Original paper

Understanding of human death by Polish specialist physicians

Rozumienie śmierci człowieka przez polskich lekarzy specjalistów

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Słowa kluczowe: śmierć, neurologiczne kryteria śmierci, postawy wobec śmierci mózgu, śmierć mózgowa.

Abstract

Introduction: All over the world it has been accepted that the legal classification of death, and thus the actual death of a human being, is based on brain death. But one must take into account that the process of the clarification of neurological criteria is still ongoing. Medical, bioethical, psychological, and thanatopedagogical scholars debate in order to draw a precise line between the life and death of a human being.
Aim of the research: Due to the social importance of the thanatological topic, a survey was conducted to learn the opinions of specialist physicians on their understanding of human death in relation to the Polish legal and medical regulations in the area.
Material and methods: The study involved 109 specialist physicians employed in various medical centres in Poland. An original questionnaire prepared for this purpose was used to examine the understanding of human death in light of the legal and medical acts that came into force between 2007 and 2019.
Results and conclusions: The study reveals that 12.94% of specialist physicians feel that they can fully and correctly identify the basis for declaring a patient dead after diagnosing the irreversible cessation of brain function, while 57.80% of all respondents understand death in accordance with the legal acts currently in force in Poland. In addition, 72.48% of the study participants indicated that irreversible loss of consciousness is not adequate grounds for determining a patient's death, while 56.89% felt that brain death is equal to the biological death of a human being.

Streszczenie

Wprowadzenie: Od ponad sześćdziesięciu lat zagadnienie śmierci człowieka, w szczególności wskazanie samego momentu, jest przedmiotem debat nie tylko w środowisku medycznym, lecz także w innych środowiskach naukowych. Na świecie przyjęto, że podstawą prawnego uznania zgonu człowieka, a więc zaistnienie jego faktycznej śmierci, jest śmierć mózgu. Trzeba jednak wziąć pod uwagę, że proces doprecyzowywania kryteriów neurologicznych nadal trwa. Naukowcy z dziedzin, takich jak medycyna, bioetyka, psychologia i tanatopedagogika, debatują, aby wytyczyć dokładną granicę między życiem i śmiercią człowieka.
Cel pracy: Ze względu na znaczenie społeczne problematyki tanatologicznej przeprowadzono badania, których celem było poznanie opinii lekarzy specjalistów na temat ich rozumienia śmierci człowieka w odniesieniu do polskich regulacji prawnych i medycznych w tym zakresie.
Materiał i metody: W badaniu wzięło udział 109 lekarzy specjalistów zatrudnionych w różnych ośrodkach medycznych w Polsce. Za pomocą przygotowanej w tym celu autorskiej ankiety oceniono ich rozumienie śmierci człowieka w świetle aktów prawnych i medycznych obowiązujących w latach 2007–2019.
Wyniki i wnioski: Z badania wynika, że 12,94% lekarzy specjalistów ma poczucie, że potrafi w pełni i prawidłowo wskazać podstawy uznania pacjenta za zmarłego po stwierdzeniu nieodwracalnego ustania czynności mózgu, podczas gdy 57,80% ogółu respondentów rozumie śmierć w zgodzie z aktami prawnymi aktualnie obowiązującymi w Polsce. Ponadto 72,48% uczestników badania wskazało, że nieodwracalna utrata przytomności nie jest wystarczającą podstawą do stwierdzenia zgonu pacjenta, natomiast 56,89% było zdania, że śmierć mózgu jest równoznaczna ze śmiercią biologiczną człowieka.

Introduction

Human death in its essence remains a mystery, although it is 'the most predictable event in our lives, one that is to be expected with absolute certainty' [1] (p.1). From the earliest times it is noticeable that thinkers have been struggling with the fact of mortality [2–4]. The problem of death is one of the fundamental topics of philosophical consideration, both in the past and in the present [5–7]. It is worth noting that philosophical and theological reflections on human death have made direct and indirect references to medical science [8–13]. In each of the world's great religions, the teaching on human death depends on both theological declarations based on Revelation and on philosophical assumptions made [14, 15]. In Christianity, the reference to death is directly linked to the belief in the resurrection and in eternal life [16–19]. For several decades there has been a scientific and social debate within various fields of knowledge about the fact of death and the process of human dying [20–22]. Until 1968, doctors determined a person's death based only on cardiopulmonary criterion. This criterion for determining death made reference to physiological changes occurring in the human body, which were characterised by the cessation of signs of life and the appearance of physiological symptoms indicating that death has already occurred. The new definition and criteria for determining human death in relation to the condition of the brain was first defined by the Harvard Ad Hoc Committee, which was closely related to the need for organ transplants. This interdisciplinary body of scientists and scholars initiated the thanatological transition from heart to brain [23–25]. Therefore, starting from the late 1960s, physicians have been ascertaining an individual's death not solely based on the cardiopulmonary standard but also relying on a nationally recognised set of neurological criteria [26, 27]. To date, no single set of neurological criteria has been defined that is valid in all countries of the world. In individual countries, the determination of human death is made taking into account the applicable medico-legal norms. It is an indisputable fact that while the cardiopulmonary criterion for determining human death has been continuously the same for centuries, the over 5 decades-long worldwide scientific debate to establish a single set of neurological criteria has not reached its goal so far. Physicians hold varying attitudes on equating brain death with human death, ranging from complete acceptance to outright denial [28–30]. In addition, brain death is one of the important issues in legal and ethical debates [31–34].

