of 20 min. The study protocol for this study was approved by the Ethical Review Board of the University of Twente and the study was exempted from medical ethics review.

Survey instrument

Background information - Respondents were asked for their age (in years) and gender (male/female) to include a representative sample of the population in each country based on these characteristics. Further background information included educational level (low/middle/high), religion (Christian/Muslim/other/non-religious), and experience with having a close relative or friend in a coma after cardiac arrest (yes/no).

Perspectives on quality of life - In medical literature, the outcome of coma after cardiac arrest is usually classified according to the Cerebral Performance Category (CPC), a five point scale ranging from 1 to 5, with 1 indicating full recovery and 5 death. CPC-3 is “the grey area” regarding what is usually considered a good or poor outcome.⁸ In this study, three health state descriptions within the range of CPC-3 outcomes and one for CPC-4 were formulated in collaboration with clinical and ethical experts. Clinical experts included two neurologists with ample experience with acute patients in post-anoxic coma, and one care-home specialist, with ample experience with the long-term consequences of post-anoxic coma. Ethical experts included were two ethicists, with experience with the clinical case who focused on any implicit or explicit value judgments in the descriptions. Written descriptions of physical and cognitive abilities were based on the descriptions in the Cerebral Performance Categories – Extended (CPC-E) Scale.¹⁹ No visual or video support was provided to prevent implicit or explicit value judgements in the information, or responses based on anecdotal information. After being presented with each of the health states, respondents were asked to indicate on a 4-point Likert scale (ranging from “definitely yes” to “definitely no”) whether they would prefer to stay alive if the out-

come were as described (health state descriptions are presented in [appendix 2](#)).

Preferences for prognostic information: Preferences for receiving information on the predicted outcome in case of positive (good outcome is predicted) and negative (poor outcome is predicted) prognoses, and preferred timing of information on negative prognosis, were elicited by directly asking respondents whether and when they would like to receive this information.

Attitudes toward withdrawal of life-sustaining treatment (WLST): Direct questioning was used to elicit attitudes towards WLST. First, respondents were informed about possible WLST in case of poor prognosis. Then, respondents were asked to indicate agreement with the decision to withdraw life-sustaining treatment when poor outcome is predicted; acceptance of WLST in case of prognostic uncertainty; acceptable prognostic uncertainty; priorities in clinical decision making; optimal timing for WLST; and which considerations should be taken into account in the decision to withdraw life-sustaining treatment.

Involvement in decision making - Preferences regarding involvement in decision making were elicited using direct questions. Respondents were asked who should initiate the conversation on WLST; and who should be responsible for making decisions regarding WLST.

The survey was pilot tested in two phases among a convenience sample of respondents in the Netherlands, who were recruited through snowball sampling. In the first phase, ten “think aloud” tests were performed to verify comprehension, readability, and feasibility of the survey. In this phase, the researcher was present and respondents were able to give feedback. In the second phase, 56 respondents completed the revised survey online to ensure internal and external validity and feasibility of the survey. The final survey is in [Appendix 1](#).

Study population

The study was conducted among a sample of 500 members of the general population in Germany, Italy, the Netherlands and the U.S.. These four countries were selected because of their widely different populations and differences in clinical practice, and their track record of published research on prognostication in post-anoxic coma in each country. A sample of 500 respondents has a margin of error less than 5% for categorical data.²⁰ The sample was recruited through a market research agency, between September 2019 and February 2020. Respondents were eligible if they were at least 18 years old, and were able to provide informed consent. To reach a sample representative for the population in each country, quotas were maintained for gender and age in the recruitment of respondents.

Statistical analysis

Descriptive statistics were used to study respondents’ background characteristics and responses to direct questions and rating scales. Educational level was categorized as low, medium or high using the International Standard Classification of Education (ISCED).²¹ Religion was categorized as religious or not religious, due to varying religious movements in the four different countries. With testing for potential statistical differences between the four countries, the health states were categorized as “prefer to stay alive” or “does not prefer to stay alive.” Potential statistical differences between the four countries were tested using Pearson’s Chi squared test in R. P-values < 0.05 were considered statistically significant. In pairwise

Table 1 – Background characteristics of survey respondents.

