When is it Worth Starting a Risky and Uncomfortable Treatment in Critically Ill Patients? Gender, Education and Professional Involvement in Critical Care Impact on the Opinion

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Abstract

Background: Health care professionals have to judge the appropriateness of treatment in critical care on a daily basis. While there is general consensus that critical care interventions should not be performed when they are futile, it is unclear in quantitative terms, which chances of survival are considered necessary and which risk for serious disabilities is acceptable for different stakeholder in the process of intensive care treatment.

Methods: We performed an anonymous online survey in 1052 people. We considered age, gender, nationality, education, involvement in health care, critical care medicine and treatment decisions as well as personal experience with critical illness as potential influencing variables. On a scale from 0-100%, participants were asked to give their opinion on the necessary survival changes and the acceptable risk for serious disabilities in order to start a high-risk or unpleasant therapy for themselves, relatives and for their patients, if the respondents were health care professionals who are involved in treatment decisions.

Results: For all questions, a maximum of individual variations was observed with answers ranging from 0-100% for necessary survival chances and acceptable risk of disability. A three-peak pattern with different distributions of the peaks was observed for all answers. More respondents would choose a lower necessary chance of survival (0-33% survival) when deciding for patients compared to themselves or relatives to start a risky and uncomfortable treatment. On the other hand, the majority of respondents would accept only a low risk of severe disability for both themselves and their patients. Gender, education, being a health care professional, being involved in treatment decisions and religiosity influence these opinions. Male respondents and those with university education accept a lower survival chance for themselves, relatives and patients.

Conclusion: Our study shows that people have very diverging views on the necessary chances of survival as well as on the acceptable risks for starting a risky and uncomfortable treatment, close relatives and patients. No general cut-off can be identified for the necessary survival chances or acceptable risk to help to quantify “futility”. Individual communication between health care professionals, patients and relatives in each case seems necessary.

Background

In medicine, especially in critical care medicine, fundamental decisions about the therapy strategy have to be made by health care professionals on a daily basis. Decisions on the appropriateness of intensive medical care should be based on fundamental ethical principles such as respect for the autonomy and dignity of the patient. [1–3] Interventions should aim for the well-being of the patient with avoidance of harm as the highest priority as well as fair use of available means. [4] Decisions on the appropriateness of therapies are a common practice in critical care medicine and recommended by practice guidelines. [5] The concept of “futility” has been developed, once it was noticed that therapeutic measures may be technically feasible in critical care medicine but may not benefit a patient. [6] Generally, critical care

interventions should be considered inappropriate when there is no reasonable expectation that the patient will improve sufficiently to survive outside the acute care setting, or when there is no reasonable expectation that the patient's neurologic function will improve sufficiently to allow the patient to perceive the benefits of treatment. [7] It must therefore be ensured that such decisions are made after weighing up all risks and benefits. Evidence-based decision making is common practice in critically care, however patient-centered decisions are often difficult because in critical care, patients can often no longer be asked directly about their will. Decision analysis considers the product of probability of success and utility of an outcome. [8] While it is straightforward and intuitively understandable to use medical futility as a theoretical concept where physicians should or even must cease aggressive treatment, the practical definition is difficult. The Austrian Consensus recommendations on therapy limitation and therapy discontinuation in intensive care units state that a planned admission to ICU is to be based on the existence of a positive prospect of patient survival. [6] This requires on the one hand the accurate prediction of outcome after the intervention, which is not possible in many cases. [9] On the other hand, prediction of "appropriate" positive prospect of a treatment also contains a personal component and may have a high individual variability in the interpretation of a "livable" outcome. Predictions of outcome and quality of life by doctors and nurses are inaccurate with false optimistic as well as false pessimistic results as compared to the judgements of surviving patients 6 months after discharge. [10] It is not exactly known which factors influence the perception of "appropriateness" of treatment in critical care.

In this context, we asked ourselves, which chances of survival are considered necessary by different stakeholders in intensive care (medical professionals, patients, relatives) in order to undergo high-risk or unpleasant therapies or which risk for serious disabilities would still be acceptable. We therefore aimed to determine which chances of survival are necessary and which risk for serious disabilities is acceptable for health care professionals and for non-medical people in order to start high-risk or unpleasant therapies in relation to personal and professional factors.

