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Hypothetical acceptability of minimally invasive tissue sampling and considerations for practice: A qualitative study in Vietnam

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ABSTRACT

The exact aetiology of the cause of death (COD) remains unknown for a high proportion of deaths caused by infectious diseases. Complete diagnostic autopsy (CDA) is considered the gold standard to determine COD, but it is often not used in low and middle-income countries (LMIC), including Vietnam, for a variety of reasons. One alternative is minimally invasive tissue sampling (MITS). This study was part of a larger project to explore the perceptions of MITS in Vietnam to provide recommendations for its potential implementation. We collected in-depth interviews and focus group discussions that explored MITS acceptability from 96 participants, including key informants, healthcare workers, community stakeholders, and people who had family members pass away recently. Participants highlighted the minimally invasive nature as the most considerable strength of MITS that could make it acceptable in Vietnam compared with CDA. However, participants still had concerns including the accuracy of the technique, the potential damage on the body, and the potential conflicts MITS results could have with original clinical diagnoses. Overall, the hypothetical acceptability of MITS was not clear-cut. It is imperative to consider acceptability before implementing new medical procedures into a given context, especially when it revolves around death, dying and the body.

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Introduction

In 2019, the reported number of deaths from infectious diseases was almost 7.9 million cases globally, with almost 80% of these cases occurring in low and lower-middle-income countries (LMIC) designated by the World Bank (Institute for Health Metrics and Evaluation & Global Burden of Disease, 2019). Many of these cases, however, lacked the exact aetiology for the cause of death (COD) (Phuong Hoa et al., 2012; Rao et al., 2010; H. T. Tran et al., 2018). Specific to Vietnam, infectious

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diseases account for 15–20% of all mortality, yet in over 50% of these cases, COD remains unknown (Ngo et al., 2010; Walton et al., 2018). Research in Vietnam demonstrates the challenges of establishing the exact aetiology of major infectious syndromes, as evidenced by a large proportion of cases remaining undetermined by sampling cerebrospinal fluid (usually over 50%) and sputum (usually around 30%) and the exact relevance of finding a potential pathogen in a non-sterile respiratory sample being unclear (X. D. Tran et al., 2024), despite the use of different diagnostic assays within these studies (Do et al., 2011; van Tan et al., 2010). In clinical practice, due to the lack of diagnostic capacity and as the intrinsic inability to collect certain optimal specimens, diagnoses are often incomplete. For example, understanding the underlying causes of pneumonia and encephalitis through autopsy investigation can offer valuable insights into specific aetiological agents within specific communities. This would not only inform future therapeutic strategies but also guide public health policies, such as improving vaccination programmes (Turner et al., 2012). Therefore, knowledge of COD is an important public health metric with practical applications that can benefit the overall health of a population.

While complete diagnostic autopsy (CDA) remains the gold standard for determining COD, its utilization in LMICs remains limited, primarily due to constrained capacities of healthcare facilities as well as socio-cultural barriers that hinder widespread practice (Paganelli et al., 2020). In Vietnam, CDA is rarely conducted outside of forensic settings due to the lack of facilities and training for both autopsy procedures and pathological examination (Do et al., 2011). Additionally, the majority of deaths occur at home rather than in the hospital (van Tan et al., 2010; Walton et al., 2018) and there are prevalent negative attitudes toward post-mortem examination (Do et al., 2011), further reducing the feasibility of implementing CDA.

An alternative to CDA is verbal autopsy (VA), although its efficacy in establishing specific COD is often inadequate and subject to debate (Butler, 2010). While VA methods have been validated in Vietnam (Hong et al., 2018; H. T. Tran et al., 2018), there may be more effective methods of determining COD to improve mortality data. Minimally invasive tissue sampling (MITS) emerges as a promising technique, which has been used in several LMIC contexts of stillbirths, neonates, children < 5 years (Das et al., 2021; Otieno et al., 2023), and more recently with adults in countries like Nepal (Subedi et al., 2023). A recent literature review found that the number of publications regarding MITS in LMIC contexts has increased greatly since 2015, (Paganelli et al., 2020) therefore the consideration of such methods is increasing globally. Furthermore, the method is considered to be a valuable and effective tool for improving surveillance of mortality data in contexts where CDA is not performed routinely (Subedi et al., 2023).

This paper presents findings from a qualitative study, which was part of a larger project led by the Oxford University Clinical Research Unit (OUCRU). The larger study also included a quantitative component which was published elsewhere (Dieu et al., 2023). The qualitative component aimed to explore the perceptions of MITS situated in Vietnamese context to provide recommendations for its potential implementation that would be socio-culturally appropriate and acceptable. The objective of this qualitative paper was to explore the hypothetical acceptability of MITS among healthcare workers and community members across three provinces in Vietnam.

Materials and methods

Study sites

We conducted the qualitative component in two municipalities, including Hanoi (HN) and Ho Chi Minh city (HCMC) and a province in the Central Highlands (Dak Lak – DL). The study locations were purposively selected to ensure representation of diverse perspectives across different geographical areas of the country, and at the same time, explore distinctive local cultures and traditions that might influence the participants' perspectives. In each city or province, we recruited

participants living in rural and urban areas, and people from ethnic minority groups to collect a range of experiences and perspectives.