Characteristic	Germany (n = 506)	Italy (n = 502)	Netherlands (n = 500)	U.S. (n = 504)
Age, mean (min–max; SD)	50 (18–99; 17)	50 (18–90; 17)	49 (18–88; 18)	47 (18–99; 18)
Gender, n (%)				
Male	251 (50%)	239 (48%)	258 (52%)	246 (49%)
Female	255 (50%)	263 (52%)	242 (48%)	258 (51%)
Educational level*, n (%)				
Low	16 (3%)	13 (3%)	7 (1%)	6 (1%)
Middle	329 (65%)	292 (59%)	295 (59%)	134 (27%)
High	159 (32%)	194 (39%)	198 (40%)	361 (72%)
Relation, n (%)				
Yes	329 (65%)	371 (74%)	347 (69%)	345 (68%)
No	177 (35%)	131 (26%)	153 (31%)	159 (32%)
Children, n (%)				
Yes	276 (55%)	307 (61%)	302 (60%)	351 (70%)
No	230 (45%)	195 (39%)	198 (40%)	153 (30%)
Religion, n (%)**				
Religious	256 (53%)	383 (78%)	218 (44%)	391 (78%)
Not religious	226 (47%)	107 (22%)	282 (56%)	113 (22%)
Experience with post-anoxic coma, n (%)				
Yes	116 (23%)	115 (23%)	121 (24%)	145 (29%)
No	390 (77%)	387 (77%)	379 (76%)	359 (71%)
Perceived health, mean (min–max; SD)	6.98 (1–10; 1.78)	7.61 (2–10; 1.40)	7.4 (1–10; 1.50)	7.67 (1–10; 1.94)

* Educational level was categorized using the ISCED. Low = elementary school. Middle = Trade/technical/vocational training and high school. High = College/University; ** Religion was recoded in 'religious' and 'not religious'; *** and **** can be dropped from table 1.

comparisons between the countries p values < 0.008 were considered statistically significant, since 6 pairwise comparisons could be made between the countries. All analyses were performed using R (version 3.6.0, www.r-project.org).

Results

Background characteristics

Of the 3913 potential respondents that started the survey, 3259 were eligible and gave consent for participation. In total, 2012 respondents completed; 506 from Germany, 502 from Italy, 504 from the U.S. and 500 from the Netherlands. The response rate was 62%. Age and gender were representative of the countries' populations. About 25% of the respondents indicated they had some experience with cardiac arrest, as they had family members or friends who suffered from cardiac arrest. More background characteristics of the respondent sample can be found in [Table 1](#). The mean time to complete the questionnaire was 16 min.

Perspectives on quality of life

For all four countries, respondents were least likely to prefer to live in a vegetative state (12–37%), followed by a conscious state with both severe physical and cognitive impairments (17–44%). Fewer people preferred to live in a conscious state with only severe physical impairments than in a conscious state with only severe cognitive impairments (23–62% vs. 39–64%; $p < 0.001$) ([Table 2](#)).

There are clear differences between countries in willingness to live in the different health states. Respondents in the U.S. were more likely to prefer to live in a vegetative state than respondents from Italy (37% vs. 12%, OR = 4.38, $p < 0.001$), Germany (37% vs. 21%, OR = 2.17, $p < 0.001$), or the Netherlands (37% vs. 15%, OR = 3.37, $p < 0.001$). Respondents from Germany were more likely

to prefer to stay alive in a vegetative state compared to respondents in Italy (21% vs. 12%, OR = 2.04, $p < 0.001$).