From the qualitative pilot studies conducted in Poland to date, it appears that, to some extent, doctors' reference to brain death depends on their specialty and professional experience [35]. From a medical standpoint, it is evident that there should not be such divergence in opinions regarding the definition and criteria for human death [36]. Every doctor (whether with short or long experience, without specialisation or with specialisation), based on current medical knowledge and the applicable medico-legal norms, should understand and determine the death of a human individual in the same way. In terms of medical advancements, it is crucial for physicians to reach a consensus on the definition of death and the criteria used to determine it. Bearing these principles in mind, it is logical to gather and assess the perspectives of medical experts regarding human mortality. This inquiry can be framed as follows: What factors shape specialist physicians' understanding of death? Do their views on understanding human death evolve as they enhance their professional qualifications through obtaining specialist qualifications? To what extent are the views of medical specialists consistent with the regulations of Polish legislation? The need for this type of research is noticeable, as no quantitative studies have been conducted in Poland so far that would inform us about the understanding of human death by specialist physicians in relation to current legal regulations. In Poland, a study was conducted on the understanding of human death by doctors – but among doctors without specialisation. That study found that the understanding of human death by the vast majority of pre-specialist physicians was not fully in line with the current law in Poland. The lack of such concordance concerned issues relating directly to the determination of human death based on the current set of neurological criteria [37].

In Poland the concepts of 'death' and 'brain death' have reference to the law in force. Between 2007 and 2019, the basic legal act in this respect was the Notice of the Minister of Health of 17 July 2007 on the Criteria and Method of Determining the Permanent Irreversible Cessation of the Brain Function, based on Art. 9 sec. 3 of the 'Cell, Tissue, and Organ Recovery, Storage, and Transplantation Act of 1 July 2005' (acronym NMH2007) (Dz. U./Journal of Laws/No. 169 item 1411) [38]. This legal document was amended in 2019 as the Notice of the Minister of Health of 4 December 2019 on the Manner and Criteria for Determining the Permanent Irreversible Cessation of Brain Function, having its legal basis in Art. 43a sec. 3 point 1 of the 'Act of 5 December 1996 on the Professions of Doctor and Dentist' (acronym NMH2019) (Dz. U./Journal of Laws/of 2019, item 537, 577, 730, and 1590) [39]. This legislation remains in effect. Variances between the 2 documents pertain to the phrasing of the human death definition, the establishment of brain death criteria, and the criteria for brainstem damage. In legal act NMH 2007, human death is defined as 'a dissociated phenomenon', while according to NMH2019 it 'is the permanent loss of consciousness and the permanent loss of all func-

tions of the brainstem'. In NMH2007 it is stated that 'the qualifying factor for brain death is the irreversible lack of brainstem function', while in NMH2019 it is asserted that 'critical brain injury leads to a diagnosis of death based on neurological criteria, traditionally referred to as brain death'. Additionally, there exists a minor discrepancy in the definition of criteria for brainstem damage. According to NMH2007, 'permanent damage to the brainstem is determined by specific nervous reflexes and the absence of spontaneous breathing', while in NMH2019 it was introduced that 'in most cases, the brain oedema resulting from its damage increases from the side of the supratentorial space, and the brain stem dies as the last part of it. Permanent damage to the brainstem is determined by the absence of specific nervous reflexes and the absence of spontaneous breathing'. It is puzzling why NMH2019 does not specify the criterion that determines a human's life or death, while in NMH2007 it was formulated as follows: 'The state of the brain determines a person's life or death'.

In this research study, prompted by ongoing medical and interdisciplinary discourse, the Interdisciplinary Research Team embarked on a study concerning specialist physicians' comprehension of human death. The researchers aimed to analyse the selected statements regarding death and its determination, particularly in light of the prevailing law in Poland. At the time, the legal and medical framework NMH2007 was in effect. It should be noted that shortly after the completion of the research, the Notice of the Minister of Health dated 4 December 2019 was issued. In this official document, death was not defined as 'a dissociated phenomenon', but as 'permanent loss of capacity for consciousness and loss of all brain functions'. The current definition of death enforced in Poland significantly diverges from the operational definition of human death outlined in the Montreal Forum Report of 2012, even though its authors make reference to it. The operational definition of human death does not specify what death is, but states only when it occurs, and more specifically, based on what symptoms it can be determined: 'Death occurs when there is permanent loss of capacity for consciousness and loss of all brain functions' [the subsequent sentence in this Report states: 'In the context of death determination "permanent" refers to the loss of function that cannot resume spontaneously and will not be restored through intervention'] [40].

The existence of ambiguity regarding the comprehension of human death within both the Polish legislations of 2007 and 2019 motivated our Interdisciplinary Research Team to undertake a survey on specialist physicians' interpretation of human death. It was assumed that the opinions of specialist physicians could be helpful for the further medical debate on human death.