Sampling and participant recruitment

Based on stakeholder mapping and consultations with the OUCRU health research advisory board, a group comprised of members of the public, we included four main groups of participants. First, we included a variety of key informants (e.g. public health experts, public health researchers and medical legislative officers). Second, we recruited healthcare workers including doctors and nurses from different clinical departments, especially those working in intensive care units (ICUs). Third, we recruited community stakeholders including elderly people, religious leaders, and local authorities who may have in-depth understanding and knowledge of local traditions and rituals. Finally, we included relatives whose family member died more than six months prior to the interview. This was to ensure that potential participants had had some time to recover from grief and bereavement. We used purposive sampling to recruit initial participants for the study through our existing network, adhering to the outlined criteria and diversity in terms of religion and ethnicity. Subsequently, we used snowball sampling to recruit additional participants within the four groups. Local administrative officers and healthcare workers also helped us to contact some community stakeholders and family members based on the specified criteria.

Data collection

We used in-depth interviews (IDIs) and focus group discussions (FGDs) to collect data for the study. As the conversations involved discussing sensitive issues such as death, dying and rituals, as well as personal views on a new method of autopsy, we used IDIs to ensure participants' privacy to share their thoughts comfortably (DiCicco-Bloom & Crabtree, 2006; Ryan et al., 2009). This was also extremely important for people who shared experiences of having a family member die recently. We conducted FGDs with doctors and nurses to gather collective perceptions regarding MITS and its potential implementation. Further, in FGDs, we explored the routine processes that occur when a patient dies in the hospital setting. We offered a monetary compensation of 200,000 Vietnam dong (equivalent to US\$8) for each participant for their time.

For both the IDIs and FGDs, we used semi-structured topic guides which were developed specifically for each participant group and revised as the data collection progressed to ensure we could explore new avenues that were brought up in subsequent data collection. The topic guides revolved around the participants' perceptions of MITS, including its perceived benefits and concerns, the potential acceptability of the method and any considerations for implementation should the method be used in Vietnam in the future. To ensure the participants had sufficient understanding of MITS, we developed an animation explaining the process of MITS. We consulted with the OUCRU health research advisory board regarding the content of the animation to ensure that the video clip was easy to understand for lay people.

Three experienced qualitative researchers collected the data in Vietnamese. Throughout data collection, the research team had regular debrief sessions to discuss the findings and any new themes to incorporate into subsequent interviews. We audio recorded the IDIs and FGDs, if participants provided consent; otherwise, we took detailed notes. We transcribed the audio verbatim and then removed all personal identifiers. We then discussed among the data collection team to choose the most informative conversations for translation. 12 transcripts were translated into English by an experienced researcher and a contracted translator, which were then checked back by the research team to ensure accuracy. We imported the transcripts and field notes into Nvivo 12 for analysis.

Data analysis

We used a form of reflexive thematic analysis, loosely based on the process described by Braun and Clarke (Braun & Clarke, 2006). The analysis started with the researchers familiarising themselves with the transcripts through repeated reading and discussing the content in team debrief meetings that were held during data collection. We then used open coding techniques on the first six transcripts to explore patterns across the selected transcripts. These initial codes became the foundation of the codebook which we applied to the other transcripts while adding and adjusting the codes as necessary. We then grouped the codes into subthemes and themes. While the data analysis was primarily conducted by one researcher, we held regular discussions to reflect upon the analysis process and subsequent codes and themes. These meetings, along with regular debrief meetings with the whole research team, ensured methodological rigour.

Ethics approvals

The study was approved by Oxford University Tropical Research Ethics Committee (OxTREC), and the institutional review board of the National Hospital for Tropical Diseases, Hanoi; the Hospital for Tropical Diseases, Ho Chi Minh city; and the Centre for Disease Control in Dak Lak province.

Results

The data collection was conducted between October 2021 and May 2023. In total, we contacted 97 potential participants and 96 agreed to participate in an IDI or a FGD. We conducted 58 individual IDIs, one paired interview and five FGDs across the three locations. The IDIs lasted from 17 min to 167 min. The FGDs involved between six to ten people and lasted an average of two hours and 30 min. In two IDIs, the participants did not consent for audio recording, therefore the researchers took detailed notes of the key points discussed.

Most participants were from major cities (i.e. Hanoi and HCMC) and half of the participants were healthcare professionals (Table 1). Although we tried to recruit participants from other ethnic groups, most of them were Vietnamese Kinh – the major ethnic group in Vietnam.

We structured the results into two main sections, including perceptions of MITS and general acceptability of MITS. We included some of the ethical and practical considerations provided by participants in Appendix 1.