Methods

A web-based questionnaire in German and English was developed, since no appropriate validated questionnaire could be identified from literature (see supplementary file). The questionnaire consisted of 11–13 questions. Of these questions 8 questions related to demographic characteristics and professional and personal exposure to critical care treatment. Further 3–5 questions then assessed the individual survival chances and risk of severe disability the respondents would accept when undergoing a risky or uncomfortable treatment. Questions were asked regarding the own situation, the situation of close relatives and for patients (for those respondents who are professionally involved in such decisions). Face validity, feasibility and utility was tested by 10 people (medical and non-medical professionals unrelated to the study) before fielding the questionnaire. The questionnaire was distributed via email and social media invitations between 16.9.2016 and 11.07.2020. SurveyGizmo (Boulder, CO 80301 USA) was used for data collection. The study was approved by the research ethics committee of the Medical University of Graz (28–462 ex 15/16). Data collection was performed anonymously without logging any personal identifiers. SPSS V26 (IBM, Armonk, NY, USA) was used for analysis. Data are presented as

absolute numbers, percentages or median with 95% confidence interval. Univariate inter-group data analysis using Chi-Square test was used for categorical data. Normality testing was performed using Shapiro-Wilk test for continuous data. Since variables were not normally distributed, Mann-Whitney U test was used to compare groups. In addition, multinomial logistic regression was performed to identify which factors could predict the changes of survival with and without severe disability that were considered appropriate to undergo risky treatment. A $p < 0.05$ was considered statistically significant.

Results

Characteristics of survey participants

Between September 2016 and July 2020 several emails were sent via professional and private mailing lists and postings in social media groups were placed. Therefore, it is unknown to us, how many persons received an invitation for this questionnaire. 1223 people started the questionnaire, 164 only clicked on the link of the questionnaire and 7 started to answer the questions but did not submit any answers, therefore 1052 questionnaires were available for analysis. The mean age of respondents was 44 (44;45), 396 (37.6%) were male, 653 (62.1%) were female and 3 (0.3%) preferred not to tell. Male respondents were significantly older than female (46 (44;49) versus (42 (41;44) years, $p < 0.0001$). The majority (890; 84.6%) were Christian, 108 (10.3%) were atheists. 531 (50.5%) of the respondents considered themselves as religious, 510 (48.5%) said that they are not religious and 11 (1%) did not answer this question. The majority (693; 65.9%) reported a university degree as highest education, followed by apprenticeship (202; 19.2%) and high school education (140; 13.3%). By far the most respondents were from Austria (932; 88.6%), a few were from Germany (38; 3.6%), Italy (14; 1.3%) and Switzerland (13; 1.2%) and the remaining participants were from 24 countries with no more than 6 respondents from the same country. More women than men (53.6% versus 46.3%, $p = 0.025$) reported that they are religious, more male respondents came from other countries than Austria (15.9% versus 7.0%, $p < 0.0001$), and more men had a university education (76.6% versus 60% of the women, $p < 0.0001$). Religion influenced the rate of respondents who considered themselves as religious (Christian: 57.2%, other religions 30% and atheists 13%, $p < 0.0001$), whereas being religious or not was not associated with education and nationality. Table 1 summarizes the characteristics of the participants

Table 1
Description of the study population

		N	Percentage (from total participants n = 1052)
Gender	Female	653	62.1
	Male	396	37.6
	No answer	3	0.3
Religion	Christian	890	84.6
	Atheist	108	10.3
	Buddhism	10	1.0
	Islam	2	0.2
	Other	30	2.9
	No answer	12	1.1
Religious	Yes	531	50.5
	No	510	48.5
	No answer	11	1
Country	Austria	932	88.6
	Germany	38	3.6
	Italy	14	1.3
	Switzerland	13	1.2
	Other*	43	4.1
	No answer	12	1.1
Education	University	693	65.9
	High school	140	13.3
	Apprenticeship	202	19.2
	Compulsory education	14	1.3
	No answer	3	0.3
*Algeria, Argentina, Australia, Azerbaijan, Bahamas, Bosnia and Herzegovina, Bulgaria, Burkina Faso, Canada, Croatia, Czech Republic, Greece, Hungary, India, Kazakhstan, Netherlands, Poland, Romania, Serbia, Slovakia, Slovenia, South Korea, Spain, Thailand			