Respondents in the U.S. were also more likely to prefer to stay alive in a conscious state with both severe physical and cognitive impairments compared to respondents in Italy (44% vs. 17%, OR = 3.76, $p < 0.001$), Germany (44% vs. 26%, OR = 2.21, $p < 0.001$), or the Netherlands (44% vs. 25%, OR = 2.29, $p < 0.001$). Respondents from Germany (26% vs. 17%, OR = 1.69, $p < 0.001$) and the Netherlands (25% vs. 17%, OR = 1.56, $p = 0.0048$) are more likely to prefer to live in a conscious state with severe physical and cognitive impairments than respondents from Italy.

Respondents from Germany (59% vs. 39%, OR = 2.22, $p < 0.001$), the Netherlands (61% vs. 39%, OR = 2.44, $p < 0.001$), and the U.S. (64% vs. 39%, OR = 2.70, $p < 0.001$) were more likely to prefer to stay alive in a conscious state with severe cognitive impairments than respondents from Italy. Respondents from Germany (57% vs. 33%, OR = 2.70, $p < 0.001$), the Netherlands (56% vs. 33%, OR = 2.56, $p < 0.001$) and the U.S. (62% vs. 33%, OR = 3.33, $p < 0.001$) were also more likely to prefer to live in a conscious state with only severe physical impairments than respondents from Italy.

Preferences for prognostic information

The results of this study indicate that for all four countries the majority of the respondents would like to receive prognostic information if it predicts a good outcome (90% for the U.S., 92% for Germany and the Netherlands, 94% for Italy) and if it predicts a poor outcome (84% for Germany, 87% for the U.S., 89% for the Netherlands, 92% for Italy).

There is no clear preference for the timing of poor prognostic information ([Table 3](#)). Preferences did vary between countries. In the U.S., 38% of respondents would like to be informed at 24 h, com-

Table 2 – Willingness to live in different health states after post-anoxic coma.

Health states*	Germany (n = 506)	Italy (n = 502)	Netherlands (n = 500)	U.S. (n = 504)
Vegetative state, n (%)				
Want to stay alive	41 (8%)	25 (5%)	35 (7%)	126 (25%)
Probably want to stay alive	68 (13%)	35 (7%)	40 (8%)	62 (12%)
Probably do not want to stay alive	127 (25%)	120 (24%)	141 (28%)	92 (18%)
Do not want to stay alive	270 (53%)	322 (64%)	284 (57%)	224 (44%)
Conscious state with severe physical and cognitive impairments, n (%)				
Want to stay alive	45 (9%)	30 (6%)	40 (8%)	140 (28%)
Probably want to stay alive	88 (17%)	57 (11%)	84 (17%)	82 (16%)
Probably do not want to stay alive	162 (32%)	134 (27%)	184 (37%)	103 (20%)
Do not want to stay alive	211 (42%)	281 (56%)	192 (38%)	179 (36%)
Conscious state with severe cognitive impairments, n (%)				
Want to stay alive	112 (22%)	66 (13%)	110 (22%)	178 (35%)
Probably want to stay alive	188 (37%)	132 (26%)	196 (39%)	143 (28%)
Probably do not want to stay alive	127 (25%)	143 (28%)	128 (26%)	103 (20%)
Do not want to stay alive	79 (16%)	161 (32%)	66 (13%)	80 (16%)
Conscious state with severe physical impairments, n (%)				
Want to stay alive	110 (22%)	46 (9%)	94 (19%)	175 (35%)
Probably want to stay alive	177 (35%)	118 (24%)	184 (37%)	135 (27%)
Probably do not want to stay alive	126 (25%)	138 (27%)	138 (28%)	104 (21%)
Do not want to stay alive	93 (18%)	200 (40%)	84 (17%)	90 (18%)

* Health states were described using the CPC-E in terms of what a respondent would be and would not be able to do in such state, i.e., eating, walking, communicate, etc.

Table 3 – Preferences for timing of prognostic information, allowance of WLST, important considerations and preferences for involvement in decision-making regarding WLST.

