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The Journal of Philosophy and Ethics in Health Care and Medicine has revised its submission guidelines, starting from this issue. The journal will now accept and publish two types of papers: newly submitted papers and secondary publications of papers that have already been peer-reviewed and published in Japanese.

Newly submitted papers will undergo peer review by the journal's editorial board. On the other hand, secondary publications, having already undergone peer review, will not be reviewed again by the editorial board. Instead, the editorial board will determine whether to publish the paper and, if necessary, suggest modifications to enhance its quality as an English-language publication. Additionally, secondary publication papers must include a statement between the abstract and the main text, indicating that they are secondary publications, along with the name of the original journal and a note regarding the permission for republication.

As a result, this year's issue includes one newly submitted paper and two secondary publication papers.

Another change introduced with this issue is the transition to online-only publication, discontinuing the printing of physical copies.

The summaries of the papers included in this issue are as follows:

The newly submitted paper is Baby Box and the Concept of Epistemic Injustice in Japan, by Sylwia Maria Olejarz. Through the lens of epistemic injustice, this paper examines the Baby Box, a system allowing parents who find it difficult to raise their child to anonymously place them in care. Based on an analysis of epistemic injustice, the paper also proposes future measures to be taken.

Two secondary publication papers are included in this issue. The first is Totsuka Yoji's View on Life and Death: A Natural Scientist's Objective Self-Awareness by Ren Ino. This paper discusses the blog written by Totsuka Yoji, a prominent candidate for the Nobel Prize in Physics. Totsuka left behind a blog before his passing from cancer, and this paper examines his views on life and death as expressed in his writings.

The second secondary publication paper is Bioethical Study on Radiation Exposure in Medicine—Proposed Behavioral Changes During Radiological Examination in Medical Practice, by Osamu Kamei and Koichi Setoyama. This paper explores radiation exposure in medical examinations, analyzing the issue based on the principles of beneficence and nonmaleficence. It also reassesses the approach to obtaining informed consent from patients and suggests improvements for future practice. These are the papers included in this issue.

Finally, we would like to express our gratitude to Hitoshi Arima, the former editor-in-chief, for his support in publishing this issue and for his dedication to the journal during his tenure.

Baby Box and the Concept of Epistemic Injustice in Japan

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Abstract

A baby box is often portrayed as a last resort to save the lives of unwanted infants. However, this paper aims to add a new contribution to this ethical problem in Japan and clarify it within the context of epistemic injustice: (1) testimonial and (2) hermeneutical. The author hypothesizes that parent/s in despair who will give birth or have already given birth to an unwanted baby originally have tendencies to isolating behavior (learned helplessness, social fear, and avoidant patterns in the face of a problem). Probably at some point in their lives, they were the subject of epistemic injustice (school, the closest community) and due to this reason, they tend to avoid public social welfare institutions and in the worst scenario, commit infanticide. The author argues that parent/s in crisis stay helpless and silent (testimonial smothering) or are silenced (testimonial quieting) facing epistemic injustice in society. In conclusion, the author suggests two possible options (that are not mutually exclusive) to approach this problem:(1) providing more baby boxes with the possibility for unbiased consultation for both sexes and (2) including mandatory education on the concept of responsible parenthood and the value of prenatal life in the junior high school and high school curriculum to enrich students' language, understanding and emotional processing of the problem of pregnancy. Hopefully, the mentioned countermeasures can break the silence of "voiceless" parent/s and decrease the number of infanticides in Japan.

Keywords: baby box, baby hatch, child abandonment, baby dumping, Japan, epistemic injustice, testimonial injustice, hermeneutical injustice.

Introduction

On May 31, 2022, a tragic situation took place in Chitose, when a woman placed the body of her newborn baby in a coin-operated locker (case A). That woman did not know what to do and how to ask for help. She stayed isolated from family and friends and panicked. This led to an enormous tragedy both for her baby and for her. She did not know that there was a newly opened baby box a one-hour train ride from Chitose, in Tobetsu. Another example is a woman who contacted a baby box in January 2024 (data confidential). In this case (B), a woman confessed that she *intentionally* did not want to contact public social welfare centers (hospitals, Ninshin SOS, hotlines, etc.). She believed her story would not be heard and understood, so she chose the private baby box in Tobetsu. In case C, in February 2023 parents (data confidential) contacted local welfare institutions and consulted their case; however, they were unable to receive any satisfactory solution. They contacted Tobetsu Baby Box and after online consultations decided to bring their baby there. What lessons about injustice (testimonial and hermeneutical) can be drawn from these three cases? Before the analysis, I will briefly outline the scale of the child abandonment and child abuse problem in Japan.

2. The Significance of child abandonment and child abuse problem in Japan

The problem of child abandonment in Japan raises serious ethical concerns. Dr. Takeshi Hasuda, who is in charge of Kumamoto Jikei Hospital's baby box, underlines the scale of the problem stressing that "there are about 20 cases of abandonment or murder of babies per year (Hasuda 2022)[1] However, we cannot forget about the cases of child abuse and neglect, which are constantly rising from year to year. According to the recent government data, there were 219,170 child abuse in fiscal 2022, marking an increase for the 32nd consecutive year.[2] Child abuse and child neglect can be prolonged in time and only in the worst scenario is punctuated by a child's death. Many victims are suffering in silence (babies, mothers with severe postpartum depression, and victims being in the vicious circle of domestic violence, DV). The parents are scared and silenced to the level that they are physically and mentally unable to contact public institutions. Many victims gave up helplessly and did not act rationally.

3. The Existing solutions and options for unwanted pregnancy and unwanted infant

In the event of an unwanted pregnancy, a mother in Japan has several options, which require making her personal information public. The first is abortion. Currently, there are two types of abortion in Japan: 1) a surgical abortion A) up to 12 weeks gestation (mechanical removing fetus from the uterus up to 12 weeks gestation by the method of curettage or aspiration) and B) from 12 to 21 weeks 6 days gestation (induced abortion); 2) a medical abortion introduced in Japan in 2023 (up to 9 weeks gestation) by using the oral abortion drug (Mifepristone/Misoprostol). The national insurance system does not cover abortion expenses, and the procedure requires the written consent of the woman (depending on the clinic, sometimes the consent of a partner is also required).[3]

The second option is direct consultation at Child Guidance Centers across Japan. They work according to strict guidelines, and workers are obliged to carry out a family assessment to check whether the family has the conditions to raise a given child. This option is often criticized for being bureaucratic and non-empathetic. This option cannot be anonymous (a person must provide a valid ID or insurance if they want to use the health care system and receive the Childbirth and Childcare Lump-Sum Grant).

The third option is a hotline which provides anonymous consultation via telephone, LINE, and e-mail ("Ninshin SOS"). However, their offer is limited to providing specific addresses and information requiring direct consultation; employees cannot anonymously accept children in the event of an emergency.

The fourth option is a Non-Profit Organization (NPO), which can consult each case, provide psychological care, temporary shelter, and material assistance, and arrange (in some cases) special adoptions. However, NPOs cannot anonymously accept unwanted infants.[4]

The last option is a baby box (anonymously accepting unwanted babies). The only officially recognized baby box is located in Kumamoto Jikei Hospital and operated by Dr. Takeshi Hasuda. Since December 2019, the hospital has provided an additional option called "confidential birth". with established guidelines.[5] In this paper, I would like to introduce the second baby box (not officially recognized by the government), established by a private woman in Tobetsu town, Hokkaido, in May 2022 (here called Tobetsu Baby Box).

4. A private baby box in Tobetsu town as an example of a grassroots movement to protect infants from baby dumping in Japan

In May 2022, a woman living in Tobetsu town in Hokkaido opened a private, anonymous baby box. This idea was added to other services within her Citizens' group. In the period between May 2022 and May 2024, she received about 2084 messages related to baby box and child abandonment, about 43 children (per each year) received temporary custody, and her baby box accepted 6 babies (including a baby with a disability) in the period between May 2022 and January 2025.[6] Five newborns and one baby (not a newborn, data about the age are not made public.). All of the babies were received directly, from hand to hand. Five babies

were inducted in a confidential manner (The Tobetsu Baby Box operator knows the names of parent/s and their contact) and only one case was accepted anonymously (directly, from hand to hand, without data about the parents). All services provided by Tobetsu Baby Box are free of charge (transportation, food, shelter, clothes, daily necessities for children, psychological consultations, various therapies, and becoming a surrogate for matters of health and insurance.

The service has no particular conditions (except prior reservation) and accepts babies regardless of age, health condition, nationality, etc. It must be stressed again that in Tobetsu Baby Box, babies must be transferred directly from the parent's/ parents' hands to the operator's hands to avoid a police investigation. So far, all babies (except one case, not public) received by Tobetsu Baby Box can access and receive information about their origins, in the future (The operator has the contact and address of their biological parent/s).

However, Tobetsu Baby Box has no close access to health services (hospital, gynecological and obstetrical care, midwife service, neonatal intensive care, etc.) and for this reason, was requested about 23 times by the Hokkaido Government Office to stop its operation.[7] The argument is serious, namely, that in the case of an emergency, both mother's and infant's life and health could be endangered.[8]

What are the main differences between the Tobetsu Baby Box and the other options provided by the public support system in Japan? The differences are summarized in the table below:

Baby Box Tobetsu	Public Support System
Private operation, therefore, more flexible	Government-supported, therefore, strictly regulated
No particular conditions (except advanced reservation before visiting)	Many formal conditions
Anonymous or confidential (disclosing personal info. to the operator of Tobetsu Baby Box)	To receive support parent/s finally must disclose personal data
High level of trust	Low level of trust
Altruistic motivation	Government ordered
Nonjudgmental, empathetic attitude,	Formal and bureaucratic atmosphere
People with no family registry, or insurance also can use	Must have ID/insurance to use

Clearly, the biggest advantage of the Tobetsu Baby Box is that the operator is a private person who, in difficult cases that cannot be resolved within other legal frameworks, uses the law of 'normal adoption' and 'Legal Guardianship for Minors' as a last resort.[9] After a baby is born, legally she will be the baby's grandmother. She can legally register the baby in the operator's family register and apply for a resident card record and the insurance for the baby.[10] Staff at public institutions cannot act similarly, so babies are sent to various public facilities and must wait for adoptions and decisions of the family court for an unknown period. However, public consultation institutions are also invaluable, in the later stages of the unwanted babies problem, and they also regulate the formalities of registration. The cooperation between public consultation institutions and the Tobetsu Baby Box should be strengthened, by maintaining a *win-win strategy*.

Three possible scenarios are

1) *a lose-lose scenario* when child abandonment and child abuse problems will not be addressed by public institutions (lose), and Tobetsu Baby Box will be forced to close its operation (lose).
2) *a lose-win scenario*, when Tobetsu Baby Box will be forced to close its operation (lose) and institutional support will have a very minimal positive change (win).
3) *a win-win scenario* when Tobetsu Baby Box and public institutions will work together and complement each other's deficiencies. Tobetsu Baby Box in this scenario is considered a "mediator" between parent/s in distress and the public support system.[11]

In this part, I want to stress that the originality of this study lies in the unique research method, called ethnographic immersion. In other words, the author used the method of long-term participant observation of the Tobetsu Baby Box settings (as the author lives in the same town). The author gained information from direct observations, semi-structured interviews, talks with Baby Box guests, document analysis, talks with people in charge of this issue in the local Child Welfare Center, and laypeople from various communities in the town. However, the most important are 1) the voice of the operator and 2) first-hand data disclosing the reasons for choosing the Tobetsu Baby Box. The author will analyze the opinion of the

Tobetsu Baby Box operator and then two voices – reflections – of the Tobetsu Baby Box users.

5. Why do we need Baby Boxes in Japan – the voice of the operator of the Tobetsu Baby Box

This section presents the most important comments and statements made by the operator of the Tobetsu Baby Box in a semi-structured interview, to explain more vividly why such a service is invaluable in Japanese society.

The first and most important question given to the operator was: "What was the main reason for starting Baby Boxes?" She explained: "Japan is a welfare state. However, in reality, sad and painful incidents such as infant murders, forced suicides, and child murders by parents due to child abuse occur. I opened the baby box because I want to help unconditionally the most vulnerable babies and children."

In this answer, the Baby Box operator wanted to stress that the most important point of her service is "unconditional help," which can be perceived as the personification of the Christian "Good Samaritan" concept.

The next question was: "What is the need for Baby Boxes in Japan?" The reply was: "Tobetsu Baby Box is a means of conveying the message: "We will definitely help you."[12] I think it's important not to refuse help. We cannot refuse, no matter whether it is anonymous or not, no matter what the background or circumstances, no matter how high the risk."

Here again the Baby Box operator's „no matter what" attitude exemplifies an unconditional willingness and readiness to help unknown people in trouble, demonstrating an altruistic attitude toward them. This type of behavior is called "pure altruism" in evolutionary psychology when individuals are involved in helping others without expectation of reciprocity or material gain. However, some studies in social neuroscience show that altruistic behavior is not "purely" selfless, because it brings a "feeling good" effect to the altruist. Namely, altruistic behavior activates specific areas in the human brain (nucleus accumbens), which is a part of the reward system path and contributes to the release of dopamine (a" feel good" hormone and neurotransmitter).[13]

The author's next inquiry was particularly essential for her 12-year research on baby box systems: "What is the role of the Baby Box?" The response surprised the author: "Celebrating the birth and existence of a child. Protecting the <<lives>> and <<hearts>> of children and parents. A place where parents' values, circumstances, and thoughts are not denied."