The majority of the respondents were health care professionals (73.1%), and from those the majority (86%) reported to work with critically ill patients. From those who reported to work with critically ill

patients, 65.5% reported that they are professionally involved in treatment decisions in critically ill patients. (Fig. 1) 21.6% reported that they already were critically ill or in a life-threatening situation themselves and of those, 65.6% were personally involved in treatment decisions. 77.6% reported that a closely related person has been critically ill or in a life-threatening situation. Of those, 58.6% stated that they were personally involved in treatment decisions. Male respondents were more likely to work with critically ill than women (92.3% versus 86.3%, $p = 0.017$) and to be professionally involved in treatment decisions (83.5% versus 55.6%, $p < 0.0001$). Interestingly, more people who reported that they had been critically ill themselves, also considered themselves to be religious (60.3% versus 48.3% who were not critically ill, $p = 0.002$). A similar association was found for those who reported that one of their relatives was critically ill (53.0% versus 44.2% who had no relatives who were critically ill, $p = 0.002$). Level of education was significantly associated with working as a health care professional (university 81.9%, high school 44.9%, apprenticeship 68.9%, compulsory education 50%, $p < 0.0001$), working with critically ill (university 91.0%, high school 76.3%, apprenticeship 85.6%, compulsory education 57.3%, $p < 0.0001$), and being professionally involved in treatment decisions (university 82.5%, high school 20%, apprenticeship 12.6%, compulsory education 25%, $p < 0.0001$), the numbers of participants with compulsory education are very low and it is unlikely that people with compulsory education only are professionally involved in treatment decisions of critically ill patients; therefore results for this group are questionable. For multivariate analysis education was grouped into university and other (combining high school, apprenticeship and compulsory education).

Participant's answers regarding necessary survival chances and acceptable risks of intensive care treatments

Participants were asked to imagine that they are in the hospital with a life-threatening disease and to give their opinion for which survival chance they would undergo a risky and uncomfortable treatment on a slide scale between 0 and 100%. Next, they were asked to choose for a close friend or relative. And finally, all participants were asked to imagine that they are in a situation for which a risky and uncomfortable treatment will ensure survival, but there is a risk of severe disability after the treatment. They were asked, which risk of severe disability with the need for long-term care they would consider acceptable. Those, who stated that they were health care workers and were professionally involved in treatment decisions of critically ill patients, were also asked to imagine that they are treating a critically ill patient who is unconscious and to decide which survival chance they would consider necessary to begin a risky and uncomfortable treatment on this patient and which risk of severe disability with the need for long-term care they would consider acceptable.

Responses of all five questions covered the complete span from 0-100%. The distribution shows a triphasic pattern for all answers in the density plots (Fig. 2A-E) The answers regarding the necessary survival chances for the respondents themselves and for their relatives showed the highest density of answers in the middle tercile, the answers regarding necessary patient survival and acceptable risk for disability for themselves and patients showed the highest peak in the lowest tercile. (Table 2)

Table 2
Distribution of answers regarding necessary survival
chances and acceptable risks of critical care
treatments (grouped into terciles; low 0–33%,
medium 34–66%, high 67–100%)

		N	percentage
self survival	low	298	29,0%
	medium	383	37,2%
	high	348	33,8%
relative survival	low	332	32,1%
	medium	390	37,7%
	high	312	30,2%
patient survival	low	222	52,5%
	medium	128	30,3%
	high	73	17,3%
patient risk	low	251	61,8%
	medium	99	24,4%
	high	56	13,8%
self risk	low	676	73,0%
	medium	195	21,1%
	high	55	5,9%

Table 3

Multivariate multinomial logistic regression model for necessary survival chances to accept a risky and uncomfortable procedure during critical illness. The lowest tercile (0–33%) of necessary survival chances was chosen as comparator. Independent predictors are printed in bold.

Variable	Comparisons	Wald	adjusted odds ratio	95% confidence interval		adjusted p-value
Medium necessary survival chance						
Constant		3.469				0.063
Gender	female compared to male	10.991	1.714	1.247	2.358	0.001
Education	lower education compared to university education	8.622	1.728	1.199	2.489	0.003
Health care professional	no compared to yes	0.492	1.145	0.784	1.671	0.483
High necessary survival chances						
Constant		15.817				< 0.001
Gender	female compared to male	17.167	2.024	1.450	2.826	< 0.001
Education	lower education compared to university education	17.321	2.185	1.512	3.158	< 0.001
Health care professional	no compared to yes	1.207	1.241	0.844	1.823	0.272

Influence of demographic factors on the answers regarding necessary survival chances and acceptable risks of critical care treatments

Male respondents consider a lower chance of survival necessary for themselves ($p < 0.0001$), for their relatives ($p < 0.0001$) and for patients ($p < 0.039$) to undertake a risky and uncomfortable treatment compared to female respondents. (Fig. 3A-C) While religion did not influence the answers, being religious resulted in considering a lower chance of survival necessary to begin a risky and uncomfortable treatment for relatives ($p = 0.034$) but being religious did not influence any other answer. (Fig. 3D) Nationality was grouped in “Austria” and “other” for this analysis, however, sample size for other nations was still small ($n = 108$), therefore the results for nationality need to be interpreted with caution. Having a nationality other than Austrian resulted in the acceptance of a higher risk of severe disability with the need for long-term care for themselves ($p = 0.014$) and respondents considered a lower chance of survival necessary for patients to start a risky and uncomfortable treatment ($p = 0.009$, only $n = 48$ answers in this group) (Fig. 3E and F). Respondents with university education ($p < 0.0001$ compared to apprenticeship, p