Aim of the research

The primary objective of the study was to assess specialist physicians' comprehension of human death in light of NMH2007. In pursuit of this goal, the researchers aimed to address the following inquiries:

1. How do physicians with specialisations perceive human death in accordance with NMH2007?
2. In what areas do respondents' opinions on NMH2017 and brain death align or diverge?
3. To what extent do the views of Polish specialist physicians on human death differ from those of non-specialised Polish physicians?
4. How do age, gender, length of service, specialty type, workplace, and frequency of death determination impact the opinions of surveyed physicians regarding their understanding of human death in light of NMH2007?

The researchers hypothesised that the interpretation of human death among the majority of specialist physicians aligns with the NMH2007 legislation, with any discrepancies likely to be contingent upon their specific area of specialisation. Additionally, the researchers posited that sociodemographic factors such as age, gender, years of experience, and workplace location, as well as the frequency of death determinations, could influence potential variations in their opinions about human death.

Material and methods

The study was carried out from 1 September 2019, to 30 November 2019, coinciding with the period of NMH2007 enforcement. A total of 109 specialist physicians participated in the survey, with over half of them being women (n = 64; 58.72%). The researchers reached out to 200 specialist physicians across various medical centres throughout Poland, resulting in 109 completed questionnaires for analysis, yielding a response rate of 54.50%. The participants who completed the study were practicing physicians aged between 29 and 80 years, with an average age of 49.54 ±12.05 years. Women comprised most of the respondents (n = 64; 58.72%). The participants' professional experience ranged from 4 to 56 years, with a mean of 23.46 ±11.85 years. Most commonly, the physicians worked in teaching hospitals (n = 47; 43.12%), and most of them declared having a specialisation in cardiology (n = 43; 39.45%). Most specialist physicians had made the determination of death in their work (n = 87; 79.82%), with more than half (n = 57; 52.29%) doing so several times a year. The selection of the study group of specialist physicians was purposeful. Doctors with cardiology and internal medicine specialities were chosen because they determine death based on cardiopulmonary criterium. Doctors with anaesthesiology and neurology specialities were chosen because they determine human death using

Table 1. Characteristics of the study group

Variables	Mean ± SD or *N*	Median (min.; max.) or %
Age [years]	49.39 ±12.29	49.0 (29.0; 80.0)
Seniority [years]	23.46 ±11.85	23.0 (4.0; 56.0)
Sex:		
Female	64	58.72
Male	45	41.28
Place of work:		
Teaching hospital	47	43.12
Regional hospital	27	24.77
City/district hospital	13	11.93
Other	22	20.18
Frequency of declared deaths:		
I declare no deaths	22	20.18
At least once a year	6	5.50
Several times a year	57	52.29
Several times a month	21	19.27
More than several times a month	3	2.75
Speciality:		
Cardiology	43	39.45
Internal medicine	30	27.52
Anaesthesiology	18	16.51
Neurology	18	16.51

both cardiopulmonary and neurological criteria. As per existing Polish laws, the determination of human death using neurological criteria involves a commission comprising 2 specialist physicians: an anaesthesiologist and a neurologist. The logic behind the selection of doctors with such specialities was that they have the most appropriate competence, training, and experience in determining human death. The characteristics of the specialist physicians who participated in the survey are presented in Table 1.

For this study, the diagnostic survey method was employed. The research instrument utilised was the authors' test, comprising 100 multiple-choice questions (MCQs) formulated in accordance with the NMH2007 regulations. Questions from the authors' test directly addressing the research topics outlined were specifically selected.

Statistical analysis

The study's findings were employed using numerical data, percentages, and descriptive statistics, encompassing measures such as mean, standard deviation, median, minimum, and maximum values. To investigate discrepancies in the respondents' age and experience concerning their perspectives on the understanding and timing of human death, the Mann-Whitney *U* test was employed due to the absence of normal distribution, necessitating the use of a non-parametric test. Normality of distribution was assessed via the Shapiro-Wilk W test. Furthermore, Pearson's χ^2 test was utilised to explore potential associations between respondents' age, gender, experience, specialisation type, workplace, and frequency of reported deaths.

Results

The research revealed a lack of uniform understanding among specialist physicians regarding death. While 18 (16.51%) respondents interpreted human death as the loss of internal organ integration, aligning with the definition in NMH2007, a significant majority of 63 (57.80%) respondents embraced a more comprehensive view. These respondents not only acknowledged death as the loss of internal organ integration but also recognised it as the cessation of human existence, the departure of the soul from the body, and the irreversible loss of consciousness. Importantly, this broader interpretation of human

death remained consistent with the prevailing Polish legislation at the time of the study. Interestingly, a minor fraction of 2 (1.83%) participants perceived death as the termination of human existence, while 26 (23.85%) participants viewed it solely as the departure of the soul from the body and the irreversible loss of consciousness.