This response vividly shows respect for the parents' situation, without denying their feelings and traumas and without judging whether it is right or wrong. The answer also brings a surprising word "celebration". "Celebration" is associated with happy events, such as weddings and the birth of a new life. However, in the case of unplanned and unwanted pregnancies, nobody celebrates the birth of new life but rather laments over the birth of a new burden and trouble. Therefore, the perspective adopted by the Tobetsu Baby Box operator and her attitude toward "unwanted life celebration" is particularly outstanding. She is the only one to find a glimpse of joy and blessing in the extremely hopeless and sadly tragic situation of a mother and her unwanted infant. This need to "celebrate" life irresistibly reminds the author of the need to build a "culture of life", which John Paul II called for in his encyclical "Evangelium Vitae" and contrasted it with the "culture of death".[14]

The next question to the Baby Box operator was: „How does the baby box specifically help society and the Tobetsu/Sapporo area?" The lady answered:

> An important function of government is to protect residents. Tobetsu Baby Box is useful in making visible "facts" that the government does not see and cannot comprehend (cannot grasp).[15] The essential role of Baby Box is <<connecting>> so that the government can actually provide practical support for infants, mothers/parents. Children have no guilt or responsibility. I am truly grateful that the government and citizens are working to help children.

Here, it is important to acknowledge that there are "blind spots" in the public support system provided by governmental institutions. Although public institutions have good intentions and work very hard, it is impossible for them to reach the weakest people in desperate need (with learned helplessness and avoidant behavior strategies). They intentionally avoid and hide from society. Such people often feel shame, do not trust

institutions, and do not want to cause a burden to others.[16]

In the second part of the question about the usefulness of Baby Box for Tobetsu and Sapporo, she answers:

> On the contrary, Baby Box has increased administrative work to public institutions and at the same time has received a lot of generous and flexible help. Tobetsu Baby Box does not want to take away the work of child guidance centers. Baby Box is targeting only that part, which the government cannot do due to its position. For example, the government must take a stance of <<responding equally according to the manual>>. Regarding Baby Box, I believe there is no point in implementing Baby Boxes unless they convey the message:<<You are very important. We want to help you. You are a special person. Thank you so much for trusting us. Congratulations on giving birth!>>

This part stresses the very high altruistic standards of Baby Box, its flexibility, and points out the importance of showing a "more human face" of social help. Therefore, this unique selfless attitude should be noticed and positively evaluated by Japanese society.

The next question was: "What is the most important challenge for Baby Box going forward?" The lady answered: "I hope they will be established throughout the country. It is essential to have a consistent level of quality and a clear concept of Baby Boxes."

In this statement, she underlines that we do not have to institutionalize Baby Boxes; however, when we establish new Baby Boxes, we have to keep the same spirit of altruism and unconditional acceptance of the most vulnerable group – unwanted infants and their parents.

The author's next question was „Why is it necessary to increase the number of baby hatches across the country (Japan)?" She replied:

> Consultation services are available nationwide. However, incidents still occur. There's a need for Baby Boxes (places that offer unconditional love) where people who cannot seek public consultation can feel safe according to their own values. If it is simply <<a box to put babies in,>> it would be rational to install them at hospitals, fire stations, or child consultation centers.[17] If the concept of a baby box is created just only to add safety ("just putting a baby in a safe place or box"), that could be an option. However, in my personal opinion, that feels sad. I want to warmly welcome the parents and children who come. For those who are suffering and are at their limit, I believe what they need the most at this moment is <<kindness rather than correctness.>> I believe babies and children are beings to be <<celebrated>> and loved."

The phrase that struck the author most profoundly, as used by the Baby Box operator, was "atatakaku omotenashi shitai desu" ("I want to offer warm hospitality/ welcome them with warmth"). The word "omotenashi" is typically reserved for guests, particularly those who are long-awaited or considered special. It is exceptionally unusual to employ this word about mothers relinquishing their unwanted infants.

The next inquiry to the operator was: "Are you planning to cooperate with overseas Baby Boxes? Is it important?" She answered:

> Yes. I will cooperate in any way I can. This is very important for future generations as well. I refer to overseas baby posts. It broadens my perspective and gives me courage. By learning from precedents, positive aspects, and challenges, I believe we can implement solutions and evolve into a better form. Tobetsu Baby Box is a unique practical example. It's located in a suburban area with heavy snowfall; it is a private residential-style facility; despite being the northernmost, it serves the entire country; it is not limited to just infants; there is no paid staff; it operates on a reservation system. All cases involve direct handovers of babies from hand to hand (I believe the key point is to gain trust, making people feel that even when meeting face-to-face, this person will not betray them).

Here it is essential to notice, that Tobetsu Baby Box is building not only on the experience of the Kumamoto Baby Box at Jikei Hospital but also on the traditions and ideas found in countries such as Germany, Poland, Italy, and the US, where baby boxes[18] are utilized as the last-resort solution to an illegal baby abandonment problem. There are many people of goodwill abroad who spread the concept of care for unwanted babies and will certainly support Tobetsu Baby Box, if they learn about it. The difficult barrier is the Japanese

language and the lack of information and scientific papers on this topic in English.

Additionally, the author was interested in the "educational disparities" of Tobetsu Baby Box users. The operator of a Baby Box confirmed educational disparities and explained:

> In cases where people used or contacted us intending to use Tobetsu Baby Box, and in cases I supported them, I felt the <<educational disparities>>. Some people had only completed junior high school education, while others, though not <<intellectually disabled>>, had very weak comprehension and foresight. For example, there was a case of an expectant pregnant woman who had not had prenatal check-ups and was in financial trouble close to her due date. She went far from home without bringing money, and her labor started there. She contacted me anonymously after labor began, but she could not foresee that if the baby was born at that location, nothing could be done. On the other hand, this woman was very honest and loving. The baby was safely transported to the hospital in time, and born there. The woman found the baby so cute that she decided to raise it on her own; she understood that she would receive administrative support, and we (the Baby Box operator and the mother) were able to move forward together.

Tobetsu Baby Box operator stressed that she "believes that with comprehensive and generous support, we can find solutions for the people needing support due to so-called <<educational disparities>>.

The founder of Tobetsu Baby Box underlined the opposite situation: "On the other hand, there were also some people who thought, <<I don't want absolutely anyone to know about my family life, because I have a socially trusted profession>>. In that sense, <<educational disparities>> are also involved and relevant."

Here is the key answer to why some women act completely irrationally under the influence of impulse, which potentially leads and actually has led to a tragedy for a baby. Of course, one reason is that the mothers are in postpartum shock, but a contributing factor is a lack of elementary knowledge (about the birth) or a lack of prudence and an inability to foresee the consequences of their actions.

However, what the author wants to stress the most is the solution proposed by the Baby Box founder. She suggested that "even if we deal with poorly informed and distressed parents, it is not hopeless as far as we are <<generous>> supporters (teatsui sapōto)". These words are again, very exceptional and unusual when applied to mothers of unwanted infants.

Additionally, the Tobetsu Baby Box operator mentioned the tragic Italian accident, which took place in January 2025.[19] She stressed that it could be closely related to "educational disparities". She explained:

> A tragic incident involving a baby box occurred in Italy. From this incident, we can infer the following about people who use baby boxes: They may not understand how to close the door properly. They may not understand the importance of making sure the door is tightly closed. You may not realize that leaving the door open in the winter can expose your infant to cold temperatures and put them at risk of death from hypothermia.[20]

Teaching students (starting from junior high school age) through careful analysis of tragic cases of baby relinquishment and what to do and what not to do in the event of anonymous use of Baby Box would help to reduce poorly informed expecting parents.

The author was interested in whether there were any gender disparities in Baby Box use. The operator of Baby Box answered that

> A pregnant woman under emergency conditions is a "female". In cases of rape or cases where the sexual partner is unknown, only women contact me.It is important to provide special consideration and confidentiality and to support them in a way that suits their needs. In some cases, the woman's partner, who is not the baby's father, contacted us to help the woman and her baby.

She explained that married couples also contacted her service in Tobetsu: "Among infants and child-rearing generations, there are many cases involving married couples." She also mentioned the cases of when "mothers with postpartum depression or a history of psychiatric treatment reach their limit, go beyond it, and send her an SOS when they feel they have no other options."

Importantly, the operator of the Tobetsu Baby Box explained that "there have been multiple cases

where fathers, feeling cornered, have trusted me and consulted the Baby Box." But she emphasizes: "When people reach their limit there is no gender disparity."

Tobetsu Baby Box's founder recognizes existing patterns in handled cases: "There are certain patterns. Half of the cases I have handled involved men. In all cases involving infants, men were also part of the situation. Cases of single births and a newborn within 5 days of birth were all contacted by women only."[21] She accurately notes that "Legally speaking, for single mothers, if they are the sole parent with custody, it is easier to consent to <<special adoption>> compared to married couples. Child consultation centers also find it easier to protect in such cases."

The Tobetsu Baby Box operator, as an eyewitness to the crisis of women in distress, emphasized that "true emergencies arise in the case of complete isolation" (no partner, nobody to assist during childbirth). In such a situation, no one is present to observe or respond to potential tragedy. A secondary level of emergency involves women who suffer from postpartum depression or other psychiatric disorders and who live with a partner". Initially, the partner is the first person to notice the potential danger. These cases are difficult to prove as "unable to raise" and are often not recognized as valid concerns by public institutions.[22]

The author asked about the most important societal fears and concerns related to the baby box. The lady answered: "Japan has many dedicated doctors, pregnancy services, and child support practitioners with noble intentions. However, Japan's challenge lies in the fear of administrative repercussions for actions not officially sanctioned, which could lead to "professional ruin" (for example, suspension of insurance reimbursements for hospitals or revocation of medical licenses for doctors)."

Lastly, the author sought to understand what an individual can do to protect vulnerable infants. She answered, giving an extensive explanation: "The Baby Box is a place that protects the <<life and heart>> of both children and parents. Japanese administration also wishes to protect children and deeply understands that children bear no guilt or responsibility. The goal is the same. By taking various approaches, the most vulnerable children can be saved. Parents and families can also be saved. The most important thing for each individual is to <<take action>> in whatever way they can." Based on this reply, the author believes that every reader can support and contribute to solving this problem using their skills and available resources.

In the next section, we will finally give the voices of Tobetsu Baby Box users and see the problem of child abandonment from their perspectives.

6. The Voices of Tobetsu Baby Box Users

Between May 2022 and March 2024, more than 2000 inquiries and consultations were performed by the Tobetsu Baby Box operator via LINE, short message, phone, or email.[23] The author wants to present and analyze the content of two responses written to the question: "Why did you decide to use/consult the Tobetsu Baby Box?"(Informed consent was obtained to disclose anonymously the content and use it in this paper).

Person A (a father's voice)

"This is because I felt that even if I consulted a public institution, the response would be bureaucratic and they would not care about my situation or my feelings. I received advice from the Tobetsu Baby Box operator and consulted a Child Guidance Center. No matter what kind of decision, they continue to say: << I will consult with the person in charge.>> I was also passed around. It is normal for (the Child Guidance Center) to send no message for 2 weeks, but when I finally contacted them from my side, they said: <<We are currently checking the situation.>> My wife is physically and mentally exhausted and tends to be depressed, though she still keeps going. The Child Guidance Center visited us at home and said that the house was not dirty and that our second daughter, who has Down syndrome, was not skinny. According to the view of the Child Guidance Center, they judged that we (my wife and I) could raise the baby and refused our application.

After that, the Child Guidance Center wouldn't do anything, so I told them that I was thinking about using a baby box. Then another person in charge of the Child Guidance Center contacted me and we had another discussion, but there has been no progress so far.

To be honest, I don't have much hope for the Child Guidance Centers anymore."[24]

Person B (An unmarried pregnant woman who had not been diagnosed at the hospital, had little money, and had no place to live)

"The reason I asked the Tobetsu Baby Box operator is that it is hard to rely on public institutions, so I looked at the website and I thought that Baby Box would be able to take my circumstances into consideration and help!"[25]

Additionally, it is worth noticing that the Tobetsu Baby Box operator always repeats "I promise to help you."[26] The abovementioned voices of the Tobetsu Baby Box users are clear: we can hear their helplessness, hopelessness, irritation, lack of trust in institutional help, and desperation. The person A expressed that they were at their limit (to care for a baby).[27]

The abovementioned responses from the Tobetsu Baby Box users brought me to the concept of epistemic injustice coined by Miranda Fricker in her book "Epistemic Injustice: Power and the Ethics of Knowing."[28] In the next section, I will briefly explain the types and examples of epistemic injustice and then clarify them in the context of the Tobetsu Baby Box users.