= 0.016 compared to high school) or high school education ($p = 0.008$ compared to apprenticeship) would consider a lower chance of survival necessary to begin a risky and uncomfortable treatment for themselves. A comparable result was obtained for the necessary survival chance of relatives. (Fig. 3G and H)

Influence of professional or personal exposure to critical care on the answers regarding necessary survival chances and acceptable risks of critical care treatments

Being a health care professional but not being involved in treating critically ill patients influenced the answers. Health care professionals would accept a lower chance of survival themselves and for relatives necessary to begin a risky and uncomfortable treatment (both $p = 0.023$). (Fig. 4A and B) When analyzing the results separately for female and male respondents, female health care professionals did not respond differently to non-health care professionals, whereas male health care professionals would accept a lower chance of survival for themselves and for relatives compared to male non-medical respondents. Those, who stated that they are professionally involved in treatment decisions of critically ill patients, would consider a lower chance of survival for themselves ($p < 0.0001$) and for relatives ($p < 0.0001$) necessary to begin a risky and uncomfortable treatment and accept a higher risk of severe disability with the need for long-term care for themselves ($p = 0.002$) (Fig. 4C-E). No gender specific patterns were observed when comparing people who are professionally involved in treatment decisions with those who are not involved. Neither having experienced a critical illness personally nor with a close relative or friend influenced the answers on the necessary survival chance and risk of disability. Also, personal involvement in treatment decisions either when self-affected or for close relatives or friends did not influence the answers on the necessary survival chance and risk of disability.

Multivariate analysis of factors influencing the answers regarding necessary survival chances and acceptable risks of critical care treatments

To understand, which demographic factors influence the necessary survival chances or acceptable disability risks, multinomial logistic regression was used to test the effects of the variables found to influence answers by Mann-Whitney tests (gender, education, religiosity, being a health care professional and being involved in treatment decisions). The choices of the survival chance necessary to accept a risky or uncomfortable procedure for the respondents themselves were influenced by gender ($p < 0.001$), education ($p < 0.001$) and making treatment decisions for patients ($p < 0.001$). In a multivariate model including gender, education and being a health care professional, only gender and education independently influenced the opinion of the participants. (see Table 1)

In a separate model, only health care professionals were analysed to test the influence of being involved in treatment decision and gender on the choice of necessary survival chances of the respondents themselves. Education was excluded from the model because of its strong associations with treatment decision experience. Both, gender ($p = 0.001$) and being professionally involved in treatment decisions ($p < 0.001$) were independently influencing the choice of necessary survival chances. (supplementary Table 1)

Since gender, education, and being a health care professional were not independent of each other, subgroup analysis was done to validate the results of the regression model. The choice of necessary survival chances to accept a risky or uncomfortable procedure of university educated health care professionals involved in treatment decisions ($n = 406$) was only influenced by gender ($p = 0.002$) while gender did not play a role for university educated participants who were not health care professionals ($p = 0.212$). For healthcare professionals who were not involved in treatment decisions ($n = 220$), the main explanatory variable was religiosity ($p = 0.020$). Participants who claimed not to be religious were more likely to choose medium or high necessary survival chances to accept a risky or uncomfortable procedure compared to religious participants (OR = 2.167, 95%CI: 1.001–4.728, $p = 0.05$; and OR = 2.919, 95%CI: 1.355–6.289, $p = 0.006$, for medium and high necessary survival chances, respectively).

Similar patterns were found for the necessary survival chances to accept a risky or uncomfortable procedure for a close relative. Gender ($p < 0.001$), education ($p < 0.001$), health care profession ($p = 0.035$) and being professionally involved in treatment decisions ($p < 0.001$) significantly influenced the answers. Analogous to the necessary survival changes to accept a procedure for oneself, female participants, non-university educated participants, participants with a health care-unrelated profession as well as health care professionals who were not professionally involved in treatment decisions for critically ill patients, were more likely to require medium or high survival chances to accept a treatment for their relatives, compared to male participants, university educated participants, participants with health care professions and health care professionals involved in treatment decisions, respectively. The respective odds ratios are given in supplementary table 2.