Perceptions of MITS: weighing benefits and concerns

The participants considered different benefits of MITS, while expressing various concerns for the new method. A wide range of aspects surrounding MITS were discussed, including socio-cultural

Table 1. Demographics of study participants.

	n (%)	IDIs (%)	FGDs (%)
Study sites			
Hanoi	41 (42.71)	23 (39.66)	3 (60.00)
Ho Chi Minh city	36 (37.50)	24 (41.38)	1 (20.00)
Dak Lak	19 (19.70)	11 (18.96)	1 (20.00)
Participant groups			
Key informants	8 (8.33)	6 (10.34)	0 (0.00)
Healthcare workers	48 (50.00)	30 (51.72)	3 (60.00)
Community stakeholders	28 (29.17)	10 (17.24)	2 (40.00)
Family members	12 (12.50)	12 (20.70)	0 (0.00)
Ethnic groups			
Viet	94 (97.92)	56 (96.55)	5 (100.00)
Ede	2 (2.08)	2 (3.45)	0 (0.00)
Total	96 (100)	58 (100)	5 (100)

Table 2. Perceived benefits and concerns for MITS, and suggestions for increasing the acceptability of MITS.

	Benefits	Concerns	Suggestions
Socio-cultural aspects	MITS is less invasive than CDA	- The sampling process would still cause certain damage on the deceased's body - Delay to funeral and burial plans of the family	- Transparency in communications and processes - Respect for the body and the deceased's family - Use of various channels to raise awareness in the community
Technical aspects: The use of hollow needles for sampling	- Less occupational risks and trauma for healthcare workers - Less demanding in terms of tools, equipment and expertise	- Accuracy of the results: sampling through needles and ultrasound might not capture the whole picture of the injury - Expertise of healthcare workers who would conduct the sampling process	Trainings for healthcare workers about MITS
Medical science	- Help determine COD for cases that could not be done through clinical examination and tests - Improve clinical skills of healthcare workers - Provide an opportunity to explore mechanisms of new diseases	MITS results might be different from clinical diagnoses that could affect trust in the hospital/clinic settings	Discussions with the hospitals about how to explain the results to the family
Healthcare system capacity and costs	MITS techniques might cost less than CDA due to the simplified sampling process	- Current capacity of the healthcare system cannot adopt the new method: overburdened healthcare workers and the tools and equipment are too advanced for lower-level health facilities - Who will cover the costs?	
Lawful basis		Are there any official approvals from the Government for MITS implementation?	

aspect, considerations for the sampling process, potential contribution to medicine, possible influences on the current healthcare system, and finally, legality. Table 2 demonstrates the juxtaposition weighing the main benefits and concerns for each aspect.

Socio-cultural aspect of MITS

As MITS is a technique concerning death and the body, which are sensitive topics in Vietnam, the socio-cultural aspects of MITS implementation was indeed salient across our discussions with the participants. On one hand, participants noted that MITS would be less invasive and simplified when compared with CDA. While CDA required that the body was dissected, which was described by some participants in the community as “*disgusting*”, in MITS, the samples would be collected via hollow needles that would cause less damage to the body. This was considered more appropriate in Vietnamese culture as it is widely believed and practiced among Vietnamese people that the body is sacred and must be taken great care of after the person passes away (Son & Nga, 2019).

I think the benefit of [MITS] is that the dissecting thing is less. The way they collect the samples here ... I think it will avoid dissecting the body. So ... I think ... this new method looks better than the old one. In the old one, they will have to cut open everything. – A community member from Daklak (DL-COMM-IDI-002)

On the other hand, for some participants, especially community stakeholders and family members, this advantage might not be sufficient to overcome the socio-cultural beliefs and traditions among Vietnamese people related to death and dying rituals. Specifically, some participants remarked that its sampling process would still leave several marks on the deceased's body and

would involve the removal of small portions of tissue. This could still be undesirable for some families as it is customary in many regions of Vietnam to maintain an intact body, regardless of urban or rural areas. To demonstrate this similar perspective shared among community participants, we chose an excerpt from a participant in an urban area of Ho Chi Minh City, who stressed that ensuring a peaceful death and afterlife was their obligation as a child to their father:

If [MITS] could prolong my father's life, I would do anything, at all costs, even if I had to use up all my money. But if this is just to contribute to science, for scientific purposes, then to be honest, I will have to consider it. And maybe, I will say no. It's not because of religion but it's from the love of a child to the father. I want him to rest in peace, for his body to be intact and untouched. – A community member from Ho Chi Minh City (HCMC-IDI-COMM-004)

Additionally, some healthcare workers were concerned that the MITS sampling process might delay the family's plans for death rituals. The sampling process could take about one hour while most families would want to take the deceased immediately home after the hospital paperwork was completed, if in fact the person passed away in a healthcare setting. Furthermore, it is common in Vietnamese practice that the rituals for the deceased, such as the funeral and burial or cremation, must be organised at a 'good' hour for both the family and the deceased. The sampling process of MITS might, therefore, interrupt this, which would not be ideal for some communities.

When the patient dies, their family must want all procedures and rituals to be done as quickly as possible. For example, they might want to have the [good hour] or something like that. If your process of collecting samples doesn't match with their plan, certainly they won't agree. – A healthcare worker in Hanoi (HN-HCW-FGD-001)

Technical aspects relating to the sampling process

The sampling process of MITS, which uses hollow needles to collect samples from tissues, organs and body parts was perceived by some healthcare workers as a positive point of the new method as it would reduce potential occupational risks for healthcare workers. Some participants further noted that healthcare workers might experience less trauma when they performed MITS, in comparison to CDA, because of its less invasive nature.