Timing poor prognostic information, n (%)	Germany (n = 506)	Italy (n = 502)	Netherlands (n = 500)	U.S. (n = 504)
24 h after admission	116 (23%)	121 (24%)	146 (29%)	191 (38%)
48 h after admission	152 (30%)	170 (34%)	166 (33%)	157 (31%)
72 h after admission	199 (39%)	195 (39%)	150 (30%)	134 (27%)
Other	39 (8%)	16 (3%)	38 (8%)	22 (4%)
WLST in general, n (%)				
Is allowed	296 (58%)	259 (52%)	326 (65%)	367 (73%)
Is not allowed	162 (32%)	172 (34%)	105 (21%)	85 (17%)
Depends	48 (9%)	71 (14%)	69 (14%)	52 (10%)
WLST in face of uncertainty, n (%)				
Is allowed	234 (46%)	295 (59%)	248 (50%)	318 (63%)
Is not allowed	272 (54%)	207 (41%)	252 (50%)	186 (37%)
Considerations in decision WLST, n (%)				
Reliability of prognosis	343 (68%)	309 (62%)	295 (59%)	318 (63%)
Expected quality of life of the patient	315 (62%)	318 (63%)	358 (72%)	338 (67%)
Wishes of the patient	356 (70%)	309 (62%)	365 (73%)	311 (62%)
Health of patient pre CA	138 (27%)	108 (22%)	184 (37%)	193 (38%)
Age of the patient	183 (36%)	189 (38%)	198 (40%)	223 (44%)
Social costs of the treatment	36 (7%)	42 (8%)	56 (11%)	91 (18%)
Out of pocket expenses	41 (8%)	36 (7%)	-	92 (18%)
Other	5 (1%)	7 (1%)	11 (2%)	10 (2%)
Initiation conversation WLST, n (%)				
Physician	378 (75%)	343 (68%)	315 (63%)	301 (60%)
Family	121 (24%)	147 (29%)	167 (33%)	189 (38%)
Other	7 (1%)	12 (2%)	18 (4%)	14 (3%)
Responsibility for decision WLST, n (%)				
Medical team	53 (10%)	21 (4%)	30 (6%)	79 (16%)
Medical team's decision, taking family's opinion into account	78 (15%)	96 (19%)	87 (17%)	89 (18%)
Joined decision; ultimate decision medical team	90 (18%)	99 (20%)	74 (15%)	83 (16%)
Joined decision; ultimate decision family	114 (23%)	140 (28%)	124 (25%)	122 (24%)
Joined decision; ultimate decision third party	31 (6%)	33 (7%)	39 (8%)	27 (5%)
Family's decision; after being advised by medical team	140 (28%)	113 (23%)	146 (29%)	104 (21%)

pared to 23% in Germany ($p < 0.001$) and 24% in Italy ($p < 0.001$). The difference in the percentage of respondents that would like to be informed at 24 h also differed significantly between Germany and the Netherlands (23% vs. 29%, $p = 0.004$).

Attitudes toward withdrawal of life-sustaining treatment

In all four countries, a majority (52–73%) of respondents indicated WLST is allowed in case of poor prognosis (Table 3). A positive attitude towards WLST was more likely in the U.S. and Netherlands than in Germany (resp. 73% vs. 58%, OR = 2.36, $p < 0.001$ and 65% vs. 58%, OR = 1.70, $p < 0.001$) or Italy (resp. 73% vs. 52%, OR = 2.87, $p < 0.001$ and 65% vs. 52%, OR = 2.06, $p < 0.001$).

After respondents were informed about the inevitable prognostic uncertainty, the percentage of respondents who indicated WLST is komma tussen allowed en dropped in Germany (–12%), the Netherlands (–16%) and the U.S. (–10%), but increased in Italy (+7%). When prognosis was uncertain, respondents in the U.S. and Italy were more likely to indicate WLST is allowed than respondents from Germany (resp. 63% vs. 46%, OR = 1.99, $p < 0.001$ and 59% vs. 46%, OR = 1.66, $p < 0.001$) and the Netherlands (resp. 63% vs. 50%, OR = 1.74, $p < 0.001$ and 59% vs. 50%, OR = 1.45, $p = 0.004$).