For health care professionals with university level education involved in treatment decisions, the driving force was gender ($p < 0.001$); female participants were more likely to choose medium or high necessary survival chances compared to male participants (OR = 2.522, 95%CI: 1.598–3.980, $p < 0.001$, and OR = 1.752, 95%CI: 1.046–2.934, $p = 0.033$, for medium and high survival chances, respectively). For university educated participants who were not health care professionals as well as for health care professionals who were not professionally involved in treatment decisions for critically ill patients, no prominent influencing factor could be identified.

The multinomial logistic regression model to predict the acceptable disability risks to save one's life, identified having a health care profession as the only significant influencing factor ($p = 0.045$). Participants who do not have a health care profession were more likely to accept high risks of disability to save their lives compared to health care professionals (OR = 1.869, 95%CI: 1.036–3.370, 0.038, for

medium and high risk, respectively). No other factor showed significant influence on this decision, neither in the whole study population nor when health care professionals and non-health care professionals were examined separately.

When health care professionals were asked to choose the necessary survival rate of patients to start a risky or uncomfortable treatment, the answers were mainly influenced by gender ($p = 0.007$) and education ($p = 0.020$). Female participants were more likely to require medium necessary survival chances compared to male participants and non-university educated participants were more likely to require high necessary survival chances compared to university educated participants. This pattern was validated in a multivariate model (supplementary table 3)

Since gender was such a prominent influence on most of the categories, we further analysed female and male participants separately. For male participants, a university education ($p = 0.002$), being a health care professional ($p = 0.006$) and being professionally involved in treatment decisions for critically ill patients ($p = 0.002$) were the most influential factors for the necessary survival chances for themselves to accept a risky or uncomfortable treatment. Thereby, being a health care professional was dependent on education and only education was identified as independent predictor by a multivariate model (including education and health care profession). Being professionally involved in treatment decisions and education were highly dependent on each other and could therefore not be fitted in one model. For female participants, education ($p = 0.001$), being professionally involved in treatment decisions ($p = 0.004$) and religiosity ($p = 0.003$) were the most influential factors in this decision. In a multivariate model including education and religiosity, both proved to be independent influencing factors. In a multivariate model including religiosity and being professionally involved in treatment decisions also both factors independently predict the necessary survival chances. All relevant odds ratios are listed in supplementary table 4, multivariate models in the subsequent tables 5–9.

For males, the necessary survival chances for a relative were influenced by education ($p = 0.003$), health care profession ($p = 0.020$), being professionally involved in treatment decision for a patient ($p = 0.001$) and having been involved in treatment decisions for a critically ill relative before ($p = 0.020$). Interestingly, having been involved in treatment decisions for a critically ill relative was not relevant as influencing factors in any other decision or group. In a multivariate model, education and having been involved in treatment decisions (but not being a health care professional) proved to be independent predictors for the necessary survival chances. Answers of female participants were influenced by education ($p = 0.011$) and religiosity ($p = 0.003$), which both showed significant but oppositional influence on the necessary survival chances for relatives. There was no difference in education between religious and non-religious women ($p = 0.221$).

The answers of male participants to the question of the acceptable risk for disability could not be predicted by any of our demographic factors. For females, a marginal influence of being a health care professional could be found ($p = 0.040$). Non-health care professional women were more likely to choose to accept higher risks over lower risks compared to female health care professionals (OR = 2.259, 95%CI:

1.058–4.824, $p = 0.035$). Neither for the necessary survival rate nor the acceptable disability risk for a patient, gender-specific influential factors could be identified.

Relation between answers regarding necessary survival chances and acceptable risks of critical care treatments

When comparing the answers regarding the necessary chance of survival for the respondents, for relatives and for patients to start a risky and uncomfortable treatment, respondents would start a risky and uncomfortable treatment for patients with lower survival chances than for themselves or relatives ($p < 0.0001$). Accordingly, the acceptable risk of severe disability was lower for the respondents themselves compared to the patients. ($p < 0.0001$) The necessary chance of survival for the respondents themselves, for relatives and for patients positively correlated with each other ($r = 0.870$, $p < 0.0001$; $r = 0.657$, $p < 0.0001$). Also, the acceptable risk of severe disability for oneself correlates with the result for patients ($r = 0.452$, $p < 0.0001$). A weak negative correlation between the necessary chances of survival for themselves and for relatives with the acceptable risk of severe disability was also observed ($r = -0.127$, $p < 0.0001$, $r = -0.128$, $p < 0.0001$) respectively). (Fig. 5)

A substantial proportion of respondents would consider either a lower (27.8%) or higher (18.2%) survival chance necessary to start a risky or uncomfortable treatment for their relatives as compared to themselves. 20.6% would consider a lower and only 9.8% a higher survival chance necessary for patients than for themselves for starting a risky or uncomfortable treatment. When asked for the acceptable risk of disability, 16.9% would accept a higher and 10.5% a lower risk of disability for patients than for themselves. Differing answers for the necessary survival for respondents themselves compared to relatives were not influenced by any of the demographic variables. Differing answers for the necessary survival of respondents themselves compared to patients was influenced by gender, 79.9% of female participants but only 67.7% of male participants gave a differing answer for patients compared to themselves. No influence of demographic variables on the difference between the acceptable risk of the respondents compared to the risk of patients was observed.