7. Definition of epistemic injustice in M. Fricker's theory

Miranda Fricker, moral philosopher presently teaching at New York University, introduced the concept of epistemic injustice. A person can be a giver or receiver of knowledge, and on this basis, she underlines in her book the following thought:

> To be wronged in one's capacity as a knower is to be wronged in a capacity essential to human value. When one is undermined or otherwise wronged in a capacity essential to human value, one suffers an intrinsic injustice. [...] We are long familiar with the idea, played out by the history of philosophy in many variations, that our rationality is what lends humanity its distinctive value. No wonder, then, that being insulted, undermined, or otherwise wronged in one's capacity as a giver of knowledge is something that can cut deep.[29]

Miranda Fricker distinguishes the following types of epistemic injustice:

1) **Testimonial injustice** ("speaker receives an unfair deficit of credibility from a hearer owing to prejudice on the hearer's part")[30] In other words, the speaker's words are not taken seriously and the speaker's testimony, his/her experience, and feelings are not credible due to the stereotypes embedded in the listener (racial, social, sexual or other stereotypes). A typical example is that people tend to give less credibility to black women in science based on racial prejudice.
2) **Hermeneutical injustice** ("when someone's experiences are not *well understood* — by themselves or by others — because these experiences do not fit any concepts known to them (or known to others), due to the historic exclusion of some groups of people from activities, such as scholarship and journalism, that shape the language people use to make sense of their experiences").[31] In other words, people who belong to "stigmatized groups" might be denied the conceptual resources that they need to understand their traumas, feelings and experiences. It can also be said that stigmatized groups experience something "bad and traumatic" and they have no concept or appropriate language to express it to themselves and others. Fricker gives the example of "sexual harassment" and "postpartum depression". Marginalized groups, who experienced these phenomena, lacked those concepts, and therefore could not properly transfer their experience. This put "marginalized groups" in the permanently lower and weaker position and people, who undermine their experiences in the "position of power", according to the Fricker's theory.

8. Clarification and discussion on epistemic injustice in the context of parent/s with unwanted babies

The author argues that we can apply the concepts of epistemic injustice in the context of the experiences lived by the baby box users. Here is how it can be interpreted.

1) *Testimonial injustice*: parent/s in distress and depression, who delivered an unwanted baby often are viewed as less credible. Even if they experience domestic violence (physical, psychological, sexual, or mixed), their experiences and testimonies are not taken seriously enough (with comments like: "You are

young, you can do it; just try, do your best; time heals wounds; this baby is so cute, you will be a fantastic mother; are you sure it was a rape" etc.). The other studies on refugee women also prove that "refugee women who testify to persecution and fear linked to sexual violence are, among asylum-seekers, least likely to be heard and believed."[32] This experience leads to the situation when the stigmatized group of parent/s in distress do not trust anyone and stop to reach out for help. As a result, they completely isolate themselves and finally commit crimes (suicide, extended suicide, infanticide, baby dumping in an unsafe place), because they think that nobody will believe their traumatic stories.

In the case of person A, a father, who continuously repeated, that he and his partner were not able to take care of the baby (while having one more baby with Down syndrome), the Child Guidance Center did not believe his testimony. The workers, who visited their house found it clean and the children very also "not skinny", and based on this superficial interpretation they judged that the family could raise the baby. To state it clearly, the Child Guidance Center denied the experience and feelings of those parents. They did not believe their words and considered them exaggerated. Person A faced testimonial injustice and turned to the Tobetsu Baby Box, where his testimony was carefully heard, understood, and accepted. This is the crucial reason why baby box facilities should be maintained. Baby box facilities give credibility and trust to those who are weak, stigmatized, and epistemically marginalized by groups being in the "position of power". We can also call it testimonial silencing ("an audience fails to identify a speaker as a knower")[33] or a situation, that the Child Guidance Center "knows better" than the couple in distress.

2) **Hermeneutical injustice:** parent/s in distress can have a lack of conceptual resources to transfer their experiences to others and just say like person B "it is difficult to consult" with the Child Guidance Center. This "difficulty" is related to the **lack of concepts and fluency** in transferring their experience. Person B does not know how to prove that she is unable to care for a baby. She feels she cannot, but does not know how to persuade the workers. She also does not want to be judged, criticized, and shamed. She assumes that the public support system is not for her. The Tobetsu Baby Box operator's words "I promise to help you" are the only last resort to convince her.

Hermeneutical injustice occurs when parent/s who are homeless, poor, and in severe distress and mental turmoil cannot convey their chaotic and traumatic experiences to others coherently and persuasively. They do not have such skills and conceptual tools. They are afraid to be re-traumatized and harmed by a bureaucratic system of public support and stay in a "freeze" response. This also can be called *testimonial smothering* ("The truncating of one's own testimony in order to ensure that the testimony contains only content for which one's audience demonstrates testimonial competence").[34] It means that a person does not want to speak about his/her experience, knowing that s/he will not receive enough credibility (or will receive inappropriately low credibility). For example, a raped girl/ woman in an unwanted pregnancy stays silent and does not seek help, because she expects she will receive inappropriately low credibility.

It is worth noticing that in the worst scenario, a person who is denied his/her experience (of pain, trauma, violence, mental limits) and does not have a language to convey and precisely articulate his/her narration and stay silenced can act irrationally and aggressively (cannot adequately foresee the consequences of her acts). This is the situation when baby dumping, infanticide, and suicide occur.

It also must be stressed, that the isolation and loneliness of parent/s facing a problem of unwanted pregnancy/baby does not stem solely from the prejudice and unjust behavior of public institutions toward them. Isolating behavior in the face of a serious problem of such people has probably been learned. One hypothesis is that at the earliest stage of life, various problems faced by such people were ignored and marginalized by caregivers and teachers. Additionally, their isolating behavior could be reinforced by a well-known sayings in Japanese education: "Do your things by yourself" (jibun no koto jibunde suru), and "Do not be a burden to others, "do not cause troubles to others", "do not bother others" ("hokano hito ni meiwaku wo kakenaide").[35] To state it again, these unconsciously programmed norms, together with low

self-esteem, avoidant personality traits, learned helplessness, educational and gender disparities and many other environmental factors could greatly contribute to their isolating behavior.

In this place, it must be emphasized that by using the theory of epistemic injustice, the author of this paper does not want to contribute to perpetuating new negative stereotypes about Baby Box users in Japan. The author wants to acknowledge their existence, dignity, problems, and moral right to be heard and seen with special attention and tenderness (as the Tobetsu Baby Box operator stressed, "kindness over correctness"). Denying their feelings and traumas and diminishing their credibility (based on the carer's unconscious stereotypes of a good mother, and good parents) can be considered a cruel injustice. In the author's opinion acting in this manner is unjust.

By analyzing authentic emotions and true stories of baby box users, the author wanted to show how the altruistic attitude, true dedication to others, and unshakable core values (unconditional love, selfless help, kindness, empathy) of the caring person can create trust and a positive attitude of parent/s of unwanted babies. It works on the principle of mirror reflection.

On the other hand, the servile and cold style of communication in public institutions (based on stereotypes) may contribute to a lack of trust and reluctance of parents/s in distress.

In the last paragraph, let me sum up the structure of the argument based on epistemic injustice.

9. The structure of the argument

Based on the abovementioned interpretation of epistemic justice, we can make an argument:

Premise 1: Parent/s in distress having an unwanted baby are often stigmatized and viewed as less credible (testimonial injustice).

Premise 2 Parent/s in distress having an unwanted baby are often silenced (testimonial quieting)

Premise 3 Parent/s in distress having an unwanted baby are self-silencing (testimonial smothering)

Premise 4 Parent/s in distress having an unwanted baby often have no conceptual tools and adequate language to articulate their trauma (hermeneutical injustice)

Premise 5 Baby boxes give appropriate credibility, the opportunity to listen to them and to express their voice, in an easy and nonjudgmental manner.

Conclusion: Baby boxes, by removing injustices 1,2,3, and 4, can contribute to giving more credibility to the traumatic stories of parent/s in distress and by this empower them and save their babies.

10. Future research prospects

The research on ELSI of baby boxes in Japan still has many dimensions. The next research project goal will be to prepare sample dialogues on how to talk and how not to talk to potential Baby Box users. This type of "manual" and its analysis could be a useful guide for social care providers, who can unconsciously hurt or treat unjustly vulnerable groups of parent/s with unwanted babies.

Additionally, it will be interesting to check the image of Baby Box in Japanese society (what it is associated with) and compare it with other countries (Germany, Poland, South Korea)[36] to broaden the perspective on this topic. The author works closely with Japanese Catholics and is interested in examining the role of the Catholic Church, Christian churches generally, as well as Buddhist and Shintoist statements on the necessity of building baby boxes based on their religious traditions.

The author prepared confidential baby box guidelines for places with access to medical care and for private operators.[37] These guidelines need to be published for further public discussion.

Lastly, the author suggests two possible options (that are not mutually exclusive) to approach the problem of baby dumping: (I) providing more baby boxes with the opportunity for unbiased consultation for both sexes (mothers and fathers) and (II) including mandatory education (to remove educational disparities) on the concept of responsible parenthood and the value of prenatal life in the junior high school and high school curriculum to enrich students' language, argumentation, understanding, and emotional processing of the problem of pregnancy. Online or video lectures by people related to the baby box system would also be invaluable.

Public opinion in Japan needs more knowledge, more active discussion, and more first-hand data on the real problems associated with unwanted pregnancies and Baby Boxes. Therefore, the

author will eagerly continue this research. Emotions and stories, unlike dry facts and numbers, resonate deeper with public opinion.

11. Conclusions

To sum up, this paper analyzed the idea of Baby Boxes from the perspective of epistemic injustice coined by M. Fricker, using the ethnographic immersion method (by contextualizing an ethical dilemma within its natural environment) and numerous semi-structured interviews with the Tobetsu Baby Box operator and stories of Baby-Box users. Based on the collected data, the author stressed the thesis about the invaluable significance and necessity of Baby Boxes in Japanese society. The first reason for this statement is that Baby Boxes can serve in Japanese society as a "mediator" between stigmatized, vulnerable groups of parents in despair and public support institutions, by applying a win-win strategy.

The second reason for this conclusion is the fact that the existence of the Baby Box system can not only help to remove the mentioned types of injustice (testimonial, testimonial silencing, testimonial smothering, hermeneutical injustice) but also actively contribute to the empowerment of parent/s in distress, who are currently "voiceless" in Japanese society.

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6 Data based on interviews with the Tobetsu baby box operator and the home page: https://www4.hp-ez.com/hp/kodomo-sos/page4; last access: January 6, 2025.

7 The Government of Hokkaido: https://www.pref.hokkaido.lg.jp/hf/kms/ninsin-sos/180273.html; last access: September 30, 2024.

8 The Baby Box operator’s occupation is a veterinarian and psychological counselor. She knows how to handle natural birth, but she has no midwife or medical doctor’s license. A medical emergency could occur if there are potential birth complications (for example, an urgent need for a Cesarian section, etc.)

9 「普通養子縁組」と「未成年者法定後見」の法律を使用します。The system of normal adoption（普通養子縁組の制度）：https://www.moj.go.jp/MINJI/kazoku/youshi.html

10 This happened in spring 2023.

11 This part of the analysis was presented by the author during the Japanese Association for Ethics and Philosophy in Medicine at Sophia University in Tokyo in 2023.

12 「絶対に助ける！」

13 Filkowski, M.M., Cochran, R.N., Haas, B.W. 2016: „Altruistic behavior: mapping responses in the brain,” *Neurosci Neuroecon.* 5:65-75. doi: 10.2147/NAN.S87718. Epub 2016 Nov 4. PMID: 28580317; PMCID: PMC5456281.

14 John Paul II, Evangelium Vitae, 28, 1995: “We are facing an enormous and dramatic clash between good and evil, death and life, the “culture of death” and the “culture of life”. We find ourselves not only “faced with” but necessarily “in the midst of” this conflict: we are all involved and we all share in it, with the inescapable responsibility of choosing to be unconditionally pro-life.”

15 The problem of “invisible people”(見えない人・表に出てこない人)

16 「社会に迷惑をかけたくない問題」The social problem of “not causing troubles to society.”

17 Like in Poland, the US, Germany, Italy, and other countries.

18 In Poland known as “window of life” and mainly supported by the Catholic Church, and in the US known as “Safe Haven Baby Boxes” founded by Monica Kelsey.

19 B. L. Nadeau, Dead infant found in Italian baby box after alarm fails to notify priest, https://edition.cnn.com/2025/01/02/europe/italy-puglia-baby-box-intl/index.html; last access January 6th, 2025.

20 According to the Italian police, the cause of the accident in Italy was probably because a person who left the baby did not close the door to the small baby box room that houses the crib, which would have triggered the alarm to the priest. As a result, the alarm did not ring and the heating system was not activated, and the infant was found dead (the results of the autopsy are not public). Ibidem.