Furthermore, the respondents were queried regarding the vitality of the patient's body when death is declared by a medical board following the diagnosis of irreversible cessation of brain function. In this regard, 14 surveyed (12.84%) physicians concurred with the stipulations of the binding medical and legal act, which state that "...the patient's body is dead when the tissues and organs no longer form an integrated whole, thus they do not constitute a living organism". Conversely, the remaining 95 (87.16%) respondents held that the patient's body remains alive despite the fact that its functionality is limited by either irreversible loss of consciousness (n = 11; 10.09%) or by the fact that the brain is dead (n = 47; 43.12%) or the because the brain does not perform essential organism-coordinating activities (n = 37; 33.95%).

Some respondents expressed scepticism in addressing whether the irreversible loss of consciousness of a patient is adequate grounds for declaring them deceased. This inquiry aimed to assess the extent to which specialist physicians' knowledge regarding death based on irreversible loss of consciousness aligns with the provisions of NMH2007. According to 79 (72.48%) surveyed individuals, none of the responses provided in the test were consistent with the prevailing medical and legal regulations at the time. Conversely, the remaining 30 (27.52%) respondents based their answers on 3 concepts found in relevant literature: bioethics (loss of personhood) [41, 42] – 7 (6.42%); religious or spiritual beliefs (loss of the soul or spiritual aspect of human existence) [43] – 5 (4.59%); and utilitarianism (anticipating entry into a vegetative state and inability to return to active life) [44, 45] – 18 (16.51%). Notably, under NMH2019, the irreversible loss of consciousness of a patient is deemed sufficient grounds for declaring them deceased. It raises the question of whether changes in medical law over recent decades regarding the definition of human death and criteria for determination have led to differing viewpoints, indicating a lack of clarity in understanding and determining human death. Determination of human death should rely on clear, consistent, and timeless criteria regardless of any ideological, political, or economic conditions.

The study also delved into the legal-medical correlation between brain death and human death. According to NMH2007, '... the death of a human being as a whole [determined on the basis of cardiopulmonary criterion – authors' note] in selected cases, is equal to the brain death of a human being as a whole'. Our survey revealed that most specialist physicians, i.e. 65 (59.63%) individuals, concurred with this statement. The remaining 44 (40.37%) respondents provided responses grounded in current scientific discourse found in global literature on the topic. Specifically, 31 (28.44%) surveyed physicians defined the death of a human being as the irreversible loss of consciousness, while 13 (11.93%) individuals interpreted it as the loss of human attributes due to the permanent absence of characteristics distinctive to a human person. Notably, none of the specialist physicians surveyed expressed the viewpoint that brain death is connected to the concept that the brain serves as the seat of the soul [46, 47]. Their opinions are presented in Table 2.

Statistical analysis revealed that most of the surveyed physicians were in consensus that the irreversible loss of consciousness in a patient does not suffice as grounds for declaring the patient deceased. These respondents were notably older (p = 0.006) and had been practicing significantly longer (p = 0.005) compared to those who did not align with the current stipulations of NMH2007 but concurred with alternative concepts of human death presented in the multiple-choice questionnaire (MCQ) responses. Conversely, there were no significant differences in age and years of service among respondents who agreed with the document's contents regarding the understanding of death and the condition of the patient's body for determining death after diagnosing irreversible cessation of brain function – thus equating brain death with human death – compared to those who disagreed with the document's content. It is worth noting, however, that specialist physicians endorsing human death in accordance with NMH2007 were marginally older and had slightly longer tenures compared to those who aligned with other death concepts described in the literature. The associations between the age and seniority of specialist physicians and their stance on the understanding of human death are outlined in Table 3.

Statistical analysis indicated no significant disparities in the responses of the surveyed physicians regarding their comprehension of human death based on gender. However, it was observed that women (n = 40; 62.50%) were slightly more inclined to select the concept outlined in NMH2007 compared to men (n = 23; 51.11%), while men (n = 30; 66.67%) were more prone to provide answers consistent with the document compared to women (n = 35; 54.69%), thus suggesting an association between brain death and human death. Additionally, no significant correlation was observed between workplace, frequency of death determinations, specialisation type, and the viewpoints of specialist physicians on the understanding of human death. The results of these analyses are detailed in Table 4.

The timing of human death has been a highly debated topic in the ongoing scientific and bioethical discourse surrounding this subject. The study revealed that 51 (46.79%) respondents identified

Table 2. Opinions of specialist physicians on the understanding of human death

Statement	*N*	%
I understand human death as:		
The cessation of being a human person.	2	1.83
The leaving of the body by the soul and the irreversible loss of consciousness.	26	23.85
The loss of the internal integration of organs.	18	16.51
Something that requires all the above criteria to be met.	63	57.80
When a medical board declares death after diagnosing the irreversible cessation of the brain function, the patient's body is:		
Alive, but he or she has lost consciousness irreversibly.	11	10.09
Alive, but his or her brain is dead.	47	43.12
Alive, but his or her brain does not perform the essential functions that coordinate the functioning of the body.	37	33.95
Dead, as there has been a disintegration of the organism as a functional whole caused by the collapse of its individual functions over time.	14	12.84
The irreversible loss of consciousness of the patient constitutes sufficient grounds for declaring him or her dead since it means that:		
The patient has lost the characteristics proper to a human person (loss of personhood).	7	6.42
The patient's soul or spiritual element has left his or her body, making it impossible for him or her to be a human being.	5	4.59
The patient is likely to enter a vegetative state and be unable to return to active life.	18	16.51
The above answers are not contained in the current *NMH2007*.	79	72.48
Brain death is the same as the death of the human being because:		
It represents an irreversible loss of consciousness.	31	28.44
It denotes the death of the brain, regarded as the seat of the soul.	0	0.0
It entails the loss of the capacity to be a human being due to the permanent loss of the characteristics specific to the human person.	13	11.93
It is synonymous with the biological death of a human being.	65	59.63

the moment of human death in accordance with NMH2007. Conversely, the remaining 58 (53.21%) respondents provided incomplete or inconsistent responses with the contents of this document. Details regarding these findings are presented in Table 5.