Most respondents (75% U.S.; 60% Germany; 55% Italy) indicated that minimizing the risk of WLST in patients with a possible good outcome (based on a false positive prediction of poor outcome) should be prioritized over minimizing the risk of continuation of treatment in patients who would probably survive with a poor outcome (data from the Netherlands are missing).

The median accepted risk of WLST in patients with a possible good outcome was 0.3% in Italy (3 unjust deaths out of 1000 patients in which WLST was performed), 0.4% in Germany and 0.5% in the Netherlands and U.S.

The most frequently mentioned considerations in a decision to continue or stop life-sustaining treatment were wishes of the patient (62–73%), expected quality of life of the patient (62–72%) and reliability of the prognosis (59–68%). Social costs and out of pocket expenses were considered least important in all countries (7–18%). The U.S. respondents considered costs significantly more important compared to the three European countries ($p < 0.01$) (Table 3).

Involvement in decision making

A majority of the respondents in all four countries (60–75%) indicated they prefer the clinician to initiate the conversation regarding possible WLST. A shared decision between the medical team and family was most preferred by the respondents in all four countries (46–54%) (Table 3).

Discussion

The objective of the current study was to elicit and compare public preferences for prognostic information, attitudes towards the decision to withdraw life-sustaining treatment, and perspectives on acceptable quality of life after post-anoxic coma in four countries.

Although WLST based on a predicted poor outcome is practiced in all four countries studied, over one-third of the respondents did not accept WLST when a poor outcome is predicted with some degree of prognostic uncertainty. However, in clinical practice, where life-sustaining treatment is withdrawn, prognostic uncertainty is never zero.⁹ The majority of respondents indicated that reducing the risk of death due to WLST for patients that would have had good out-

comes (i.e., based on a false positive prediction of poor outcome) should have higher priority than reducing the risk that patients survive with poor outcomes. It is difficult to quantify these risks in clinical practice, due to the self-fulfilling prophecy associated with WLST. However, a recent study by Steinberg et al. (2020), concluded that providers tend to be overly optimistic in their outcome predictions, both in terms of predicted survival as well as functional outcome, which suggests a cautious approach towards WLST. This study also found that none of the patients in which health care providers recommended WLST had favorable outcomes (defined as discharged from the hospital to home or acute rehabilitation).²² On the other hand, an international comparison of current guideline adherence in patients with post-anoxic coma suggests variation in and premature use of neuro-prognostic tests, which might increase the risk of inappropriate WLST.²³

The quality of life after post-anoxic coma is perceived as worse with increased severity of the health state description. In current literature, poor outcome after cardiac arrest is mostly defined as a score of three to five on the Cerebral Performance Categories (CPC).⁸ However, over one-third of the respondents in all four countries perceived a health state description within the domain CPC3 as acceptable quality of life. And even a vegetative state (CPC4) was perceived as acceptable by a minority of the respondents. Over the years, scientific perceptions on acceptable quality of life after coma have changed, and a more narrow view on acceptable quality of life was adopted in outcome evaluation after 2006.²⁴ However, the results of our study align with those of a study among health professionals by Friberg et al. (2015), and suggest that using the CPC categories 4 and 5 as poor outcomes would be more in line with public perspectives on acceptable quality of life.²⁵

The study results suggest geographical variation in the public perspective on prognostication in patients in coma after cardiac arrest in the four countries included in this study. Variation between, but also within the countries, which will make it difficult to reach medical-scientific consensus on prognostication practice. It must be taken into account that these four countries do not represent the public perspective across the world, and these findings only give a first insight in possible variation in attitudes towards WLST and perspectives on acceptable quality of life. Repeating this study in other countries would result in a broader perspective on this important topic.