21 「私がお預かりしたケースの半分は男性が関わっています。乳児ケースは全て男性も関わっています。1人で産んだケース及び生後5日以内新生児は全て女性のみからのコンタクトです。」

22 The author wants to stress that she interviewed several people in charge of Tobetsu Child Welfare Center, but they represented the same position as the Prefecture Government of Hokkaido. You can access the Hokkaido Prefecture Government’s statement on Tobetsu Baby Box here: https://www.pref.hokkaido.lg.jp/hf/kms/ninsin-sos/180273.html

23 Kodomo SOS (Tobetsu Baby Box) home page: https://www4.hp-ez.com/hp/kodomo-sos/page8

24 「公的機関に相談してもお役所的な対応で相談者側の状況や気持ちはお構いなしだと思ったからです。実際に、BabyBoxにアドバイスしていただき、児童相談所に相談しましたが、何を決めるにも「責任者に相談します」ばかりで、たらい回しにもされました。2週間なにも連絡なしはあたりまえで、その都度こちらから連絡し、状況を確認している状況です。妻は体力的にも、精神的にも疲弊し、鬱の傾向ありで引っかかった事を伝えて

も、家に訪問してきて、家の中が汚くない、ダウン症の次女が痩せ細ってない、という理由から児童相談所としては育てられる、という判断で一度断られてます。その後、児童相談所が何もしてくれないから、赤ちゃんポストを考えてると伝えたところ、児童相談所の別の担当者が連絡してきて、改めて話し合いしてますが、こちらも現在のところ進展なしです。正直なところ、もう児童相談所にはほとんど期待してないです。」

25 「当別町のベビーボックスを頼った理由はどうしても公的機関には頼りづらく、ホームページを見て赤ちゃんポストなら事情を考慮して力になっていただけると思ったからです！」

26 「絶対に助けると約束します！」

27 「もう限界状態でした。」

28 Fricker, M. (2007). Epistemic injustice: power and the ethics of knowing. New York: Oxford University Press.

29 Ibidem, p.44.

30 Op. cit., 9-29.

31 Op. cit., p.1.

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33 Dotson, K. (2011): "Tracking Epistemic Violence, Tracking Practices of Silencing," *Hypatia*, 26(2), 236–257. http://www.jstor.org/stable/23016544, p. 242.

34 Op. cit., p.249.

35 The Tobetsu Baby Box operator stressed that "it is OK to cause trouble to her, because she does not perceive an unwanted baby's life as a trouble".

36 The author already contributed to this topic, writing about a Polish model:
Olejarz, S. M. (2017): "Ethical Concerns Relating to Child Abandonment and Baby Hatches: The Case of Poland," *Journal of Philosophy and Ethics in Health Care and Medicine*, No. 11;and comparing it to a Japanese model:
Olejarz, S. M. (2018): "An Analysis of the Socio-Cultural Context of Child Abandonment and Baby Hatches in Japan and Poland," *Journal of Philosophy and Ethics in Health Care and Medicine*, No. 12.

37 The guidelines were presented during the conference of the 36th Japanese Association for Bioethics at Ritsumeikan University in December 2024.

Totsuka Yoji's View on Life and Death: A Natural Scientist's Objective Self-awareness

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Abstract

Totsuka was a leading physicist and the top candidate for the Nobel Prize in Physics for his work on discovering the neutrino's mass, an elementary particle. However, he died of cancer before receiving any honor. He continued to write the blog "A Few More Months" from 11 months before his death until July 2, 2008 (8 days before his death), describing his views on life and death. The blog was primarily a record of his illness, but the blog was also a source of information for other patients with cancer. The blog was based on his recording habits as a natural scientist and his objectivism. He even considered interesting the delusion caused by his brain tumor and analyzed it as objectively as possible. He also approached religion (Christianity and Buddhism) through self-objectivity: and reached enlightenment [satori] and humor [kaigyaku]. He called this activity "disciple [shugyo]." He died expressing deep gratitude to his wife and the other people around him. We should learn about death through Totsuka because the experiences of others are the only sources of information that we can gather on death.

Keywords: thanatology, anticancer drug, social and spiritual pains, enlightenment [satori], humor [kaigyaku], disciple [shugyo]

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Introduction

This article deals with thanatological issues, for instance, what people think when they confront death. Thoughts associated with death are an ancient issue in the history of theology and philosophy, and the issue still has inspired interest and study, as typified by the writing of Elisabeth Kübler-Ross and others.

From this thanatological point of view, of the four pains [physical, psychological, social, and spiritual] discussed in biomedical ethics, the social and the spiritual pains are particularly important. With regard to the former, it is necessary to consider the sense of loss when a person with a great sense of social mission dies. As for the latter, the core question is how to overcome or learn how to accept the pain: The author asserts that social pain associated with the loss of a person with a great sense of social mission offers chances of gaining greater as "objective self-awareness [self-objectivity]", while spiritual pain offers chances to achieve "enlightenment [*satori*]."

TOTSUKA Yoji (1942-2008) was a world class physicist who was considered the top candidate for the Nobel Prize in Physics for his work on discovering the neutrino's mass, an elementary particle. However, he died of cancer without receiving this great honor (July 10, 2008: from now on, the year, month, and day are expressed as 8-digit Arabic numerals, 20080710).

This paper analyzes the writings published in his blog "A Few More Months," written until

8 days before his death for about 11 months, from 20070804 to 20080702. The most important narratives in this blog, mainly those regarding life and death, were edited by his friend, famous critic TACHIBANA Takashi, after Totsuka's death and first published in 2009 as *Record of a Scientist Who Fought Cancer* (Totsuka 2011 (revised version); from now on, I will refer to it as 'the book' and references from it will only include the page numbers or the 8-digit date, depending on the need to refer to the time of writing).

The main background and treatment history are presented in Table 1, based on "Totsuka Yoji's History of Cancer Treatment" (444-445).

Table 1. History of Totsuka

Date	Event
19420306	Born in *Fuji* City, *Shizuoka* Prefecture, Japan
19720329	Completion of the Doctoral degree at the Graduate School of Science, The University of Tokyo Married while still a student Obtained a degree (Ph.D. in Physics) To write his doctoral dissertation, he devoted himself to observation and research in a mine in *Kamioka*, *Gifu* Prefecture, 15 years before the construction of Kamiokande
197304	Until 1981, he stayed at DESY in Hamburg, former West Germany, for a total of six and a half years, excluding a period of temporary return (until he was appointed assistant professor in 1979, he had unstable jobs and was depleted by excessive alcohol consumption and his harsh research life)
1981	"Sick both physically and mentally" (according to his wife), returned to Japan. Due to sarcoidosis, an intractable disease of the lungs, he was recommended to rest and get treatment, but while receiving steroid treatment, he rather devoted all his energy to the construction of the Kamioka underground experiment facility (in the end, there were no symptoms of deterioration due to sarcoidosis as feared)
10980723	Kamioka Observatory, ICRR [Institute for Cosmic Ray Research], The University of Tokyo (Kamioka Nuclear Decay Experiment [KAMIOKANDE]) was established (once again, he began his life in his "second hometown" of Kamioka for about 20 years)
198704	Professor, Faculty of Science, University of Tokyo (198804, Professor, ICRR)
199504	Director, Kamioka Space Particle Research Facility [newly established Super-Kamiokande: SK] (up to 200209)
20001113	Colorectal cancer surgery to remove the rectum and colon
20011112	A large-scale damage accident occurred in SK, and he declared it would be restored within a year. He sacrificed everything he had and took the spearhead the restoration
20021210	Attended the Nobel Prize in Physics ceremony for his mentor KOSHIBA Masatoshi
20030401	Director, High Energy Accelerator Research Organization [KEK]
20040421	Surgery to remove metastatic tumor (2 places) in the left lung
20041103	Received the Order of Culture [Japan's most prestigious award]
20050920	Found metastatic tumor in the right lung (multiple places); however, he prioritized work and postponed treatment
20060331	Retired as director of KEK and started anticancer drug treatment (FOLFOX therapy) at 20060406
20060526	He transferred to the National Cancer Center Hospital East (*Kashiwa* City, *Chiba* Prefecture), which was close to his home and convenient for commuting to the hospital.
20060814	Due to interstitial pneumonia, which is a side effect of anticancer drugs, the treatment was temporarily discontinued (resumed at 20060825)
20070129	Emergency hospitalization due to ileus [intestinal obstruction], anticancer drug treatment temporarily stopped (discharged at 20070209)
20070221	Change of anticancer drugs: initiation of FOLFIRI therapy
20070409	Emergency hospitalization due to interstitial pneumonia: temporary discontinuation of anticancer drug treatment (discharged at 20070507)
20070625	Change of anticancer drugs: initiation of Avastin
20070804	Start of the blog "A Few More Months"
20070902	Emergency hospitalization due to ileus
20071126	Changed anticancer drugs: started TS-1; however, discontinued 20080116 because of severe watery eyes due to side effects.
20080130	Found a metastatic tumor in the liver
20080225	Initiation of the anticancer drug cetuximab
20080305	Emergency hospitalization due to ileus; metastases to the bone were found (discharged at 20080310)
20080323	Emergency hospitalization due to unconsciousness; discovery of brain tumor (discharged at 20080409)
20080421	Termination of cetuximab [due to desire to participate (however, ultimately failed) in a peptide vaccine clinical study]
20080613	The last dialogue with Tachibana Takashi ["Record of Cancer Declaration 'Life Expectancy of 19 Months,'" *Bungei-Shunju* magazine, August 2008 issue (see *Bibliography*)]
20080625	The last interview (2 hours, with MIDORI Shin'ya and other Tachibana seminar students of the University of Tokyo: Included in Totsuka 2008B: 11-40)
20080701	The last contact between NAKAJIMA Shigehiko, the editor of *Nikkei Science* magazine, about the series of articles
20080702	Hospitalization straight from outpatient
20080710	Died (aged 66)

1. Totsuka's legacy: the blog

1A. Main themes in Totsuka's blog

"Blog" means "Web Log [Record]." According to Totsuka, natural scientists must record experiments and calculations in a log book notated by date of entry (cf. 260-261). In his last dialogue with Tachibana, two weeks before his death, Totsuka said "The cancer record I keep is a 'logbook,' so to speak, of cancer observations" (430).

On the other hand, according to his blog, "I started blogging because I wanted to keep my children, my siblings, and acquaintances up to date with me who were living far away, and because I thought that blogging would be a convenient way to store what I wanted to write down as I went along (emphasis mine)" (179; cf. 261), so "I would be grateful if my acquaintances and children could summarize it." Moreover, "[i]f these articles should be of interest to people other than my children, siblings, and acquaintances, it would be an unexpected pleasure for me" (180).

As seen above, Totsuka's blog is (1) a record using the typical style of a natural scientist and (2) thought to have started the blog freely, at random, and spontaneously. (3) Blogs are an excellent multimedia mode of expression in today's internet age.

Point (3) is most important. This is because the book is not only written as a so-called course of treatment or record of fighting disease, but the blog also contains a large number of medical materials such as CT images of his cancer, which the patient, the natural scientist Totsuka, collected and organized on his initiative at the active request to the doctors in charge: More over, Totsuka "digitized" them, "measured the size, drew growth curves, estimated the prognosis," and even "entered the period of taking anticancer drugs and measured their effects" (cf. 8-9, "Preface" by Tachibana).

Tostuka took advantage of the characteristics of the medium chosen. His blog is a medical record composed by a natural scientist who has became a terminally ill patient, saying "Since there are still too many things we don't know about cancer, we should create a database that collects a wide range of testimonials (medical history, treatment effects, side effects of anticancer drugs, etc.) of patients with a scientific mind (9, "Preface"); The blog is also an essay written freely according to his heart, and its expression is a sign of the 2000s.

In this respect, from the viewpoint of bioethics and thanatology [view of life and death], the blog stands in the lineage of traditional "records of life and death" but the blog also occupies similar to that of MASAOKA Shiki (1867-1902) and his posthumous work *Byosho Roku-shaku* [Six-Foot Sickbed]. Although Shiki was not a natural scientist, he advocated "Sketching" in literary expression, and Shiki wrote essays in his last years as an "object of objectivity," he suffered from severe illness [See below. Cf. Ino 2019; Ino 2016B (in Japanese)]. Shiki's final compositions took the form of a series of articles in the daily newspaper where he worked, Shiki and Totsuka have in common the above: (1) professional consciousness (to put it more simply, temperament and disposition [*ethos*/ἔθος]), (2) content and (3) means of expression and media.

1B. Overall framework of the blog

The entire blog contains a huge volume of information that spans all four periods, listed below, and the book [Totsuka 2011] excerpts sections titled "Chronicle of Fighting Illness," "Thoughts on the Disease of Cancer," and "Reflections on Treatments," plus "mainly Thoughts on Reflecting on My Life, Life Theory, Education Theory, etc."; The "specialized science theories and science policy theories that are not topics for the general public," which made up the majority of the blog, were nearly omitted, and "only the independent "Introduction to Science" section, written for young people" was published as another book (cf. 9; Totsuka 2008B).

The content of the blog includes multiple topics: "It's not just a book about fighting the disease" and "It's a great book about fighting the disease, but more than that, the rest of the book is great. The entire book is a collection of essays on various topics as his heart dictated [徒然*tsurezure*]," and "the content is truly rich" including "theories of life," "of science," "of nature," "of medicine," "of society," "of education," "of religion," and "of the times," and "in any case, his writing freely [徒然] covers everything" (cf. 8, "Preface").

By category, "Life" is the most common, followed by "Medical" type ("'Colon Cancer Treatment Progress" and "Short Note on Anticancer Drug Treatment"). In particular, Totsuka wrote

about plants to which he showed his attachment in his recollections of his Kamioka period ("Okuhida" the region Kamiokande was located) in the early parts of blogs and later, more familiar observations ("Flowers in My Garden"). His consistent and clear "reliance on nature" and "experiment first" attitudes established his 'human nature [*ethos*]' as a scientist and as a human being as a whole, Totsuka. (Tables 2 and 3, below.)