The statistical analysis showed that there were no significant variances in the age and seniority of specialist physicians concerning the timing of human death (Table 6).

There was no significant correlation observed between gender, workplace, specialisation, frequency of death declarations, and the viewpoints of specialist physicians regarding the timing of human death. Cardiologists (n = 13; 30.23%) and internal medicine specialists (n = 10; 33.33%) were slightly more likely to select a response consistent with NMH2007 regarding the timing of death compared to anaesthesiologists (n = 2; 11.11%) and neurologists (n = 2; 11.11%). The findings of the analyses are presented in Table 7.

Finally, the responses of specialist physicians were compared with pre-specialists whose understanding of human death is presented in the previously published article (Leśniewski *et al.* 2022b). Specialist physicians were significantly more likely ($p < 0.001$) than pre-specialist physicians to select responses consistent with NMH2007 as to their understanding of human death. Specialists were notably more inclined ($p < 0.001$) to offer a response aligning with this document, indicating that the irreversible loss of consciousness in a patient is insufficient grounds for declaring them deceased. For the other questions/statements, there were no statistically significant differences between specialists' and non-specialists' understanding of death. Nonetheless, specialist physicians exhibited a slight inclination towards indicating a response in line with NMH2007, suggesting that the condition of a patient's body permits the determination of death following a diagnosis of irreversible cessation of brain function. Consequently, they were more inclined to suggest that brain death equates to human death, aligning with the timing outlined in this document. Please refer to Table 8 for further details.

Table 3. Age and length of service of specialist physicians in the context of their opinion on the understanding of human death

Statement	Reference	Age [years]			Test t-Student		Seniority			Test *t*-Student	
		Mean	SD	Median	*t*	*P*-value	Mean	SD	Median	*t*	*P*-value
Understanding of death in relation to NMH2007.	Consistent (*n* = 63)	51.03	12.01	51.0	1.520	0.131	24.92	12.08	26.0	1.516	0.132
	Inconsistent (*n* = 46)	47.50	11.94	46.0			21.46	11.36	20.0		
Specialist physicians' belief that the irreversible loss of consciousness of a patient constitutes sufficient grounds for declaring him or her dead according to *NMH2007*.	Consistent (*n* = 79)	51.47	11.45	52.0	2.793	0.006	25.42	11.47	25.0	2.894	0.005
	Inconsistent (*n* = 30)	44.47	12.32	43.50			18.30	11.46	17.0		
Specialist physicians' belief in the stipulation contained in *NMH2007* that cerebral death is synonymous with human death.	Consistent (*n* = 65)	51.47	11.45	52.0	-0.277	0.782	25.42	11.47	25.0	-0.161	0.872
	Inconsistent (*n* = 44)	44.47	12.32	43.50			18.30	11.46	17.0		

Discussion

Using the published results of a study in IJERPH [37] on the opinions of Polish early career pre-specialist physicians on their understanding of human death in light of the current NMH2007, the same team of researchers assumed that the vast majority of physicians with specialities in cardiology, internal medicine, anaesthesiology, or neurology would understand human death unequivocally and in accordance with NMH2007. The results of our own study confirmed this hypothesis. Human death is understood by 74.31% of the surveyed medical specialists in accordance with NMH2007. It should be noted, however, that of this amount, 16.51% chose a response that is a complete reflection of the contents contained in this document. For 57.80% of specialists, however (and for 33.63% of doctors without specialities), human death is understood not only as the loss of the internal integration of organs [48–51], but also as the cessation of being a human person, the leaving of the body by the soul (as it is stated in Christian doctrine) [52, 53] or the irreversible loss of consciousness [54] – which is not in opposition to the content of the medical law in force at the time of the study. On the other hand, it is puzzling that for 23.85% of the doctors surveyed, death is only the soul leaving the body and irreversibly losing consciousness, and for 1.83% of them, death is understood only as the cessation of being a human person. This inconsistent understanding of human death is comparable for doctors without specialities (76.99%). It is worth noting, however, that doctors without specialisation were far more likely to choose the answer (43.36%) that very directly reflects the contents of the document than were doctors with specialisation (16.51%). For the researchers this was a surprising result, due to the fact that all physicians with selected specialities who are part of committees adjudicating human death (anaesthesiologists and neurologists) and thus those who most often pronounce death (cardiologists and internists) should have chosen answers that are consistent with existing legislation.