The healthcare workers might think this method is simple, takes less time and requires less technical skills. Particularly, their emotions won't be affected. Whatever it is, dissecting a dead body must have enormous effects on the healthcare workers who are involved. – A healthcare worker from Ho Chi Minh City (HCMC-HCW-IDI-002)

Further, in comparison to CDA, some participants, including both healthcare workers and community participants, perceived that the simplified sampling process of MITS would require fewer tools and equipment, and would be less demanding regarding the expertise of those who would conduct the sampling process. This would then lead to a potential reduction in the length of time compared with CDA, which could also contribute to reduced costs. MITS, therefore, was perceived by most participants to be more accessible and easier to implement.

For healthcare workers, I think [MITS] is better than [CDA] to determine cause of death. In this method, we will only use one tool to collect the samples for analyses, right? Well, first, it will require fewer human resources. Regarding tools and equipment, I think they would not have to be modern and expensive. It would also be less costly in terms of infection control. When we dissect the body, of course it would require more tools and equipment. – A healthcare worker from Hanoi (HN-HCW-IDI-002)

Despite this, key informants and some healthcare workers questioned the accuracy of MITS in determining COD as they had never heard of the method before. The respondents showed their reluctance and caution when expressing their perceptions of MITS due to their unawareness of the method. We received several questions during the IDIs and FGDs regarding the sensitivity and specificity of MITS in comparison to CDA, which they considered the gold standard for determining COD. Participants commonly asked about previous and current implementation of MITS in other countries that could prove its reliability and validity.

A barrier in terms of technical aspect is that you would have to prove that your method has value. In professional terms, you would have to prove that it has high sensitivity and specificity, which means that the causes given by your method is nearly the same as those from the forensic examination. Let's consider forensic examination as the best one, the gold standard, then your minimally invasive method also needs to give similar results. You can't implement a method without values, right? – A key informant in Hanoi (HN-KID-IDI-003)

Concerns regarding the accuracy of MITS arose due to the use of hollow needles. In contrast to CDA, some healthcare workers highlighted that MITS may not allow for the observation of organ and tissue damage during the sampling procedure. Consequently, the accuracy of MITS would be potentially compromised, especially in cases of new diseases such as COVID-19. Others emphasized the importance of thorough training and extensive knowledge of pathology in order to conduct the MITS sampling techniques properly.

I think this method is very nice but at the same time, it requires very specialised skill sets. From what I've seen [from the animation], they would have to insert needles into some body parts that locate very deep inside the body, which some experienced surgeons might also find tricky to do. So, [this method] will need thorough trainings. – A healthcare worker in Ho Chi Minh City (HCMC-HCW-IDI-002)

Benefits and concerns in clinical setting

Most healthcare workers acknowledged the potential contribution of MITS to advancing medical science and improving their own clinical skills. First, MITS was perceived to fill the gap in determining COD for cases where it could not be established by clinical examinations and available tests. According to many healthcare workers, the results from MITS would help them learn and improve clinical skills to better take care of other patients having similar conditions in the future. Additionally, some participants thought that MITS could help explore and understand the mechanisms of new diseases to advance medical science, which is usually limited for clinical examinations and analyses. If MITS was proven to be accurate and applicable in Vietnam, some healthcare workers even expressed that it could provide a more precise way to determine COD in health facilities.

[MITS] is valuable at some point. It will be helpful in the mortality surveillance because it will be more accurate – this is related to reporting. In terms of clinical practice, through [MITS], we might understand the COD which we didn't before, and learn some experiences from there. – A healthcare worker from Daklak (DL-HCW-FGD-001)

Despite several perceived benefits for healthcare workers, one of the major concerns regarding MITS was possible differences between the MITS results and the doctors' clinical diagnoses. Some healthcare workers were concerned that the family could misunderstand and potentially lose trust in doctors and the health facility, perhaps even leading to litigation.

You should do something to avoid the conflicts of the results. I mean if the deceased's family knows, they might think that the doctor's diagnosis is wrong. There must be a solution to persuade both the doctor and the family so that no conflict will happen. It will be troublesome if the results given are so vague that the family has to question it. – A healthcare worker in Hanoi (HN-HCW-IDI-001)

Legality of MITS in Vietnam

The lawful basis for MITS was also questioned by some healthcare workers and key informants. Since the method requires working on cadavers, some healthcare workers were concerned that its implementation, without official approval from the government, would violate the penal code of Vietnam, i.e. any actions to violate the bodies and the remains of the deceased would be treated as a crime. Therefore, consultation with legislative experts and finding a legal basis for MITS before implementing was highly recommended by several participants.

I think, if you want to do [MITS], first and foremost, you will have all lawful bases in place. First of all, we have the law regarding the violation of the body. We also have very clear legal regulations on whether or not it is possible to do and in which cases this is allowed, as well as the accompanied procedures. These are your legal bases for [MITS]. This is related to the law on the violation of the body. It is fine to insert a small needle into the body, but you will need a concrete lawful foundation. The Ministry of Health and the law needs to allow you to do that. – A healthcare worker in Hanoi (HN-HCW-IDI-003)

The legal aspect could also play an important role on the sustainability of MITS in Vietnam after the research phase. According to some participants, the acceptance and integration of MITS into routine healthcare activities hinges on the recognition of its benefits and subsequent approval by regulatory authorities. This was considered difficult at present, as key informants explained, because their view was that health policy makers had not prioritized the importance of mortality data and surveillance.