2. Ethos of Totsuka

2A. Records by a competent natural scientist

In light of Section 1 and Table 2 and 3, we can see that the most important feature of the book [Totsuka 2011] is that it is a record of life and death made by an outstanding natural scientist/world-class physicist with an "objective self-awareness" [self-objective view/self-objectification].

Tachibana said "No matter what theme the pen strokes, you can see Totsuka's unique, cool, sharply cut, and brilliant pen wits. Reading the book, one is reminded everywhere that this man was a scientist to the bone" (8, "Preface"). In this case, "cool" and "sharp" are words that generally describe personality, but if we exaggerate a bit, they are also associated with modern scientific attitudes, these attitudes and are very easy for us moderns to understand.

In other words, the very general attitude and behavior of the person Totsuka is supported by modern natural scientism. For example, "probably you had a hard time in the worst condition" but "I admire the way you are facing cancer coolly like a scientist" (e-mail from Tachibana to Totsuka, emphasis mine), Tachibana describes both sides of the story.

The most important keywords deeply associated with modern natural scientism, is "object" [客観／客体、対象]. Even in the history of philosophy, from Ionian natural philosophy, which was oriented toward external natural objects, Socrates, the founder of Western philosophy, turned our attention to inner selves (e.g., the view of Hegel's *Lectures on the History of Philosophy*; cf. Ino 2016A: 17-18). That is "objective self-awareness" [self-objectification] (cf. Ino 2019: 40, *passim*). Thus, objective self-awareness can be found in both modern natural science and ancient philosophies.

As mentioned above, the objective view is primarily and object view; a particularly good example is the close observation of plants to which Totsuka became attached in the latter half of his life.

Even when his awareness of mortality was not yet pronounced, Totsuka had been a keen observer of nature since his days in Kamiona: a single large tree rises, and even the locals do not know its name. Then "the task of finding out the names of the trees in the nearby mountains joins me." "Of course, tree identification started out as a hobby, but after buying more than a dozen books on the subject and seeing Totsuka start pressing leaves, the landowner at work said, "This is not a hobby , but a study" (cf. 67). Being recognized at such an early age as a researcher of this caliber, Totsuka found the compliment gratifying.

The blog started 11 months before his death, and the scope of his activities was limited. His observations then turned to flowers in the garden planted by his wife. Observing the flowers was the greatest comfort to him in his illness. Regardless of the topic considered, the point of view taken in the blog helps to emphasize a more nearly

Table 2. Number of times mention is made of each of nine topic categories, in all four periods

	Life	Colorectal cancer	Anticancer drugs	Okuhida	Home	Education	Introduction to science	Science policy	Other
I (42)	15	12	2	6	0	4	1	0	2
II (29)	8	1	4	2	11	0	0	0	3
III (36)	14	13	1	0	7	0	0	2	1
IV (25)	2	9	0	0	7	5	0	0	2

Periods: I (20070804-20071102), II (20071103-20080208), III (20080209-20080501), IV (20080503-20080702)

Table 3. Number of submissions per month for all 11 months

200708	28	200709	26	200710	26	200711	24	200712	20	200801	26
200802	23	200803	13	200802	23	200803	13	200806	16	200807	2

objective position. Totsuka observes the self as "somene else." He writes that, "I keep records as if they were other people's affairs, which is the sad nature[2] of those who have lived their lives as researchers" (83, emphasis mine). Totsuka applied objectification to the disease in his body and the interiority of the self as an ailing subject [objective self-awareness]. He even considered interesting the delusions caused by his brain tumor and analyzed them as objectively as possible, and painted them as well (cf. 20080410).

2B. Optimism among natural scientists

Thus, Totsuka's writing style is "objective" but simultaneously "simple" and "humanistic." His charm of simplicity and human richness, along with objectivism, is due to his optimism, which he claims is necessary for a natural scientist. Totsuka asserts that natural scientists must be optimists. Even in the case of informed consent [IC] situations with physicians, "scientists must always be optimistic. In my opinion, a pessimistic attitude occurs when one tries to force the use of science that is not understood in dialogue or reports. It is a sign of lack of confidence" (333-334), he said harshly.

Furthermore, Totsuka, who does not believe in God or the afterlife, is the ultimate optimist as a natural scientist: "Is there really no Heaven? When we all die, everyone will experience first-hand whether or not this is true" and "I, too, will be able to observe this as my last scientific task." Moreover, he says, "It is pity that, it's impossible for me to share my observation with you" (cf. 94: 20070825, emphasis mine). For Totsuka, even without Heaven, there is a scientific perspective [of the self] from which to observe the world: it is truly the ultimate *cogito.*

Totsuka tried to remain an optimist, even in his final days. As 2007 drew to a close (20071228), he looked back on a year that was "the worst year of my life" (235) in terms of health. Hot topics included the Science Council of Japan, climate change (which he was very concerned about, and the biased media coverage of the latter. However, "researchers in the field of experimental physics," especially "group leaders" such as Totsuka "have to bring their optimist side to the surface in every situation," and "this habit has become so ingrained in me that I dare to see the good side even in rather dire situations" (cf. 232), he recalls.

Still, he said "but people have to be optimists: and I hope 2008 will be a year where I can find good signs and activity develop them. My New Year's resolution is to build on the experience of 2007 and somehow experience the New Year of 2009" (235). However, that resolution never came true; approximately 6 months later, he died.

2C. Experimental physicist

Totsuka's objectivism and optimism, which are essential to natural scientists, are further characterized by the fact that he was an experimental physicist. He is an admitted "experimenter" of physics, which is distinct from the image of 'theoretical' physicist that the public at first associates with, especially in Japan, which was defeated in WW II and regained some of its national prestige with the first Nobel Prize by YUKAWA Hideki in 1949.

Totsuka, began his observations for his doctoral dissertation in the ruins of a mine 1000 meters underground in Kamioka and later worked hard at Kamiokande and Super Kamiokande, which were constructed there. Wearing the work clothes and helmet that made him look like a real worker, one would not have guessed that he was a brilliant physicist. However, he told his wife with great affection that the helmet was his alter ego.

Totsuka's experimental orientation is more fully realized in his physical activities and in his heart-felt "ethos," or, more precisely, his view of science. He argues that "Facts revealed by experiments must be accepted," "If there are experimental facts, we start from where we can accept them," and "The reason why experimental physics is interesting comes from that point" (51, "Preface").

In "Creativity Cultivation School" website, Totsuka quotes the words of the school's president of this school, ARIMA Akito, a prominent theoretical physicist and former president of the University of Tokyo (Totsuka once studied in Arima's lesson in his student years), "Look at nature honestly" (a plaque written by Arima in the office of the director of the Institute for Cosmic Ray Research at the University of Tokyo, where Totsuka once served in this capacity): This motto is exemplified by Totsuka in his last days. This consistent, clear-cut, "reliance on nature" and "experiment first" attitude was established by scientists and such ideas underscored the ethos of Totsuka as a

human being.

3. Interest in religion and his unique *"Shugyo"*[discipline]

3A. Criticism against transcendental God from an atheist

Totsuka always said that, "the spirit resides in the body" and that "I should live my life with the awareness of "putting energy into my heart and putting our strength into my belly," which I cultivated during my time at the university's athletic (*Karate*) club" (cf. 181, 20071103).

By chance, while confronting death, he met Buddhist scholar SASAKI Nodoka, and Totsuka was deeply moved and greatly influenced by Sasaki' view of life and death.

Totsuka described himself as "an atheist to the bone" but he showed a keen interest in religion, especially Buddhism. However, it was by no means that he was trying to turn to religion as his death approached; for the rest of his short life, his naive, simple, and voracious intellectual curiosity worked.

On the other hand, as for Christianity, which formed the greatest basis of Western culture and, of course, had a decisive influence on the natural sciences, Totsuka, who stayed in Germany for a long time and had a very deep relationship with Western culture, was skeptical of it throughout his life, and he was concerned about the so-called ancient problem of "belief and/or knowledge": thus, Mother Teresa's confession that she had doubts about the existence of Christ (cf. 20070825; 0917, 91-94; 123-125) surprised Totsuka greatly, and he wrote that he was "somewhat relieved."

"Nature continues to show itself in a way that is different from what God has told us to do." "The question is how should religion respond in these times" (cf. 193, 20071115). On the other hand, "When I witnessed the devout faith of some respected and eminent scientists (including the deceased) who were Christians but devoted to logic," they "believed in God as a transcendent being, with the revelation that God had given to the prophets [author's supplement: I cannot help but think]. How did top-down teaching and the science of logic maintain consistency in their mind?" wonders Totsuka. Since he did not ask them directly, he says "I still have questions": One of them, for example, maybe John Polkinghorne, who also served as director of CERN during Totsuka's West German period of research. The decisive difference between the two researchers lies in their subjective or independent styles of pursuit of scientific truth (cf. Polkinghorne 2001; and see below).

Here is a semi-ultimate question: "What is the peculiarity of our universe?" It asks why "our only universe" was born in the multi-universe (according to the Multiverse theory: 10 to the power of 100 [note: also to the power of 500] at the beginning of the universe. On the other hand, Totsuka said that he does not like and also rejects the "anthropic principle" that thinks "by chance" that "our universe is a universe with just the right parameters that we can live in" and that "there are just the right parameters" (cf. 238; 282-283). Totsuka wrote that "there is a risk that [the anthropic principle] will lead to defeatism [leading to the belief] that there is no need to do science anymore." Therefore, the subjectivity of science must be firmly maintained.

3B. An encounter with a Buddhist scholar: Multiverse, Buddha, Nietzsche

This subjectivity/independence is also related to Totsuka's ailing self. In the process of understanding Buddhism, Totsuka was "convinced" by the primitive Buddhist doctrine of "the path to attain true peace in the world while being bound by the laws" as "the only way to overcome suffering through one's efforts" (cf. 274, 2008215). Sasaki taught Totsuka the essence of primitive Buddhism during the Buddha's [*Shakyamuni*'s] time. "Buddhism understands the world by the law of cause and effect, does not recognize the existence of the transcendent, and explains the phenomenal world by law. The events of the world are not caused by God's top-down, but by cause-based laws." This is "exactly the same principle as modern science" and "interesting" (cf. 228).

Totsuka's view of Buddhism, which he learned through Sasaki, offered him a helpful clue to the compelling question of what happens after death. First of all, Buddhism has an affinity with the theory of multiverse, which is the established theory of modern astrophysics [Note by author: Even in Mahayana Buddhism] Guidance from the Buddha in other universe is essential to attain *Satori* [enlightenment/epiphany], and the multiverse theory plays a major role. However, the

main difference between the two is that the multiverse theory of physics is completely impossible to negotiate with other parts of the multi-universe. In the "many-worlds interpretation" of the multiverse theory, once the worlds have branched off, they are physically isolated and unable to visit or communicate with each other. Therefore, Totsuka maintained his stance of trying to find, within himself, not others, the elements that made it possible to accept death.

In addition, Nietzsche, in whom Totsuka had taken a renewed interest, in his later years, was brought up as a topic by Totsuka in his last dialogue with Tachibana (cf. 433-435, "Dialogue"). In Nietzsche's famous idea of "eternal return," there is no such thing as the immortality of the soul, the soul dies with the death of the body, and human life comes to nothing, but eventually everything returns to eternity, and life repeats in exactly the same way. On the other hand, in Buddhism, at the time of Shakyamuni [Buddha], departing from reincarnation was liberation, that is, satori [enlightenment]. After liberation, it is a world of complete zero or nothingness; in that respect, it is completely different from that of Nietzsche (cf. 435).

Totsuka is deeply interested in the Buddhist theory that the world after liberation is nothing, although reincarnation is impossible to consider in the worldview of the natural sciences. The universe always ends when it is born; it is a world of complete nothingness, without no time or space. In this sense, Buddhism's perspective is closer to the natural sciences than Nietzsche's. However, the world of nothingness after *satori* is a world in which consciousness transcends the real phenomenal world, and there is nothing but consciousness: however, it does not mean that the physical world of existence becomes zero (cf. 435).[3]

When Tachibana wonders if the Big Bang will occur again, the universe ends, and the world of physical phenomena will be repeated, Totsuka immediately emphasizes, "That's exactly the problem." In the theory of multiverse physics, there are countless universe[s] with completely different spaces-times, and we just happen to live in one universe. The Buddhist worldview is close to this multiverse theory, and therefore it is very familiar with Totsuka's idea, as described: "I feel very relieved that what Buddha [*Shakyamuni*] thought so hard about is similar to the multiverse theory that we natural scientists are also studying so hard." "The idea of such great religious figures and thinkers were similar to what we came up with, so there is no need to be so rattled: I do not care if I die like that" (435).

Whether sorry or not, when we die, everything comes to nothing; however, the universe is born and continues to exist infinitely in space and dimensions, and all things are produced one after another. Reflectin, Totsuka writed, "Blessed are those who believe in God; my life devoted to science was also not bad" (283, 20080219). Regardless of whether there is a transcendent God, Totsuka is convinced that what he had pursued in science is never wrong.

3C. *Shugyo* for himself, and those around him

Totsuka said that his wife always cared for him. Nevertheless he could not say just a single word "*Arigato*" [Thanks] to her. His last dialogue with Tachibana also ended with these words: "I still do not have enough *shugyo* [discipline] (laughs)" with a wry smile. For Totsuka, his gratitude to the people around him, especially his wife, were so great that he could not express it in his own words; however, it seems that he was not good at expressing his gratitude given his attitude as an old-fashioned [*Showa*-era] Japanese man.