The study's findings also revealed disparities in the understanding of physicians pertaining to the patient's body condition subsequent to the medical board diagnosing death due to irreversible cessation of brain function. The largest percentage of surveyed physicians with specialities indicated that the patient's body is alive, but his brain is dead (43.12%), which is identical to the responses of physicians without a speciality (43.36%). This opinion is consistent with NMH2007. It should be noted that 56.89% of the surveyed specialist physicians and 56.64% of non-specialist physicians did not fully or completely disagree with the contents of NMH2007 in this regard. According to 33.95% of specialist physicians (30.97% of pre-specialist physicians), upon declaration of death based on neurolog-

Table 4. Opinions of specialist physicians on the understanding of human death depending on sex, place of work, frequency of declared deaths, and specialty

Statement	Reference	Sex		Pearson's χ^2 test		Place of work				Pearson's χ^2 test		Declaration of deaths		Pearson's χ^2 test		Speciality				Pearson's χ^2 test	
		Female	Male	χ^2	*P*-value	TH	RH	CH/DH	Other	χ^2	*P*-value	Yes	No	χ^2	*P*-value	C	IM	A	N	χ^2	*P*-value
Understanding of death in relation to NMH2007.	Consistent (*n* = 63)	40 (62.50%)	23 (51.11%)	1.405	0.236	24 (51.06%)	19 (70.37%)	6 (46.15%)	14 (63.64%)	3.654	0.301	48 (55.17%)	15 (68.18%)	1.218	0.270	24 (55.81%)	19 (63.33%)	9 (50.0%)	11 (61.11%)	0.976	0.807
	Inconsistent (*n* = 46)	24 (37.50%)	22 (48.89%)			23 (48.94%)	8 (29.63%)	7 (53.85%)	8 (36.36%)			39 (44.83%)	7 (31.82%)			19 (44.19%)	11 (36.67%)	9 (50.0%)	7 (38.89%)		
Specialist physicians' belief that the irreversible loss of consciousness of a patient constitutes sufficient grounds for declaring him or her dead according to NMH2007.	Consistent (*n* = 79)	48 (75.0%)	31 (68.89%)	0.495	0.482	35 (74.47%)	19 (70.37%)	8 (61.54%)	17 (77.27%)	1.187	0.756	63 (72.41%)	16 (72.73%)	0.001	0.977	29 (67.44%)	23 (76.67%)	14 (77.78%)	13 (72.22%)	1.065	0.786
	Inconsistent (*n* = 30)	16 (25.0%)	14 (31.11%)			12 (25.53%)	8 (29.63%)	5 (38.46%)	5 (22.73%)			24 (27.59%)	6 (27.27%)			14 (32.56%)	7 (23.33%)	4 (22.22%)	5 (27.78%)		
Specialist physicians' belief in the stipulation contained in NMH2007 that brain death is synonymous with human death.	Consistent (*n* = 65)	35 (54.69%)	30 (66.67%)	1.575	0.209	32 (68.09%)	16 (59.26%)	7 (53.85%)	10 (45.45%)	3.414	0.332	53 (60.92%)	12 (54.55%)	0.296	0.586	24 (55.81%)	16 (53.33%)	13 (72.22%)	12 (66.67%)	2.310	0.511
	Inconsistent (*n* = 44)	29 (45.31%)	15 (33.33%)			15 (31.91%)	11 (40.74%)	6 (46.15%)	12 (54.55%)			34 (39.08%)	10 (45.45%)			19 (44.19%)	14 (46.67%)	5 (27.78%)	6 (33.33%)		

TH – teaching hospital, RH – regional hospital, CH/DH – city hospital/district hospital, C – cardiology, IM – internal medicine, A – anaesthesiology, N – neurology.

Table 5. The moment of human death according to specialist physicians' opinions

Statement	*N*	%
Human death occurs:		
At the moment of cardiac arrest.	19	17.43
20 min after cardiac arrest at room temperature.	27	24.77
At the moment when the medical board signs a document declaring the cerebral death of the patient.	12	11.01
20 min after cardiac arrest at room temperature or at the moment when the medical board signs a document declaring the cerebral death of the patient.	51	46.79

Table 6. Age and seniority of specialist physicians and their opinions on the timing of human death

Question	Answer	Age [years]			Test *t*-Student		Seniority [years]			Test *t*-Student	
		Mean	SD	Median	*t*	*P*-value	Mean	SD	Median	*t*	*P*-value
When does human death occur?	Consistent (*n* = 27)	49.59	11.29	51.0	0.025	0.980	22.70	10.88	25.0	–0.380	0.705
	Inconsistent (*n* = 82)	49.52	12.36	48.0			23.71	12.21	23.0		

ical criteria by the medical board, the patient's body remains alive, yet the brain fails to perform essential functions necessary for body coordination. Additionally, for 12.94% of them (7.08% of pre-specialist physicians), the patient's body is considered dead due to the breakdown of individual functions over time, leading to the disintegration of the body as a functional whole. Furthermore, for 10.09% (18.59% of pre-specialist physicians), the patient's body is alive, albeit with irreversible loss of consciousness.