Well, actually, the authority hasn't paid attention to determining COD. Except for cases that are related to legal violation, regular causes of death haven't been paid attention to. You see, determining COD hasn't been prioritised at the management level ... – A key informant from Hanoi (HN-KID-001)

Healthcare system capacity and costs

As the conversations continued, healthcare workers and key informants mentioned two specific potential health system burdens, including increased workload and advanced technical requirements followed by a discussion on costs. Participants stated that healthcare workers were already overloaded, at all levels of the healthcare system, so MITS implementation would only add to this burden.

For commune health centers, this would certainly increase their workload while they already have a lot of responsibilities. They do both prevention and treatment, vaccination to pregnancy examination, not to mention all sorts of reports and statistics. So, this would no doubt add more work for them. – A key informant in Hanoi (HN-KID-IDI-001)

In terms of tools and equipment, some participants thought that the equipment would not be available in lower levels of the healthcare system, such as in commune or district levels. Further, thorough pathological analyses after the sampling process would be difficult in some levels of the health system in Vietnam where they do not have pathology departments. According to some participants, such in-depth analyses for MITS were only available in national hospitals at present time.

If we are going to implement [MITS], like we have just discussed, it's important to know who will do it. I think in terms of the sampling process, this should be done by pathologists, but not all hospitals have pathological department. My hospital doesn't have it either. – A healthcare worker in Hanoi (HN-HCW-FGD-001)

As demonstrated above, many participants perceived that because of its advanced techniques and analysis, MITS implementation would likely require financial investment from the government. While there has not been adequate attention to the importance of mortality data from the authorities and policy makers, investing in this new method did not seem promising to some participants.

One disadvantage that I think ... probably ... I can't understand everything after watching an animation but I think the investment for equipment and such must be high, higher than the old method. – A healthcare worker in Hanoi (HN-HCW-FGD-002)

Some participants highlighted that if MITS cost a lot of money, families would not be willing to pay for it, especially when they felt satisfied with the doctor's diagnosis and did not need further information on COD.

P2: If [MITS] isn't covered [by health insurance], it will cost more money.

P4: The costs are definitely higher.

P2: Well, the advantage means its costs must be higher.

P1: Some agencies must cover the costs. Otherwise, the deceased's family will never pay for it themselves.

P6: It also depends on their needs

-Healthcare workers in Daklak in a group discussion (DL-HCW-FGD-001)

Acceptability of MITS

In the previous section, we have presented a range of benefits and concerns perceived by the participants regarding MITS. There were indeed many different and often conflicting opinions about how MITS might be accepted. While some participants expressed their excitement for MITS, others were reluctant. This was the case for both healthcare workers and the community, but the narratives were slightly different.

Acceptability of MITS among healthcare workers and strategies to increase acceptability

Some healthcare workers claimed that the implementation of MITS in Vietnam would receive a warm welcome from healthcare professionals because of its potential benefits to improve clinical knowledge and expertise. However, they thought that MITS should only be conducted in certain cases, particularly in deaths without confirmed causes.

I think there's nothing to worry about [healthcare workers' reactions]. This will be better for them. For example, this can bring some experiences that they can learn from. They also need to know everything to treat patients, to help people. If the causes are preventable then this will help improve prevention and increase the time. Even with untreatable diseases, this might also help prolong life. – A key informant from Daklak (DL-KID-IDI-003)

For other healthcare workers to understand more clearly about the method, several participants suggested to organise information sessions in health facilities to officially introduce MITS, including information about the accuracy of MITS and how it might benefit them as healthcare professionals.

I think it'd be good to have some kind of communication sessions in hospitals, because not all doctors will take part in this study. So, when they are aware of this study, or they are aware of the roles and meanings of [MITS] to their profession, they could discuss this with the patients' families. – A healthcare worker in Hanoi (Hanoi-HCW-IDI-006)

In contrast, some healthcare workers were not fond of this method because of two main concerns already discussed, i.e. the potential conflicts between MITS results and clinical diagnoses, and the increased workload in an already strained healthcare system. Most participants, especially community participants, strongly advised that the deceased's family should be informed of the MITS results because it would be an act of respect to those who had consented to MITS, emphasizing that it was the family's right to be informed of the outcomes. However, to avoid any potential issues, most healthcare workers suggested that the hospital should be informed of the MITS results before it is provided to the deceased's family. If there are differences between the results and clinical diagnoses, there should be a discussion between the MITS team and the hospital about the most appropriate explanation that should be provided to the family. Some healthcare workers even suggested that a professional panel involving medical experts from relevant fields should be established to review the results and decide on what information should be given to the family.