Buddhist Sasaki was impressed by Totsuka's appearance as a "*Shugyo-sha*" [person of discipline] and praised him: "Totsuka, rest in peace."

> "The subsequent life of a person who has been sentenced to death is spectacular. The fact that every moment of life is painful comes to us for the first time when death suddenly stands in front of us. So, what should we do when we feel suffering? Shakyamuni told us to observe our minds: Observe and accurately read their structures and movements. And we cut off the evil elements of the mind that cause suffering; Of course, it is impossible for ordinary people. [...] However, even if one can not them to be realize such thoughts, he/she may at least find it possible to end life proudly and toward-looking."
>
> "Dr. Totsuka wrote a blog until shortly before his death. In it, the days before his death are recorded in detail. The way <u>he calmly analyzed himself in the face of death</u> and tried to somehow eliminate the cause of suffering from his mind, was exactly the way of a

shugyo-sha."

"Everyone knows that Dr. Totsuka is a top-notch physicist, but for me, he is the embodiment of Shakyamuni's teaching, which Totsuka has shown me through practicing the Buddha's *shugyo*."

(Cf. Sasaki 2009: 140-142, "How to die at his best," emphasis mine)

The proclamation of life expectancy, for instance, *shugyo,* are all elements that the author is trying to describe, and they are completely depicted in this memorial by Sasaki.

4. Last duty and the days left

4A. The last duty

In his last dialogue with Tachibana, Totsuka said, "Unfortunately, unlike you, Mr. Tachibana, my cancer has spread throughout my body and has already [reached] the final state, but because of my profession as a researcher, I can't help but observe my own condition" (410).

For Totsuka, who confronts death by striving for objective self-awareness, analysis, and reporting, what was decisive was, first, the metastasis to the bone and brain, and second, his decision to participate in a clinical study of peptide vaccine therapy, ending with his last anticancer drug, cetuximab, before all those were used up (cf. 200804; the date was not specified).

The latter clinical study was no longer for his treatment but out of a desire to serve future generations [Please remember that I qualify Totsuka as "a person with great sense of social mission," in "Introduction"]. More than four weeks prior, he had to stop other cancer treatments: stopped taking decadron (a steroid) to treat his brain tumor, and suffered from loss of appetite and other considerable adverse effects, but he still had the necessary tests to participate. However, he was unable to participate in the treatment study because the size of his brain tumor was beyond the scope of the vaccine treatment study. How disappointed must he have been when even the hope for his last service was cut off!

Subsequently, no anticancer drugs were administered, a and steroid administration was resumed (cf. 20080523).

Moreover, as if he had made up his mind, he intensively compiled a "Report of A Certain Colorectal Cancer" (1)-(7) from a few days later (cf. 20080611; 0612; 0616; 0617; 0618; 0619; 0621). Regarding the writing style, the text is written in a report tone, not in the conventional conversational one, which is consistently adopted throughout his blog. This is the best example of Totsuka, a terminal cancer patient, demonstrating his natural scientific temperament [*ethos*]. I will show only the main points of content that can be seen from the subheadings:

1. Cause, history of discovery, course of treatment, and side effects (four illustrations; same applies below)
2. Side effects
3. Changes in tumor (metastasis) size over time (one illustration)
4. Time change in tumor marker test (one illustration)
5. Comments from patient on anticancer drug treatment/comments on standard and dormant therapy (two illustrations)
6. Oxygen deficiency and metastasis at the tumor center
7. Any changes observed in the doubling time/growth rate of liver tumors/bone tumors and brain tumors/examinations should be included in the standard treatment (two illustrations)

Totsuka spent his last days writing this report (approximately 20 days).

4B. Acceptance of death (the real meaning of satori)

Earlier, in a blog (20080527) that referred to blog reader Mr. A (a stage-4 colon cancer patient, a young father with a little son; he was consulting Totsuka personally), the following words were quoted from June 2, 1902 [*Meiji* 35] in Shiki's *Byosho Roku-shaku* [Six-Foot Sickbed]:

"It was a mistake to think that *satori* meant to die with no regret at any moment; however, *satori* meant to live nonchalant[ly] at any moment."

In fact, this was introduced by Totsuka's daughter on the youth support facility blog where she works so that Totsuka could learn about it. "[The youth support facility blog] was also words for my father." According to Totsuka's wife, when he saw this passage, he was exited, saying "Yes, this is it" (cf. 43).

These words seem to have been deeply engraved in Totsuka's mind as he lived through his

last days, and they are also mentioned in his last dialogue with Tachibana, "I am most perplexed when everyone is worried about me and says, "Please spend the best of each day." There is no way I can do that (laughs)." Quoting Shiki's words, he said, "They seem to be very famous words, but I didn't know them until recently. It's amazing to die with a nonchalant face, but it still amazing to be 'living nonchalant[ly]': But in the end, I think that's the only way" (cf. 432-433).

Like Totsuka, Shiki, who was a non-religious, had a state of "*satori*" that was imbued with the objectivity of his interpretation and view of life and death. Also Totsuka, who was familiar with various religious and philosophic views, maintained, however, the objectivity [of a natural scientist] and finally reached the state of enlightenment: He must have grasped Shiki's words of *Satori* and felt that he had gained Shiki's intentions.

4C. The last "Few" "Days"

After Totsuka's passing (20080710), the last blog update was made by his son (20080715), and as a family member who was with him until the end, he said that he would have liked to write about his father's spectacular days after his hospitalization; however, because he and his family supposed that Totsuka would have disliked that, he did not write about Totsuka's last days.

However, the state of affairs in the days after hospitalization was revealed in the widow's memoir "40 years of Running Together" (cf. Totsuka 2009A: 158-159).

In his early blog, Totsuka stated that "the timescale for my future is 2 or 3 months," so there can be no "A Few More Hours" because he will have a mental breakdown before that and he will somehow keep track of it until "A Few More Days" (cf. 20070806). As it turned out, the last blog update by himself was 20080702, eight days before his death, and he endured "A Few More Days." However, the day after he was admitted to the hospital, he told his wife, "I can't do my best anymore, can no longer see my emails, I can no longer write replies." He had sent the last email the night before. In the past, even after surgery, he had instructed her to "take out my laptop" first, but for the first time, he asked her to put it away.

After hospitalization, the patient received a blood transfusion the next day (this was the only time because his hemoglobin level returned to normal), and he had been short of breath for a long time; the blood transfusion did not improve his condition, so an oxygen mask was administered the next day. Even through it was difficult to speak, he was still conscious, instructing his family to do this and that, and instructing his wife to record his oxygen level; however, the family was informed by the doctor that he might only have 1 or 2 days left to live. He always ordered not to hide anything; however, as expected, they could not tell him all this (although he may have been vaguely aware of it).

On the third day, he was offered a ventilator, and as expected, Totsuka was surprised, saying "Is it already that serious?" After that, respiratory difficulties gradually increased, and he was unable to fall asleep. He complained "I was to fall asleep," but the medicine did not work as expected, and he and his family had s challenging time. He passed away peacefully in his sleep. For the last 10 hours or so, these were Totsuka's "A Few More 'Hours.'"

Conclusion

Totsuka always tried to provide a social contribution, as mentioned in the Introduction. He was concerned with science and the destruction of the global environment, especially climate change. Even after becoming a cancer patient, he not only worried about his condition but also strongly advocated for the establishment and effective operation of a database of numerous cases, such as cancer symptoms and side effects of anticancer drugs, and, again, strongly desired a society in which patients and their families could share the benefits of information.

Because he thought that he had so much to do and appealed to society, he deeply lamented his inadequacy because he had developed cancer. In this sense, in the view of the "4 pains" in biomedical ethics, he continued to suffer not only from physical pain, such as aggravation and side effects, and from mental pain, such as depression, but also from social pain, until just before his death. The opening of the blog and the enormous numbers of entries were also manifestations of his desire to compensate for these pains. His vision of blogging evolved into a practice of healing spiritual pain through science, philosophy, and religion.

We can learn very much from his books,

essays, and blogs, which are considered Totsuka's legacy, including answers to the questions "What is optimism as a personality trait [*ethos*], and as a characteristic of scientist? What is 'objective self-awareness'? What is *satori*? What is *shugyo*?"

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Endnotes

1 Objectivism: Self-objectivity: Self-objective view: Self-objectification.

2 I believe that "nature" here might refer to the philosophical notion of 'ethos [ἔθος],' one of the most important keywords in Aristotle's *Nicomachean Ethics*. Ethos [in English 'personality'] is the root of the word "ethics" [episteme ethike//ἐπιστήμη ἔθικὴ]. Ethos refers to the values, beliefs, and behaviors of members or groups of an era or society distinct from those of other eras or societies.

Ethos was used in the 20th century by German sociologist Max Weber as a central concept in his major work, *The Ethics of Protestantism and the Spirit of Capitalism* (1904/1905). The discussion of the "ethos of science" aborted after Weber's sudden death, was subsequently developed and recognized for its importance by Robert K. Merton, another great American sociologist (cf. Ino 2022).

3 Supplement by author: Is this "consciousness" analogous to the 'ad-perceptio/Apperzeption' or 'cogito' in the history of Western philosophy in the lineage of Augustine (of Hippo), Descartes, Leibniz, and Kant? (cf. Ino 2024: 135, 283 note ("Literature: YAMAUCHI Shiro1990"), passim).

On the hand, the "vacuum" in quantum theory is also not the so-called nothingness or vacuum in the general sense, but the quantum fluctuation: our universe was born from it.

Bioethical Study on Radiation Exposure in Medicine

Proposed Behavioral Changes During Radiological Examination in Medical Practice

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Abstract

Radiation exposure in patients during radiological examinations is based on the "principle of beneficence," which is one of the fundamental principles in biomedical ethics. It may be in conflict with the "principle of nonmaleficence." The medical benefit of accurate diagnosis for patient treatment has historically been deemed to outweigh the disadvantage of radiation exposure and has been used to justify radiation exposure in patients. In this study, drawing on the insights of the International Commission on Radiological Protection, we propose that healthcare providers should adhere to the principles of patients' "autonomy" and "prudence" by disclosing the risks of radiation exposure in accordance with the most recent and advanced scientific knowledge during the process of obtaining informed consent. One of the measures implemented involves the shift in awareness toward "tailor-made radiation protection standards" based on radiobiological findings. Herein, we explore the bioethical implications of radiation exposure during medical examinations, a topic that has been inadequately discussed so far, from a bioethics perspective. The study proposes medical care providers should modify their practices to increase awareness of the rationale behind radiation exposure.

Key Words: Medical Ethics, Medical Exposure, Informed Consent, Behavioral Changes

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Introduction

The primary objective of medicine is to alleviate the patient's ailment. Medical ethics—the appropriate conduct for those engaged in the field of medicine—has been advocated since the ancient times of Hippocrates. The Corpus Hippocraticum, which was compiled by the disciples of Hippocrates, contains records of Greek medicine, which was the epitome of medical knowledge at the time. The Hippocratic Oath[1], an oath on the professional ethics of physicians, is one of these texts that has been transmitted through Western medical education to the present day. One passage from this oath states, "I will use those dietary regimens which will benefit my patients according to my greatest ability and judgement, and I will do no harm or injustice to them. " (Source: https://www.nlm.nih.gov/hmd/topics/greek-medicine/index.html)

This passage forms the basis of two of the fundamental principles of present bioethics: "beneficence"—acting for the benefit of the patient—and "nonmaleficence"—doing no harm.

In the medical field, imaging studies such as X-ray examinations are indispensable. However, even at low doses, X-ray exposure carries a risk of

delayed effects, such as developing cancer[2]. Furthermore, there are apprehensions regarding the adverse consequences of the growing exposure to CT scanning in Japan. The level of radiation exposure in Japanese patients is among the highest in developed countries, which may be attributed to the large number of CT machines in operation, which is the highest in the world.

A CT examination can result in an equivalent dose[3] that exceeds 50 mSv, and the exposure can exceed 100 mSv in the event of multiple CT scans, depending on the area being scanned. Therefore, it must be acknowledged that the risks from radiation exposure in CT scans may already exceed permissible limits.

Diagnosing diseases using X-ray examinations is "beneficial to the patient,"; however, the risk of causing delayed adverse effects, such as cancer, as a result of X-ray exposure can also "cause harm to the patient." This paper aims to examine this dualeffect of radiation exposure in medical settings from a perspective of bioethics.

1. Radiation Exposure and the Fundamental Principles of Bioethics

In their 1979 publication, Principles of Biomedical Ethics (translated into Japanese as Seimei Igaku Rinri, third edition in 1998), T. Beauchamp and J. Childress introduced the four fundamental principles of bioethics. These principles are "respect for autonomy," "nonmaleficence," "beneficence," and "justice." These fundamental principles facilitated the engagement of individuals with varying ethical and moral perspectives in medical practice in discussions that were conducted within a common intellectual framework.