The fact that doctors, along with those acquiring specialisations and thus greater professional competence, more often than not choose not to make statements in accordance with current legislation, is cause for in-depth scientific reflection. The specialist physicians surveyed demonstrated equally varied opinions on whether brain death equates to human death. Most of the specialist physicians (59.63%) and pre-specialist physicians (56.64%) believe that brain death is synonymous with human death because it signifies the biological death of an individual. This understanding is consistent with the NMH2007 document. For the remaining surveyed specialist physicians (28.44%) and pre-specialist physicians (22.12%), brain death is equated with human death due to its representation of an irreversible loss of consciousness and the subsequent loss of human attributes resulting from permanent loss of the characteristics inherent in a human person (11.93% specialist physicians; 14.16% pre-specialist physicians). None of the surveyed specialist physicians perceived brain death as synonymous with human death because it signifies the death of the brain, traditionally considered the seat of the soul. However, among non-specialist physicians, this viewpoint was held by 7.08%.

There are notable disparities among specialists regarding whether the irreversible loss of consciousness in a patient warrants declaring them deceased. While 72.48% of surveyed specialist physicians (and 47.79% of pre-specialist physicians) believed that NMH2007 does not give sufficient grounds for recognising the irreversible loss of consciousness as for pronouncement of death. The responses of 27.52% of specialist physicians (52.21% of pre-specialist physicians) indicated that they either did not know that there was no such provision in NMH2007, or that they considered responses in the worldwide discussion of the topic that only made reference to NMH2007 as more appropriate.

Another hypothesis posited that all surveyed physicians with specialties were aware that, according to NMH2007, the irreversible loss of consciousness of a patient does not suffice as grounds for declaring death, but rather 'irreversible cessation of brainstem function' does. However, this hypothesis was also not validated because analysis of the survey data reveals that 65 (59.63%) respondents selected a response consistent with NMH2007, which was applicable at the time. It is noteworthy that specialists' comprehension of human death appears to be ambiguous, because their responses varied, probably influenced by anthropological, bioethical, religious, or medical beliefs. The final hypothesis suggested that the respondents' understanding of death is not significantly associated with their age and tenure. Nevertheless, the research revealed a statistically significant correlation between knowledge of NMH2007 and the age and experience of the physicians. Younger physicians and those with less experience were more inclined to choose responses aligned with the relevant law (NMH2007). It is worth mentioning that the Inter-

Table 7. Opinions of specialist physicians on the timing of human death depending on sex, place of work, frequency of declared deaths, speciality, and specialist physicians' opinions on the timing of human death

Question	Answer	Gender		Pearson's χ^2 test		Place of work				Pearson's χ^2 test		Declaration of death		Pearson's χ^2 test		Specialty				Pearson's χ^2 test	
		Female	Male	χ^2	*P*-value	TH	RH	CH/DH	Other	χ^2	*P*-value	Yes	No	χ^2	*P*-value	C	IM	A	N	χ^2	*P*-value
When does human death occur?	Consistent (n = 27)	17 (26.56%)	10 (22.22%)	0.267	0.605	10 (21.28%)	7 (25.93%)	3 (23.08%)	7 (31.82%)	0.934	0.817	20 (22.99%)	7 (31.82%)	0.735	0.391	13 (30.23%)	10 (33.33%)	2 (11.11%)	2 (11.11%)	5.473	0.140
	Inconsistent (n = 82)	47 (73.44%)	35 (77.78%)			37 (78.72%)	20 (74.07%)	10 (76.92%)	15 (68.18%)			67 (77.01%)	15 (68.18%)			30 (69.77%)	20 (66.67%)	16 (88.89%)	16 (88.89%)		

TH – teaching hospital, RH – regional hospital, CH/DH – city hospital/district hospital, C – cardiology, IM – internal medicine, A – anaesthesiology, N – neurology.

disciplinary Research Team, apart from the current study, conducted qualitative research among medical specialists regarding the comprehension of human death. The findings of this study are currently being assembled and readied for publication. Additionally, the authors intend to extend their research to other social groups, particularly legal professionals.

The ongoing discourse surrounding brain death centres on the disparity between concept and criterion, the incongruity between criterion and tests, the absence of alignment between tests and concept, and the gap between theory and practice [55]. Consequently, the World Brain Death Project aims to develop a consensus statement of recommendations regarding the determination of brain death/death by neurological criteria. This endeavour considers both literature reviews and expert opinions [56].