Generally speaking, there should be a discussion. If the MITS results are different from [clinical diagnosis], we must first learn something from here to treat other patients better. If the risk for [conflicts] is high, we should all sit down together to discuss solutions. Us [healthcare professionals] can't know everything. – A healthcare worker from Daklak (DL-HCW-IDI-003)

To ensure the results given to the family are considered ‘legitimate’, other participants suggested that the final results should be considered by the relevant committee who was in charge of similar activities and approved to make decisions. This solution is particularly applicable if MITS is accepted by the law and integrated into the healthcare system.

I: You mean that there must be an agency who would verify the validity of MITS results?

P1: That’s right. It’s like diagnoses must be from recognised hospitals that are trusted.

P3: I also agree with [P1]. There must be an agency who would verify that the results are correct. – Healthcare workers from Hanoi in a focus group discussion (Hanoi-HCW-FGD-002)

Acceptability of MITS in the community and strategies to increase acceptability

The hypothetical acceptance towards MITS in the community also varied. Some community members who supported MITS expressed their fondness of its minimally invasive nature. Several noted that the body would be decomposed or cremated after death anyway, therefore small incisions on the body would not bother them. Others remarked that MITS would benefit medical science and other patients, therefore, it should be allowed.

I think families will be happy with [MITS], right? They won’t have any objections against this. There are lots of good people. Well, the person dies anyway, the body will be decomposed. Some families even donate organs of the deceased to help other people to live 5, 10 or even 20 years more, while here you will just take some tissues to analyse for scientific purposes. It will not cause any damages to them, so I think they will accept it. – A family member of a recently deceased person in Hanoi (HN-FAM-IDI-003)

On the other hand, the damage on the body from MITS was unacceptable for others, as previously mentioned. Another reason for this attitude was that they did not perceive the necessity of MITS as the results would not change the outcome (i.e. death), therefore clinical diagnoses were sufficient regarding the COD. Finally, several participants thought that the unwillingness of community members would be understandable since MITS was not a widely known technique. Topics related to death, dying and the body were also considered sensitive topics in Vietnam, therefore, community members had some skeptical attitudes toward MITS.

In our Vietnamese customs, no one wants to have any interventions on the dead. We want the body to be intact. No one wants to do such thing as there’s nothing else we can do when the person has already died. And even if we know [the COD], it’s useless. Doctors and scientists want to do [MITS] because they want to research, but usually people do not want to do anything on the deceased. – A community member in Hanoi (HN-COMM-IDI-002)

For the general public, most community members remarked that it would take time for MITS to be accepted in the community, due to its sensitive nature. Raising the awareness of MITS in the community should not just involve explanations about it, but similarly should also highlight the benefits of MITS for the general public.

Well, generally speaking, the community would want to know what benefits they can get if they give consent to [MITS]. I mean it has to be transparent and publicised in mass media to reach the general public. They might be confused because they don’t understand it, you know. Everything needs very clear information for the general public to reduce their confusion. – A family member of a recently deceased person in Ho Chi Minh City (HCMC-FAM-IDI-002)

Multiple channels, mass media, leaflets, or social media, should be utilised to reach different groups in the community and to ensure that the messages would be reinforced frequently. Social media platforms were highly recommended given the popularity of social media in Vietnam. Furthermore, any communication strategies for MITS should include local influencers, such as religious leaders, the elderly, healthcare workers, and local authorities. This is particularly the case for rural communities. Using animation to describe the stages of MITS was also

recommended as the visualisation might attract more attention and potentially be easier to understand.

[MITS] relates to a sensitive topic. It's a difficult topic that you must reach families, then communities. Everything needs to be step-by-step. Your communication campaigns need to involve people from different professions or religions or relevant ministries, people who have certain influences in the community. All religions need to be included, why? So that they can educate and communicate with their people. They all need to cooperate. – A community member from Ho Chi Minh City (HCMC-COMM-IDI-002)

Ensuring trust and transparency was perceived as a critical aspect as MITS may cause damage on the deceased's body causing the issues described previously. Suggestions for increasing trust included making sure the community knew that the bodies would be respected and treated with care.

From a community perspective, if you want to do [MITS], there must be a discussion between the family and the hospital. And this must be transparent. It must not be some kind of an experiment or a test that you would lie to do. – A family member of a recently deceased person in Hanoi (HN-FAM-IDI-001)

When explaining the results to the family, there were several suggestions from the participants regarding the communication. First, for transparent communication and interactions, the MITS team should meet the family in person. This would also give the family the opportunity to ask questions about the results. The second recommendation was that the explanation must be in lay language, avoiding medical jargon. The healthcare workers who would discuss with the family should also pay attention to the family's background and develop the most suitable way for communication. Finally, if possible, the discussion should avoid the fact that there was a discrepancy in the first place, although this would certainly come with ethical and legal implications in practice.

Discussion

Overall, participants had varying views on MITS. Participants highlighted the minimally invasive nature as the most considerable strength of MITS that could make it acceptable in Vietnam compared with CDA. However, participants still had various concerns including the accuracy of the technique (despite the complete absence of aetiology in clinical diagnosis), the potential damage on the body (even if damage was limited), and the potential conflicts MITS results could have with original clinical diagnoses. We did not find any clear distinction in perceptions of participants in terms of ethnic groups and geographical areas. Overall, the hypothetical acceptability of MITS was not clear-cut, as has been the case in other studies. For example, Maixenchs and colleagues (2016) conducted a study on hypothetical acceptability of MITS in six African and Asian settings. While many participants were enthusiastic about the method, several concerns echoed findings from our study. These included potential conflicts with clinical diagnoses and socio-cultural considerations, such as disrespecting the body of the deceased. Additionally, different from our study, participants also raised concerns regarding breaches of confidentiality of diseases (e.g. HIV) and misconceptions about MITS as equating with organ removal (Maixenchs et al., 2016).