Discussion

Decision making in critical care is a complex task. While the goal of such decisions – performing treatments that have a reasonable expectation for survival outside the acute care setting with sufficient cognitive ability to perceive the benefits of treatment – are clearly set, it is difficult to quantify what a “reasonable” expectation for survival is. We performed this survey with the aim to quantify these terms. In our survey including 1052 answers from healthcare professionals and people outside the medical field gave interesting insights into these decisions.

Previous studies already aimed to quantify “futility” which can be considered as the opposite of “reasonable” expectation for survival. Physicians, nurses and respiratory therapists have a well-formed

and consistent qualitative opinion on the definition of futile care, [11] however, it is difficult to quantify futility. It has already been suggested by Schneiderman et al. in 1990 that a treatment should be considered as futile when the chance for success is less than 1%. [8] While this is easily written down, it requires a very thorough knowledge of the outcome of a treatment in the individual patient on the one hand and may also be seen very different by different individuals. Data on the exact outcome of treatment are usually not available and outcome predictions can vary considerably between predictive tools, physicians and nurses, with “human” made prediction being superior to using predictive tools alone. [12] The use of prognosis scores alone is also not considered ethically appropriate, since the scores are not developed for the purpose of deciding on “futility” and do not consider the complete picture of an individual patient. [13] The “1% survival chance” to decide about futility of critical care has been challenged by a multicenter, mixed qualitative and quantitative study in the USA where a substantial proportion (32%) of surrogates of critically ill patients elected to continue therapy when survival chances were less than 1% and 18% even elected for treatment to be continued when physicians believed that the patient had no chance to survive.

Our survey challenges the “1% survival chance” cut-off for futility further, since the range of answers span from 0 to 100% for each question asked, indicating a maximum of individual variation resulting in the impossibility to define a cut-off. Interestingly, a three-peak distribution pattern was observed for each question. The distribution of the peaks in the whole group of respondents shows an interesting pattern: While respondents for themselves and for their close relatives most commonly would accept a necessary survival chance between 34% and 66%, health care professionals would accept a necessary survival chance for their patients between 0 and 33% to start a risky or uncomfortable treatment. This indicates that in general, respondents would want a higher chance of survival when making this decision for themselves or relatives than in the professional setting. However, for both themselves and for their patients, respondents would most commonly choose a low (0–33%) risk of disability. While the relation seems “logical” for the decisions made by the respondents for themselves - the risk of disability should be low and treatments should only be initiated when survival chances are at least in a medium range - the decisions in the professional setting for patients may cause inner conflicts for health care professionals: treatment should be started although survival chances are only low but the acceptable risk of disability should also be low.

Answers were influenced by gender, education, religiosity as well as being a health care professional and being professionally involved in treatment decisions in critically ill. Regarding gender, our results support the notion that for women, chances for success of a therapy need to be higher and the potential risk needs to be lower than for men. Female respondents were of the opinion that the necessary chance of survival needs to be significantly higher for themselves, for their relatives and for patients to start a risky and uncomfortable therapy than male respondents. This relates to several studies that observed gender related differences in ICU admission rate as well as outcome. Male patients were more often admitted to ICU than female patients and receive more aggressive life support, but it was unclear whether this relates to differences in risk factors, or differences in decision-making among patients, surrogates or healthcare professionals [14] One retrospective cohort study showed that both gender of the physician and gender of

the patient influence the decision-making process; a female patient – female physician combinations resulted in the lowest likelihood of being admitted to the ICU [15]. On the other hand, an online survey with patient cases showed that the gender of the patients described in the case studies did not influence the decision whether a patient should be admitted to ICU, but female physicians tended to be more willing to admit patients. [16] Regarding outcome, female physician leadership during cardiopulmonary resuscitation is associated with improved patient outcome [17] Elderly hospitalized patients treated by female internists have lower mortality and readmissions compared with those cared for by male internists. [18] Female intensivists also make more decisions during daily patient rounds compared to male colleagues. [19] Gender also seems to influence attitude towards end of life care: Young female adults have a more positive opinion on hospice services compared to male respondents. [20] These findings suggest that the differences in practice patterns between male and female physicians, as suggested by previous studies, may have important clinical implications for patient outcomes. Our study adds to this knowledge, that gender is an important factor influencing our decisions of futility in critical care.