In the paper, "A Bioethical Study on Radiation Exposure in Medical Practice" (Studia Humana et Naturalia 51 (Kamei, Osamu: [2018: 61-72]), 52 (Kamei, Osamu et al [2019: 15-28])), published in the Bulletin of Liberal Arts Education, Kyoto Prefectural University of Medicine, we have already discussed the relationship between radiation exposure and bioethics. In these papers, we clarified the characteristics of the effects of radiation on the human body and the issues related to medical ethics. Currently, the International Commission on Radiological Protection (ICRP) (ICRP Publication 1, [1958]), which plays a leading international role in radiation protection, continues to adapt its recommendations to reflect advancements in science and shifts in societal values since its inception in 1928 (Figure 1). The primary objective of their endeavors is to present the effects and hazards of exposure with precision, leveraging scientific knowledge. Nevertheless, the ICRP had not provided comprehensive ethical explanations in their discussions.

The relationship between radiation exposure and bioethics has been comprehensively examined in ICRP Publication 109, which was published in 2008 (hereafter referred to as ICRP 109: Advice on the Application of the 2007 Recommendations) (ICRP Publication 109, [2009]). The publication

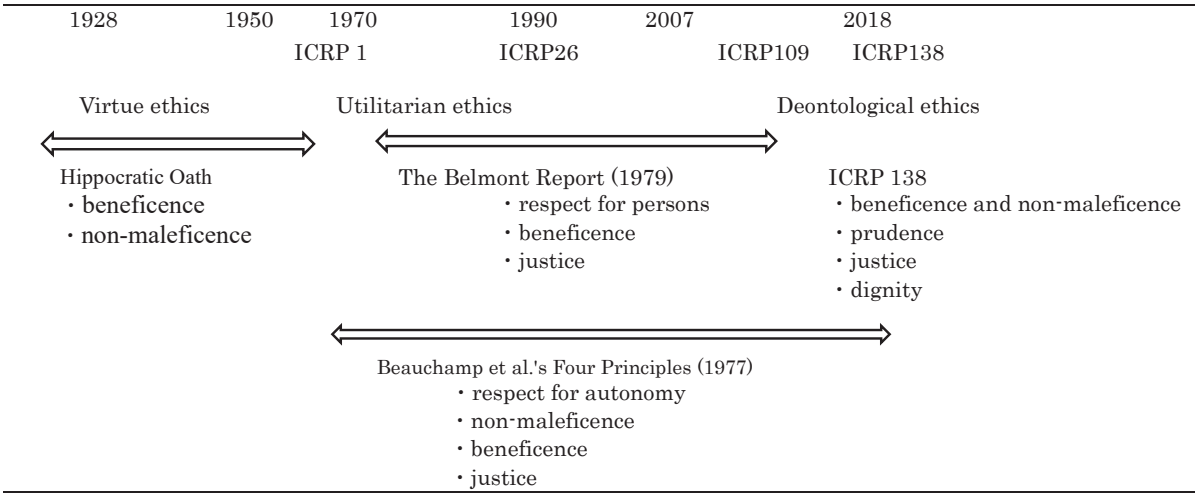

Figure 1: The Evolution of Ethical Values in the ICRP

specifically defines the changes in dominant ethical norms from 1928 to the 2007 recommendations. According to the ICRP Publication 109, recommendations from 1928 to 1950 emphasized "virtue ethics," which prioritized proactive protection to prevent harm caused by radiation to individuals with the objective of ensuring safety for individuals (an act of beneficence).

During this period (from 1928 to 1950), there was an increased emphasis on preventing radiation-related diseases, including skin cancer and leukemia, as the use of X-rays (discovered by Dr. Roentgen in 1895) and radioactive materials such as radium advanced, leading to a rise in mortality caused by these radiation hazards.

Additionally, in the international community, "utilitarian ethics," which prioritizes cost-effectiveness and regard for the overall benefit of society, gained prominence in the 1960s and 1970s. Hence, ICRP Publication 22 (1973 Recommendations) and ICRP Publication 26 (1977 Recommendations) (ICRP Publication 26, [1977]) stipulated that radiation protection was predicated on the application of "dose limits" to the radiation doses individuals received from all sources.

The 1990 and 2007 recommendations have since emphasized "deontological ethics,"[4] a moral theory that asserts that morally right actions are determined by the process of laws and rules rather than evaluating outcomes (consequentialism). This approach emphasizes the evaluation of actions based on their positive intentions rather than the outcomes of those actions.

In 2018, ICRP Publication 138: Ethical Foundations of the System of Radiological Protection (hereinafter referred to as ICRP 138) (ICRP Publication 138, [2018]) was published. This recommendation provided a clear explanation of the Ethical Foundations of the System of Radiological Protection and its role. In the same recommendation, two fundamental ethical principles were newly introduced: "prudence," and "dignity."

Within this recommendation, the "principle of beneficence" and the "principle of nonmaleficence" are interpreted as a single ethical principle. It was contended that the integration of these two principles is logical, as "nonmaleficence," or "the removal of harm," is designed to eliminate or mitigate potential hazards, thereby enhancing "happiness." This indirectly results in an improvement in the quality of social life, which ultimately equates to "beneficence," as indicated in the recommendation.

However, Beauchamp and Childress maintain that "beneficence" and "nonmaleficence" should not be equated and should be distinguished. In their work, they define "nonmaleficence" in a more restricted context, as simply "do no harm or injury." Conversely, "beneficence" is considered from three perspectives: "the prevention of harm or injury," "the removal of harm or injury," and "the promotion and execution of good."

Furthermore, the new ethical value of "prudence" is not defined in Beauchamp's four principles. In ICRP 138, "prudence" is explained in the context of the LNT (Linear No Threshold) model, which serves as the basis for cautiousness in radiation protection, particularly at low doses and low-dose rates. The recommendation underscores that this cautious approach is the most practical method for managing radiation exposure risks and is consistent with the "precautionary principle"[5].

Additionally, "prudence" and the "precautionary principle" should not be interpreted as necessitating "zero risk or the selection of the smallest risk when considering the effects of exposure" (ICRP 138: p.28). In other words, when it comes to low-dose exposure, such as medical radiation exposure, it does not demand that the risk of exposure be zero or reduced to the absolute minimum. Rather, the true essence of "prudence" lies in its rational and practical application.

Furthermore, as explained in the recommendation, the ethical value of "prudence" is defined as "the knowledge, experience, and sound judgment necessary to make and follow through on reasonable decisions" in the event of a conflict between the "principle of beneficence" and the "principle of nonmaleficence." This represents the original meaning of the Latin term "providentia," which means "foresight" or "the ability to anticipate" (ICRP Publication 138, [2018]).

Additionally, the same recommendation discusses several procedural value principles ("procedural values") aimed at supporting practical implementation, specifically "accountability," "transparency," and "inclusiveness." In this context, "accountability" refers to "the obligation to be prepared to explain the effects of radiation exposure" (ICRP 138: p. 35). Furthermore, "transparency" has already been integrated into previous recommendations and is employed in the context

of "providing information on the risks of radiation and the associated precautionary measures" as well as the "decision-making process for choosing protective measures" (ICRP 138: p. 36).

Therefore, the procedural value principles outlined in ICRP 138 are consistent with the widely recognized definition of informed consent, which entails "the disclosure of information, comprehension of the disclosed content, and agreement to the information" (ICRP 138: p. 37).

As stated above, although the ethical norms of radiological protection have undergone significant changes over time, it can be inferred that the fundamental ethical values have consistently been dominated by utilitarian ethics, which balances the "principle of beneficence to maximize the benefit to the patient" and the "principle of nonmaleficence to avoid causing harm to the patient."

2. Justification of Exposure and Bioethics

In ICRP Publication 60 (1990 Recommendations) (ICRP Publication 60, [1991]), it has been proposed that to justify any practice involving the use of radiation sources, "No practice involving exposure to radiation should be adopted unless it produces sufficient benefit to the exposed individuals or to society to outweigh the radiation detriment it causes" (ICRP 60: p. 86).

In particular, there is a historical precedent in the nuclear industry, including nuclear power generation, which has public implications, where societal benefits were prioritized over individual interests. In other words, even if the radiation exposure of individual radiation workers at each nuclear facility posed a disadvantage to them, the practice was justified if the cumulative disadvantages were outweighed by the aggregate public benefit to society.

Conversely, in the context of medical practice, for the exposure to be justified, the benefit of alleviating the disease or its symptoms must outweigh the detrimental effect of the exposure. The preceding illustrations show that the ethical value of exposure has historically been supported by the principle of "act utilitarianism" [6].

As previously mentioned, "act utilitarianism" has been used to justify the use of radiation in medical examinations, with the objective of facilitating the patient's recovery from illness. In other words, the act of exposing the body to radiation is only permissible if it would be anticipated that the benefit of curing the disease or alleviating symptoms will outweigh the damage resulting from the exposure.

Furthermore, the physician's discretion in clinical practice would be limited by restricting the use of radiation in treatments or examinations. Utilization of radiation in medical examinations is definitively permissible under the "principle of beneficence" in the physician's duties.

However, from another perspective, radiation exposure, despite being for medical purposes, entails certain hazards, including the occurrence of adverse events, which may conflict with the "principle of nonmaleficence." Thus, it is essential to evaluate the utilization of hazardous radiation on the human body for medical purposes from the perspective of the conflict between the "principle of nonmaleficence" and the "principle of beneficence." A method of balancing these principles is recommended by Beauchamp and Childress to address cases where these principles conflict according to the context of a specific case.

Hence, it is asserted that it is essential to meticulously deliberate on the relative weight and strength of these principles and ascertain the principle that is more significant in each circumstance, thereby assigning an order of priority. However, in the context of the "justification of action" regarding exposure, simply resolving the conflict between the physician's duty to avoid the harmful effects of radiation (the "principle of nonmaleficence," which would provide physical benefits) and the duty to diagnose and treat the patient (the "principle of beneficence," which offers medical benefits) solely through comparative balancing is insufficient. In other words, the sole act of weighing these two principles neglects the consideration of respect for individual patients' (or subjects') autonomy (self-determination), resulting in an excessive focus on "act utilitarianism." This leads to a vulnerability in terms of safeguarding the individuals subjected to exposure. In the subsequent section, we will explore potential solutions to this issue.

3. Utilitarianism and Justification of Actions

In June 1964, the Declaration of Helsinki (adopted

by the World Medical Association) (Helsinki, Finland, June [1964]) was developed, stating that "Medical research involving human participants is subject to ethical standards that promote and ensure respect for all participants and protect their health and rights." (General Principle 6). As previously addressed in Beauchamp et al.'s Principles of Biomedical Ethics, in the context of "respect for persons," it is emphasized that ethical treatment of individuals primarily requires respecting their autonomy. This entails that, if it is evident that no harm will be inflicted upon others, one must not interfere with that person's actions.

Additionally, regarding "beneficence," it is observed that there is a duty to optimize the benefits arising from research, and thus, minimize potential risks. Hence, it is imperative to prioritize the welfare of individuals in addition to safeguarding them from damage (principle of nonmaleficence/beneficence).

Since the 1960s, especially in Europe and the United States, the traditional concept of entrusting medical decisions entirely to physicians has been increasingly recognized as inadequate for safeguarding patients, especially in cases involving medical research, invasive testing, or treatments. Consequently, the right of patients to make their own decisions has become increasingly significant, facilitated through explanations of the medical procedures to be conducted, and ensuring patients' comprehension.

The Declaration of Helsinki established the necessity for informed consent for these reasons. The Declaration of Helsinki mandates that "patients and subjects must receive adequate explanations, comprehend the content, and provide consent" in relation to informed consent. Furthermore, the significance of disclosing risk information in the explanation is underscored.

Additionally, the Declaration points out the importance of ensuring that the content of the explanation is understood. This includes special consideration for subjects who may lack the capacity to consent, such as children or those with cognitive impairments. Consent is only considered valid when it is given voluntarily by the subject themselves.

As previously stated, the ICRP recommendations in the 1970s were concentrated on the concept of "justification of actions" based on act utilitarianism. Nevertheless, the content of action justification witnessed a substantial transformation in ICRP 26 (1977 Recommendations). This shift was predominantly influenced by the introduction of the concept of individual exposure limits within the principles of radiation protection in these recommendations. This suggests that the principles of respect for persons and their autonomy have become more prominent in the medical field.

Therefore, the concept of "justification of actions" that exclusively predicated the absolute authority of physicians was superseded by a requirement that the instructions must be based on medical (scientific) evidence. Without this evidence-based foundation, such as that presented in imaging guidelines (Diagnostic Imaging Guidelines [2016]) and other medical resources, the physician's instructions cannot be justified.

Additionally, it is imperative to mitigate the extent to which radiation exposure results in adverse effects on individuals, thereby preventing any infringements of autonomy. Therefore, the approach to radiation exposure in medical practice has evolved from act utilitarianism to rule utilitarianism[6]. As a result, for justification of actions to be established, it is deemed necessary to fulfill both medical evidence and informed consent as essential requirements.

5. Low-dose Radiation Exposure and the LNT Model

Radiation exposure, whether in a medical context or not, is characterized by the same physical effects on the body at a specific dose. However, the action of causing physical "harm" through radiation exposure is justified from a utilitarian perspective in the case of medical exposure, as the individual receives medical benefits. This understanding has achieved a certain degree of social consensus.

If the risks of exposure are known, it is possible to compare them to the medical benefits when evaluating the justification for X-ray examinations. However, when the risks of exposure are unknown, such comparisons cannot be made, which results in the lack of any basis for justifying the exposure.