A strength of this study is its inclusion of a representative sample of the population in terms of age and gender in four different countries. However, we also have to consider some limitations to our sample and the design of our survey. First, we used a web-based survey which was sent out to respondents registered to a market agency. This has likely resulted in a sample that has higher access to computers and is more willing to respond to digital surveys than the general population. Moreover, a little over a third of our eligible survey respondents did not complete the survey, of which most dropped out after answering one or two questions. Lower response rate can introduce bias in the study sample, and it is likely that people who participated had stronger opinions than those that did not.²⁶ Second, we used a descriptive format to describe the short term prognostications and long-term outcomes of patients in post-anoxic coma. By definition, written descriptions are always a reduction of reality, and it is hard to portray risks and severity of a situation in a survey format. We countered this reduction by ensuring that the description did not favor a certain interpretation. We carefully considered balanced wording and excluded any words which suggested

value judgements. We witnessed opposing reactions to the scenarios from health care professionals in the field. Some clinical experts saw them as too positive, while others found them steering too much towards the negative. Therefore, while it is obvious that the descriptions of health states as we used them leave room for interpretation by respondents, we have no reason to think that we steered answers in a specific direction. Third, the opposition towards WLST identified in this study is in contrast with clinical experiences [personal communication] in intensive care units in the countries that we surveyed, in which WLST is often accepted by family members. Obvious differences between clinical practice and the survey format we used in this study include the hypothetical nature of the questions without the actual experience of seeing a family member in coma and the contact and deliberation with a clinician that would be part of clinical practice. However, one could also wonder whether pressure from medical professionals, hospital administration and/or time pressure plays a role. Therefore, further research should focus on the experiences and perspectives of family members of actual comatose patients on intensive care units, family members of patients that have died after WLST, and those of surviving patients.

Conclusion

The results of this study indicate that in four Western countries receiving prognostic information is desirable when a family member is in post-anoxic coma. However, a considerable part of the survey respondents considers WLST in comatose patients after cardiac arrest unacceptable in case of any remaining prognostic uncertainty and prefers to live in health states that are currently considered poor outcomes in medical literature, research, and practice. As a prediction of poor outcome can result in WLST, this indicates the need for a closer look at the practices of WLST based on prognostic information, to ensure responsible use of novel prognostic test information in clinical practice. Further study could focus on preferences and attitudes of family members of actual comatose patients after cardiac arrest admitted to intensive care units, and on how communication between doctors and family members on the ICU influences acceptance of WLST and prognostic uncertainty.

Ethics approval

This study was performed in line with the principles of the Declaration of Helsinki. Approval was granted by the Ethics Committee of the University Twente.

Authors' contributions

Janine van Til and Eline Bouwers-Beens have contributed to conception and the design of the study, execution, and the analysis and interpretation of data. Karin Groothuis-Oudshoorn has contributed to the analysis and interpretation of the data. Mayli Mertens, Marianne Boenink and Jeannette Hofmeijer have contributed to the design of the study and interpretation of the data. All authors were involved in drafting, writing or revising the manuscript and have read and approved the final version of the manuscript.

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Conflicts of interest

The authors declare no conflict of interest.

CRedit authorship contribution statement

Janine van Til: Conceptualization, Methodology, Investigation, Formal analysis, Writing – original draft, Writing – review & editing. **Eline Bouwers-Beens:** Conceptualization, Methodology, Software, Investigation, Formal analysis, Writing – original draft, Writing – review & editing. **Mayli Mertens:** Methodology, Writing – review & editing. **Marianne Boenink:** Methodology, Writing – review & editing. **Catherina Groothuis-Oudshoorn:** Formal analysis, Writing – review & editing. **Jeannette Hofmeijer:** Methodology, Writing – review & editing.

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Appendix A. Supplementary material

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.resuscitation.2021.10.002>.

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