An important finding related to MITS acceptability was regarding the perceived importance of knowing COD. Researchers from Kenya developed a framework for MITS acceptance that included the 'need to preserve social standing and honor the deceased' and the 'desire to know COD', both of which aim to address the needs of family members of the deceased during this often-stressful time with barriers of opposite concerns (Oruko et al., 2020). While we framed our results differently, one notable contrast emerged regarding the desire to know COD for immediate family members, beyond the diagnosis from the doctor. In the Kenyan study, reasons for wanting to know COD included that it was an alternative explanation to witchcraft or unnatural deaths (Oruko et al., 2020). In Vietnam, the reasons for the general public to want to know COD revolved around the family hoping to feel at ease after knowing why their loved one passed away or whether there is a disease affecting the family members. In this sense, if the diagnosis given by doctors was clear enough, they would not need to know further, which may impact acceptability.

In previous research, barriers to MITS almost always included some level of social, cultural, or religious considerations (Magaço et al., 2023; Maixenchs et al., 2016; Otieno et al., 2023). Participants in our study were hesitant toward MITS because it may delay important death rituals and the majority of participants did not think that home was an appropriate space to conduct MITS. Additionally, in Vietnam, the majority of deaths actually occur at home, which is the preferred space of death, therefore patients are often discharged from the hospital to die at home when their prognosis is poor, similar to areas in Thailand where home deaths are also preferred (Stonington, 2020). In response to similar hesitations and death ‘traditions’, researchers in India piloted a mobile ambulance to conduct community MITS in remote areas because the death traditions would not allow time for transport of the deceased to hospital settings (Satav et al., 2023). This could be a viable option, socio-cultural factors permitting, for remote areas in LMICs. Participants also described to us in detail about the myriad Vietnamese traditions surrounding death and dying, and perceptions of the body, which we present in great detail in a separate manuscript (*forthcoming*).

Participants in our study spoke about MITS in comparison to CDA and listed many benefits of MITS over CDA (e.g. less invasive, less occupational risk for healthcare workers). However, in Vietnam, CDA is rarely performed except for forensic purposes (Phuong Hoa et al., 2012; Rao et al., 2010; H. T. Tran et al., 2018). At first glance, we might assume that ‘minimally invasive’ would be better than the alternatives. However, in settings where CDA is not routinely conducted, the alternatives may not be physically invasive at all, therefore in practice, we need to consider the meaning of ‘minimal’ and also compare MITS with available methods used to determine COD.

Strengths and limitations of the study

To our knowledge, this is the first study in Vietnam that examined in detail how different stakeholder groups perceive MITS and to explore how we could possibly adopt the new method appropriately. The study involved extensive number and groups of participants that contributed to a rich dataset and insights for future research of similar topic and cultures.

However, the study has several limitations. First of all, despite our efforts, we only could recruit two people from an ethnic group. This might partly explain to no differences found in perceptions of participants. Therefore, there should be more future work exploring perceptions of other ethnic minority groups in the country regarding MITS, considering that their customs and traditions are different. Another limitation of our study is that we only assessed acceptability from a hypothetical point of view, which does not always map onto what would occur during implementation. A study in Mozambique that assessed both hypothetical and experienced acceptability of MITS showed that while the overall acceptability was only slightly lower in practice, the experienced barriers included more practical considerations compared to cultural norms in the hypothetical scenarios (Mungambe et al., 2021). However, this analysis provided us with detailed information on how MITS could be considered and several ways to increase its acceptability, as well as the potential barriers that could inhibit its success. Finally, we acknowledge that every country has different contexts and cultures. While the findings of this study can be used as reference to future research, other researchers should cautiously consider their nations’ contexts for the implementation of MITS.

Conclusion

It is extremely important to consider healthcare worker and community acceptability before implementing new medical procedures and technologies into a given context, especially when it revolves around death, dying and the body. If MITS is indeed implemented in Vietnam in the future, it is essential that social science and implementation research is conducted during the actual implementation to ensure that barriers and facilitators that were discussed as part this study as well as the

many factors that were not mentioned by participants in this hypothetical study are noted and considered, including the very practical factors that families face during death and its associated rituals.

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Data availability

Anonymized data are available upon reasonable request from the corresponding author.

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Appendix 1. Ethical considerations for MITS: Consent and compensation

Consent procedures

Most participants expressed that consent from the deceased's family must be acquired before conducting the sampling procedures. Seeking consent from the family would need careful considerations on two main issues: timing and which family members should provide consent. Some healthcare workers who had experiences working in intensive care units suggested that discussions with the family about MITS should be done before the patient dies, specifically when the prognosis is not promising. From their perspectives, at this stage, the family might still be calm enough to consider. However, the healthcare workers should choose the right timing for this discussion to avoid annoying the patient's family. On the other hand, discussing with the family about MITS at any time when the patient is alive was considered to be insensible by some participants, such that it might irritate the family. The excerpts below depict these opposite opinions.