In Poland, from 2007 to 2019, the fundamental legal framework (referred to as NMH 2007) for determining brain death in patients stipulated that it entailed "a permanent loss of all brainstem functions". These criteria were established by specialists in medical fields including anaesthesiology, intensive care, neurology, neurosurgery, and forensic medicine. According to experts in these fields, 'Death is a dissociated phenomenon. This means that death engulfs tissues and systems at different times. This results in the disintegration of the system as a functional whole and the successive, permanent falling out of individual functions in different time sequences. Thus, some functions of the system, or parts thereof, may persist for some period of time in isolation from others that have previously died off.' The dissociated nature of the 'phenomenon', as outlined in NMH2007, becomes evident when the brain has been affected by death while blood circulation remains intact. In such instances, experts assert that it is the state of the brain that determines whether a person is alive or deceased. Experts also stressed that the last part of the brain that dies is its stem. Thus, the irreversible lack of brainstem function was considered as a qualifying factor for determining brain death. At the time this research was conducted, the 'Operational Definition of Human Death', established during the 2012 Montreal Forum, was gaining importance around the world. Characteristic of this definition was the refraining of medical experts from indicating the exact moment of human death, which was based on the common knowledge that death in its essence is a mystery and an ontological fact. Based on biological knowledge, one can only conclude that death has not yet occurred or has already occurred. It is for this reason that the Montreal Forum Report does not provide a precise definition of the concept of death, but only states that death 'occurs' when certain consciousness-organic changes take place. Different understandings of human death existing at the same time can lead to relativism and manifest in the use of divergent criteria in determin-

Table 8. Comparison of choices made by specialist and non-specialist physicians in understanding human death and when human death occurs

Question/statement	Answer	The group of physicians		Pearson's χ^2 test	
		Specialist	Pre-specialist	χ^2	*P*-value
Understanding of death in relation to NMH2007.	Consistent (*n* = 101)	63 (57.80%)	38 (33.63%)	13.070	< 0.001
	Inconsistent (*n* = 121)	46 (42.20%)	75 (66.37%)		
Specialist physicians' belief that the irreversible loss of consciousness of a patient constitutes sufficient grounds for declaring him or her dead according to NMH2007.	Consistent (*n* = 133)	79 (72.48%)	54 (47.79%)	14.081	< 0.001
	Inconsistent (*n* = 89)	30 (27.52%)	59 (52.21%)		
Specialist physicians' belief in the stipulation contained in NMH2007 that brain death is synonymous with human death.	Consistent (*n* = 129)	65 (59.63%)	64 (56.64%)	0.205	0.651
	Inconsistent (*n* = 93)	44 (40.37%)	49 (43.36%)		
When does human death occur?	Consistent (*n* = 53)	27 (24.77%)	26 (23.01%)	0.095	0.758
	Inconsistent (*n* = 169)	82 (75.23%)	87 (76.99%)		

ing human death. In this context, the way death is defined in NMH2019 is difficult to understand. One wonders why Polish medical experts, referring directly to the Montreal Forum Report, used the phrase 'death is' instead of the exact translation of the phrase 'death occurs' that is present in it. To what extent can the Polish legislator's thesis that 'death is the permanent loss of the ability to act consciously and the permanent loss of all functions of the brainstem' as determined by instrumental tests be considered valid? Different understandings of human death existing at the same time can lead to relativism and manifest in the use of divergent criteria in determining human death.

Despite the process of refining the neurological criteria by which brain death is determined, which has been going on for more than 50 years, various kinds of doubts, conditioned by both philosophical and theological beliefs and the difficulty of establishing a precise boundary between human life and death, are still pointed out in the worldwide debate on the subject. Therefore, various avenues of research are needed to find out the opinions of both pre-specialist and specialist physicians on the concept of brain death and the neurological criteria used to determine it. To date, research on doctors' understanding of brain death and the criteria for determining it has been conducted in both the US and Canada, as well as in South America, Asia, and Europe.

It is intriguing why only a small fraction of specialist Polish physicians aligned with the binding document on determining when a human body can be deemed deceased. This also prompts inquiry into the factors influencing their belief that irreversible loss of consciousness does not suffice for declaring death. Nevertheless, it is worth considering that physicians with shorter tenures were notably more inclined to support the content of the applicable legal and medical act compared to their more experienced counterparts. The research uncovered a surprising revelation that 53.21% of all respondents provided incomplete or non-compliant answers regarding the timing of human death according to NMH2007. The results of the study conducted on doctors with specialities (especially neurology, anaesthesiology, cardiology, and internal medicine), as in the case of pre-specialist doctors, indicate that previous efforts by medical experts to accurately delineate the fact of death, also ascertained based on neurological criteria, still appear to be insufficient for some doctors. Perhaps for this reason, although the researchers expected that doctors with qualifications would not have any doubts in their understanding of human death, the study found that, unfortunately, this hypothesis was not confirmed.

Conclusions

Physicians specialising in various fields exhibited a varied comprehension of human death, with the majority perceiving it in a manner inconsistent with the binding legal act NMH2007. A very small number of respondents suggested that the patient's body is considered deceased when tissues and organs cease to form an integrated whole, thereby not constituting a living organism. This viewpoint aligns with the aforementioned legal and medical document. A smaller percentage of participants concurred with the content of the binding medical and legal act, regarding the irreversible loss of a patient's consciousness as sufficient grounds for declaring them deceased. Conversely, most respondents upheld the validity of concepts of human death (bioethical,

religious, and utilitarian) found in the literature on the subject. For most doctors, determination of human death relied on cardiopulmonary criteria in line with applicable medical procedures, as well as the criteria for determining death outlined in NMH2007 (death of the human brain as a whole). Statistical analysis revealed notable differences in age and tenure concerning responses regarding the irreversible loss of consciousness of the patient as a sufficient basis for determining death, while NMH2007 equates brain death to biological death.

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