Another noteworthy gender aspect of our study was that the opinion on necessary survival chances to accept a risky procedure was influenced by gender in university educated health care professionals involved in treatment decisions while gender did not play a role for university educated participants who were not health care professionals. We can only speculate on the reasons for this interplay between gender and education, since our study was not designed to elucidate this in more detail. Critical care medicine is a medical specialty where women remain underrepresented, due to institutional and interpersonal factors driving gender inequity. [21] Motivation of students to choose medical schools has been studied extensively and reviewed. [22] Gender influences motivation independent of age, maturity and educational background. [23] Taken together, gender may influence the choice to study medicine and also the choice of medical specialty and this may account for the differences we found between health care professionals and non-health care professionals in our study. It would be of interest to study differences in personality traits of female health care professionals compared to female non-health care professionals to explain these differences further.

Male health care professionals in our study would start risky and uncomfortable treatment also in situations with a low survival chance. Having unrealistic views on the success of intensive care treatment may lead to “escalation of commitment” – a business term that describes the continued investment of resources into a project even after there is objective evidence of the project’s impending failure. In critical care “escalation of commitment” may result in “doing everything” in a futile situation, causing increasing health care costs without any benefit for patients. Factors influencing escalation of commitment in business could be personality type, individual experience and gender [24] Reasons for gender differences could lie in the decision-making process itself, in the perception of “appropriateness” and “futility” but also in general risk behavior, however, data on personality traits and general risk behavior have not been collected in our study.

Interestingly, when looking at the answers of male and female respondents separately, gender specific drivers could be identified with religiosity being a driver in female respondents only. Self-reported religiosity but not the religion itself also had a slight but significant influence on the opinion on necessary survival of close relatives in the whole study population. While in our study, self-reported religiosity was associated with a lower necessary survival chance to start a risky or uncomfortable treatment, a higher surrogate intrinsic religiosity was associated with lower patient receipt of life-sustaining treatments in adults and children [25] In a study in cancer patients, family caregivers and oncologists, male gender and having no religion was associated with approval of withholding life-sustaining measures. [26] In our multivariate subgroup analysis, religiosity was a significant explanatory variable in female but not in male respondents, indicating gender-specific differences in the importance of religiosity in such decisions. Interestingly people who had experienced critical illness themselves or had close relatives who were critically ill, considered themselves more often as religious in our study. Spirituality and spiritual care have an essential role in the treatment of critically ill patients and their families. [27] To the best of our knowledge, an association between previous experience of critical illness and religiosity has only been described in one qualitative study in a Muslim country so far. [28]

Education, being a health care professional and being involved in treatment decisions are strongly interrelated variables. By building different multinomial regression models we were able to show from our dataset that education strongly influences the answers in both male and female respondents. We hypothesize that this difference is most likely attributable to different opinions between nurses and physicians. Being female and working with critically ill patients without having university education, corresponds most commonly to being a nurse in Austria, since the majority of nurses has been educated in nursing schools without graduating with a university degree in the past. Interprofessional concordance on provision of critical care perceived to be futile was low in a study where nurses and physicians were asked to judge independently. [29, 30] Patients categorized by nurses as receiving futile treatment had a lower 6-month mortality compared to those judged by physicians. [29] Different perceptions on futility of care between nurses and physicians are common. [31] Nurses feel better prepared for end of life decisions in critical care. [32] Taken together, our data support the notion of different viewpoint of different groups of health care professionals on treatment decisions in critical care and support the concept that especially in critical care, team discussions and team decisions are necessary and beneficial for team members and patients [9] as part of a bioethical framework to guide the decision-making process in critical care. [1]

Interestingly, a proportion of respondents has different opinions on necessary survival chances and acceptable risks for themselves, relatives and patients. It is well documented, that for approximately one-third of ICU patients, there is disagreement between clinicians and patients/surrogates about the appropriateness of treatment. Disagreement about appropriateness of treatment was associated with prognostic discordance and lower patient/surrogate satisfaction. Patients/surrogates who reported inappropriate treatment also reported lower satisfaction and trust in the medical team. [30] Disagreement may not only be found between clinicians, patients and surrogates, but as our data show, also one individual may have differing views on the necessary rate of survivals and the acceptable risk for

themselves as compared to their relatives or patients. A similar “internal discordance” has been described for surgeons who were more likely to recommend surgery for a patient than they would choose surgery for themselves. [33] The impact of this internal discordance of opinions has so far not been studied yet but may be an interesting field of further studies to understand the reasons as well as the impact on work satisfaction of health care professionals.