The timing for consent should depend on the actual clinical condition, like if it's getting better or worse. If the patient's condition aggravates quickly that he or she has high risk of dying, it would be best to discuss with the family [about MITS] at this time. (Hanoi-HCW-FGD-002)

It's impossible to do that. They might say: 'Why are you telling us this when the patient is still alive?'. Why aren't you saving life, instead of asking for consent for [MITS]? So I just ... no ... I will never discuss this [with the family] before the patient dies. (Daklak-HCW-IDI-002)

The majority of participants suggested that seeking consent from the family should be done after the patient dies. However, this might have some risks that the family members would not be calm enough to listen about MITS and consider it. Further, it is a common practice for the family to take the body home as soon as possible, therefore, they might reject MITS at this point anyway.

I think the best moment [to ask for consent] is after the patient dies. If we ask them then, they might say yes. There's no way they will give consent to [MITS] when the patient still lives. As long as the patient is still alive, they still have hope [for their family member to live]. (Hanoi-HCW-IDI-007)

I think when the patient dies, the family must be so sad. Yet we are discussing with them about an autopsy ... Even though you will just collect a few samples, I think it'd still be difficult. They have just been in great loss, you see. (HCMC-HCW-IDI-010)

There were various perspectives about who should be approached for consent. Some participants suggested that this should follow routine practice in clinical setting, where healthcare workers will discuss with a representative from the family, who might be the legal guardian of the patient. The representative should have a certain position in the family where they are able to give decisions and have some influence.

I think in every case, we should talk to someone who has influences in the family, that mean the whole family respects his or her opinions. Of course, this family member can't decide right away, he or she must discuss with their family. But it'd be best if this person has a say in the family and is knowledgeable. (Hanoi-FAM-IDI-005)

On the other hand, many participants, including some healthcare workers, noted the sensitivity of conducting interventions on a dead body that some family members might not be confident enough to give this decision. Therefore, consent with the awareness of all family members would be more appropriate.

You should talk to the whole family, like the patient's siblings, aunts, uncles, everyone. You should talk to them all and only when they all agree, should you do it. (Daklak-FAM-IDI-002)

Some participants remarked that while discussing with the family, the healthcare worker should emphasise the benefits of MITS for the family themselves and for the common good, i.e. how it can help other patients and contribute to medicine. Moreover, they should also describe the procedure of MITS as specifically as possible for transparency, including its minimally invasive nature.

You should explain [to the family] succinctly about the purposes and the benefits of doing [MITS], that it will help find the CoD. The family of the deceased might also feel easier to accept it when they understand that it will not cause any harm to the body. (Hanoi-FAM-IDI-002)

Another point noted was that the explanation must be, at the same time, thoroughly considered so that it would not trigger any confusion and conflicts between the family and the hospital.

I think you should not say that [MITS] is to determine CoD, because when the patient dies, he or she must be diagnosed with something. So, [the family] will not accept it if you say this is to identify CoD. If you say so, they will suspect us right away, like they might questions why we are diagnosing the CoD now when the patient has been hospitalised for a while. We won't be able to answer that if they ask. (HCMC-HCW-IDI-008)

Compensation for the family

We discussed compensation for the family with participants and the perspectives also varied. For some, monetary incentives should not be given for two main reasons. First, giving money to the family after they gave consent for MITS might trigger misunderstanding that the family is selling the deceased's tissues for money. A different perspective was that families would not need compensation for doing a good thing for other patients in the future.

As far as I understand, to respect [their contribution], there should not be any incentives given, nothing. You just need to discuss transparently about what you need, in terms of medical requirements. It would not be nice if you

mentioned about money or presents. It would be disrespectful to the deceased, right? You dissect my body, then you give me something. It's unacceptable. (Hanoi-FAM-IDI-001)

Participants also suggested that support for the family could be made in more be more culturally appropriate ways. One of the suggestions was that the research team could attend the deceased's funeral and show their appreciation and sympathy to the family. They could also gift flowers and money as condolences, which was the norm in Vietnam. Alternatively, the MITS team could support the family in other practical aspects, such as costs for transportation.

I think if possible, there should be some support, for example for transportation or some expenses. Or it can be condolence money as in our Vietnamese culture. It won't violate anything ... it's not some money to pay for anyone's benefit, it's condolence money for the family to cover expenses of the funeral. Somehow it is also humane, you know. (Hanoi-HCW-IDI-009)

In contrast to this perspective, some participants thought that it would still be appropriate to offer some compensation to the family. Several people regarded that cash might be more flexible so that they could spend it on what they needed. Further, compensation might be helpful for families with financial hardships. However, to avoid any possible irritation, it would be best to discuss different forms of compensation with the family and let them decide what is appropriate for them.

I think giving money to the family is necessary and useful for the family. You can say that the money is to support funeral expenses, then it will be more acceptable. Don't give any presents because they won't need them. It's best to give them some money. (HCMC-HCW-IDI-004)