The epidemiological data that serves as an optimal sample for assessing the risks of low-dose exposure is derived from the atomic bomb

survivors of Hiroshima and Nagasaki. The Radiation Effects Research Foundation's Life Span Study cohort comprises survivors for whom exposure doses are reasonably well-determined. The average exposure dose for individuals within 2,500 meters of the hypocenter is 200 mSv, with a statistically significant risk at a minimal dose of 150 mSv (Ozasa, K, [2012:229–243]). The dose-response relationship from the relevant study (Ohsawa et al.) (Ozasa,k [2011:903-911]) is depicted in Figure 2.

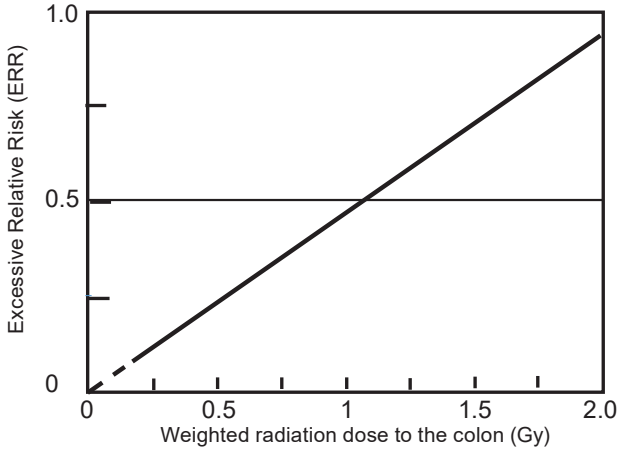

Figure 2 Excessive Relative Risk (ERR)

Source: Epidemiological survey of the atomic bomb survivor in Hiroshima and Nagasaki.

The probability of cancer (excess relative risk) caused by exposure increases in direct proportion to the increase in dose within the range of 0–2 Gy (2,000 mSv) of exposure, as illustrated in Figure 2. This type of dose-response model is known as the LNT model, which assumes that excess risk increases proportionally with the dose. The ICRP has implemented the LNT model as the foundation for considering radiation protection in low-dose ranges. Consequently, regarding cancer and genetic effects, it is presumed that there is no threshold dose (the dose at which effects appear in 1% of the population), and the incidence rate increases linearly with increasing doses from zero.

However, in the case of low-dose exposure, such as those observed in medical exposures, the risk assessment for doses below 100 mSv (the dashed portion in Figure 2) has not yielded statistically significant figures, even when extrapolating the findings from studies on atomic bomb survivors toward a zero dose. Therefore, the dose-response relationship for such low doses is depicted by a dashed line in Figure 2 to indicate that it is "statistically non-assessable." Based on current scientific knowledge, it is believed that the cancer risk caused by low-dose radiation exposure (below 100 mSv) is so negligible that it is obscured by other factors contributing to cancer development, rendering it difficult to establish the cancer risk from exposure.

Furthermore, scientific methods other than epidemiological studies have been employed to elucidate the cancer risk; however, they have not yet succeeded in elucidating the risk of low-dose exposure in humans (Health Risks from Exposure to Low Levels of Ionizing Radiation [2006:43-64]). This implies that the evaluation of low-dose exposure risks is regarded as having limitations when approached through conventional natural scientific methods.

6. Customization of Radiation Protection Standards

The ICRP 103 (2007 Recommendations) (ICRP Publication 103, [2007]) established radiation protection standards, which include a maximum annual effective dose[7] of 50 mSv for "radiation workers" engaged in occupational activities that involve radiation exposure, based on scientific findings from epidemiological data. Furthermore, the upper threshold is established at a total of 100 mSv over the course of five years, with an average of 20 mSv over that time (Table 1, see below).

The annual exposure limit for the general public is set at 1 mSv. The term "general public" incorporates everyone who is not a radiation worker, regardless of gender, encompassing all age groups, from highly radiation-sensitive infants (0 years old) to adults.

Conventionally, the approach to protection against radiation exposure has been a uniform regulation applied to all individuals subject to exposure. However, analyses of the epidemiological data obtained from Hiroshima and Nagasaki atomic bomb survivors have revealed disparities in radiation sensitivity that are based on age and sex (Ozasa,k [2011:903-911]).

The ICRP's fundamental philosophy contends that "there is no reason to differentiate between genders for the purpose of managing occupational exposure." However, under Japanese law (Law Concerning the Regulation of Radioisotopes: Act No. 167 of 1957), the limit for women of childbearing potential is set at 5 mSv over a period

Table 1: The 2007 recommendations in ICRP Publication 103

Type of limit	Occupational	Public
Effective dose	20 mSv per year, averaged over defined periods of 5 years. With the further provision that the effective dose should not exceed 50 mSv in any single year.	1 mSv in a year In special circumstances, a higher value of effective dose could be allowed in a single year, provided that the average over 5 years does not exceed 1 mSv per year.
Annual equivalent dose in		
Lens of the eye	The limit of 150 mSv has been amended in the "ICRP Publication 118 Recommendations on Tissue Reactions (2011)" to "an average of 20 mSv per year over a defined period of 5 years, with no single year exceeding 50 mSv.	15mSv
Skin	500mSv	50mSv
Hands and feet	500mSv	—
For occupationally exposed individuals (in the case of women)	after a pregnancy declaration, the effective dose to the embryo/fetus must not exceed 1 mSv for the remainder of the pregnancy.	

"Recommended dose limit values in planned exposure situations (Modified from Table 6 of the same recommendations)"

of three months, and there is a provision requiring the measurement of effective dose limits every three months to prevent inadvertent exposure until pregnancy is confirmed.

The primary goal of this regulation is to minimize exposure to the fetus during pregnancy. Hence, it is stipulated that "if a female worker declares her pregnancy (when she herself reports it to her employer), additional management must be considered to protect the embryo/fetus." Furthermore, the equivalent dose limit for the abdominal surface during pregnancy is established at "no more than 2 mSv."

In recent years, advancements at the genetic level have elucidated the individual differences in "sensitivity" to exposure. For instance, cases of increased sensitivity (Ekaterina Royba [2015]) to radiation due to specific genes, including ATM (ataxia-telangiectasia) and Brca1 heterozygotes, have been identified. Additionally, Wilson and colleagues have reported that in familial retinoblastoma (RB) patients, the RB1 gene[8] demonstrated significantly elevated sensitivity to radiation (Paul F Wilson [2018:483-494]), even in family members who did not exhibit the condition.

These results indicate that establishing uniform radiation protection standards may lead to excessive protection for some individuals, while others may receive inadequate protection. Consequently, by incorporating individual genetic information and accounting for differences in radiation "sensitivity," it is feasible to establish "tailor-made" radiation protection standards. This method enables protection against radiation exposure that is more closely aligned with the genetic sensitivity of each individual to radiation.

With advances in genetic diagnostic technologies and the reduction in associated costs, it is envisaged that estimating cancer risk based on the presence or absence of tumor suppressor genes[9] (note 9) and simplifying the calculation of individual risks from exposure will eventually become practical. This would facilitate the transition from conventional uniform radiation protection standards to customized radiation protection standards that consider sex, age, and genetic information.

Nevertheless, a new challenge has emerged in the integration of these newly established benchmarks into the legal framework for radiation protection and the association of an individual's genetic information with radiation protection standards. To resolve this, it will be crucial for international radiation-related organizations such as the ICRP to collaborate and work together on developing such systems.

Furthermore, the concept of "tailor-made radiation protection standards" necessitates a careful consideration of ethical concerns related to bioethics. Specifically, when determining individual dose limits based on differences in sensitivity informed (Lin Shi [2018:424-432] by genetic data, it is imperative to meticulously evaluate the issue of disclosing pertinent genetic information about radiation sensitivity to individuals while ensuring the privacy of their genetic information.

Thus, implementing individualized protection

standards will necessitate the development of a more sophisticated understanding of the relationship between radiation dose and associated risks.

Conclusion

By considering the complex relationship between radiation exposure for patients undergoing radiological examinations and stated principles of bioethics, we find that the incorporation of a new value judgment standard of "prudence" in conjunction with the principles of "beneficence" and "nonmaleficence," enables the optimization of benefits for the patients while minimizing their radiation exposure. These are essential bioethical principles, when considering the rationale for actions related to radiation exposure for testing purposes.

In medical settings where radiological tests are performed, it is imperative to first explain to the patients that the test aligns with the "medical rationale" delineated in radiation testing guidelines based on the ethical principles mentioned, including prudence. Furthermore, it is imperative to provide a comprehensive explanation of the medical advantages and disadvantages of the test.

The effects of low-dose exposure are scientifically unproven. Based on current scientific understanding, the hazards of exposure must be explained, considering age, sex, and the individual's hereditary vulnerability to radiation.

These explanations may cause some patients to become apprehensive about the potential risks of exposure and opt to decline the test. In such cases, it is vital to provide an explanation of the potential medical disadvantage of refusing the test. If there are alternate methods, such as MRI scans, that do not entail radiation exposure, it is crucial to offer these options as well. Providing comprehensive, personalized responses to these choices is essential.

Furthermore, it is imperative to obtain the patient's informed consent prior to conducting the examination, after ensuring that the patient comprehends both the medical advantages of the test and the risks associated with exposure.

By permitting the patients to determine whether to undergo examinations involving radiation exposure, the "respect for autonomy" of the patient is ensured, which is crucial for informed consent. However, the ability to accurately convey the risks of radiation exposure depends on the patient's level of understanding, which may vary. In cases where the patient's understanding is restricted, such as in children or individuals with cognitive impairments, it becomes necessary to consider alternate approaches such as surrogate decision-making or decision-making support that are tailored to the patient's level of understanding.

Based on these considerations, this paper recommends the implementation of informed consent procedures that correspond to the level of risk posed by examinations involving exposure. Additionally, it highlights the necessity for future reassessment of medical practices, including establishing personalized protection standards that consider each patient's sensitivity and decision-making capacity.

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Endnotes

1 Hippocratic Oath: Hippocrates was a Greek physician born in the 5th century BCE. He is credited with laying the foundation for scientific medicine by rejecting the mystical practices that preceded his time. He is often referred to as the "Father of Medicine."

2 Late-Onset Effects: Radiation exposure can cause a variety of symptoms depending on the dose received, with effects appearing at different times. Radiation effects are often classified into early-onset effects, which occur within a few months after

exposure, and late-onset effects, which occur after a longer period. Late-onset effects include cancer and genetic impacts. While the mechanisms are not fully understood, it is hypothesized that although DNA damage may be the initial cause, factors such as chromosomal instability, chronic inflammation, and aging also play a role.

3 Equivalent Dose: This concept indicates the extent of radiation exposure a person has received. Equivalent dose is measured in sieverts (Sv) and is a standardized metric used to express the biological effect of absorbed radiation energy (measured in grays, Gy). It adjusts the absorbed dose by a radiation weighting factor based on the type and energy of the radiation. The equivalent dose, HT, RH_T, RHT, R, is calculated by multiplying the absorbed dose, DT, RD_T, RDT, R, (measured in grays, Gy) by the radiation weighting factor, WRW_RWR. The formula is HT, R=WR×DT, RH_T, R = W_R \times D_T, RHT, R=WR × DT, R.

4 Deontology (Deontological Ethics): In ethics, deontology is a position that asserts the moral value of an action lies not in its consequences or subjectivity but in adherence to duty. This stance contrasts with consequentialism, which includes utilitarianism.

5 Precautionary Principle: This principle applies to cases where there are potential hypotheses about significant and irreversible environmental harm (e.g., from chemicals or genetic modification), even if the scientific proof of causality is incomplete. It allows for regulatory measures in such circumstances. The precautionary principle has been widely adopted in Europe and North America since the 1990s and is also referred to as the precautionary measures principle.

6 Act Utilitarianism and Rule Utilitarianism: Utilitarianism is the ethical theory that the morally right action is the one that maximizes happiness for all those affected. Act utilitarianism states that in any given situation, the right action is determined by directly applying the principle of utility (i.e., calculating the action's overall consequences). Rule utilitarianism, on the other hand, posits that actions are judged right or wrong based on the rules that generally maximize happiness, with utility being calculated when formulating these rules. (Source: Introduction to Medical Ethics, edited by Akabayashi Akira, 2016, pp. 33-38)

7 Effective Dose: This is a measure used to express the degree of radiation exposure a person has received. It takes into account the different sensitivities of various tissues and organs to radiation by multiplying the equivalent dose by a tissue weighting factor. The effective dose is the sum of these tissue-weighted equivalent doses for the entire body. It is used in radiation protection management and is expressed in sieverts (Sv). (Source: ICRP 103: 2007 Recommendations)

8 Retinoblastoma: Retinoblastoma is a malignant tumor that usually develops in children under the age of five and occurs in the developing retina. It originates from cells where both copies of the RB1 gene have mutations that predispose the cells to cancer. Retinoblastoma can occur as a unilateral (affecting one eye) or bilateral (affecting both eyes) condition. (Source: Retinoblastoma, by Dietmar R. Lohmann, MD and Brenda L. Gallie, MD, National Library of Medicine, November 21, 2018)

9 Tumor Suppressor Gene: These are genes that encode proteins responsible for suppressing cancer formation. When these genes are damaged or malfunction, they lose their ability to prevent cancer, leading to increased susceptibility to cancer. Tumor suppressor genes are involved in various functions such as regulating the cell cycle, repairing DNA, and controlling gene transcription.