Our study has some limitations: As in all anonymous online surveys we have to trust that people answer correctly regarding their demographics. We decided to use the whole dataset, even when data seem to be unrealistic to us, since it was not possible to verify or falsify respondents’ answers and therefore exclusion of participants may introduce a bias. To keep the questionnaire short and therefore attractive for a large number of respondents, we only asked for broad categories of demographic data and did not include any psychometric assessments. Finally, there may be a selection bias in the respondents since the questionnaire was distributed anonymously and we have no data on people who received but did not answer the questions, which is again a limitation our questionnaire shares with other anonymous surveys. Since the questionnaire was distributed by a female (V.S) and a male (M.Z.) researcher, we believe that we introduced no gender specific selection bias.

Conclusion

Our study shows that health care professionals as well as non-medical people have very diverging views on the necessary chances of survival to start a risky and uncomfortable treatment as well as on the acceptable risks for such a treatment for themselves, close relatives and patients. Gender, education, being a health care professional, being involved in treatment decisions and religiosity influence these opinions. No general cut-off can be identified for the necessary survival chances or acceptable risk to define “futility”. These results are of importance when communicating with patients, relatives and in multi-professional teams.

Declarations

Ethical approval and consent to participate:

The study was approved by the research ethics committee of the Medical University of Graz (28-462 ex 15/16) and performed according to the declaration of Helsinki. Participants received the online survey via email or social media and were informed in the introduction that they agree to participate in the survey by filling in the questionnaire anonymously. No separate informed consent was signed by the participants. This procedure was approved by the ethics committee of the Medical University of Graz.

Consent for publication:

not applicable

Availability of data and materials:

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request

Competing interests:

None of the authors reports a conflict of interest

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Authors' contributions:

MZ conception, data acquisition, interpretation, revision and final approval of the manuscript AH analysis, visualization, revision and final approval of the manuscript VS data acquisition, analysis, interpretation, drafting of the manuscript, final approval of the manuscript

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Figures

Figure 1

Distribution of answers in relation to their professional involvement with critically ill patients.

Figure 2

Density plot showing the distribution of responses to the different questions A: necessary survival for the respondents themselves to undergo a risky or uncomfortable therapy when critically ill B: necessary survival for close relatives to undergo a risky or uncomfortable therapy when critically ill C: necessary survival for critically ill patients to undergo a risky or uncomfortable therapy D: acceptable risk for severe disability for respondents themselves E: acceptable risk for severe disability for patients

Figure 3

Density plot showing the distribution of responses to the different questions in relation to different demographic variables (only significant differences are shown). A-C: necessary survival for the respondents themselves, relatives and patients to undergo a risky or uncomfortable therapy when critically ill in relation to gender of the respondents D: necessary survival for relatives to undergo a risky or uncomfortable therapy when critically ill in relation to being religious or not. E-F: necessary survival for patients to undergo a risky or uncomfortable therapy when critically ill and acceptable risk for severe disability for respondents themselves in relation to country of origin of the respondents G-H: necessary

survival for the respondents themselves and for relatives to undergo a risky or uncomfortable therapy when critically ill in relation to education of the respondents

Figure 4

Density plot showing the distribution of responses to the different questions in relation to health care related demographic variables (only significant differences are shown) A-B: necessary survival for the respondents themselves and relatives to undergo a risky or uncomfortable therapy when critically ill in relation to being a health care professional or not. C-E: necessary survival for the respondents themselves and relatives to undergo a risky or uncomfortable therapy as well as the acceptable risk for severe disability for themselves when critically ill in relation to being a being professionally involved in treatment decisions or not.

Figure 5

Correlation plot showing significant correlations ($p < 0.05$, Spearman r) between the answers to the different question in the survey. Larger circle size indicates a lower p value and the intensity of the color (blue = positive, red= negative correlation) indicates the strength of correlation.

Figure 6

Sankey diagrams showing the flow between categories between different questions. The answers were grouped into low survival/risk (0-37.5%), medium survival/risk (37.6-62.5%) and high survival/ risk (62.6-100%). A: necessary survival to start a risky or uncomfortable treatment for the respondents themselves and for a close relative (n=1028 paired answers) B: necessary survival to start a risky or uncomfortable treatment for the respondents themselves and for a patient (n=421 paired answers) C: acceptable risk for severe disability for the respondents themselves and for patients (n=384 paired answers)

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