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Ethical, Legal and Social Issues of Umbilical Cord Blood Banking and Genetic Research in Ibadan, Southwestern Nigeria: A Qualitative Study

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Running Title: ELSI of Umbilical Cord Blood Banking and Genetic Research in Nigeria

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Abstract

Background: Umbilical cord blood (UCB) is increasingly recognised as a valuable source of stem cells for clinical treatment and biomedical research, including genetic research. However, its collection, storage and use raise ethical, legal and social issues relating to informed consent, cultural and religious beliefs, privacy, confidentiality, and ownership and control of biological materials. This study explored these issues in Ibadan, Southwestern Nigeria.

Methods: This qualitative study involved 25 participants: medical doctors, recently delivered parents, pregnant women, biomedical researchers and community members. Key informant and in-depth interviews were conducted over five weeks, audio-recorded, transcribed and de-identified. Data were analysed using inductive and deductive coding and a framework approach in Atlas.ti 20.

Results: Participants had limited knowledge of the legal and regulatory framework governing UCB collection, banking and genetic research. Cultural and religious beliefs influenced their views on UCB collection and use. Participants raised concerns about consent (including mother, father and child interests), privacy, ownership, and commercialisation, and were uncertain how Nigerian laws apply to UCB banking and genetic research.

Conclusion: This study adds empirical evidence from Nigeria on how consent, cultural beliefs, and ownership of cord blood are understood, and shows that clear legal and regulatory guidance is needed to protect mothers and children. Such guidance should address consent arrangements, the interests of the child, privacy and confidentiality, ownership and control of biological materials, and the responsibilities of researchers and UCB banks. It should also consider cultural and religious beliefs and promote public awareness.

Keywords: umbilical cord blood; ELSI of genomics; cord blood banking; ownership of biological materials; biobanking

1. INTRODUCTION

Genetic research encompasses the study of inherited variation, disease-causing mutations, and gene–environment interactions to understand and treat human disease. It is also described as the scientific study of genes, heredity, and genetic variation detailing how genetic information is structured, transmitted, expressed, and how it influences traits, health, and disease. [1]

While human tissue has always had cultural and scientific values, umbilical cord blood (UCB) in particular, has cultural intrinsic value attached to it and with the emergence of tissue economies, which are driven largely by advances in technology, and attempts to reverse cultural notions and perceptions of human tissue as a useless by-product of treatment, UCB [2,3] has become a valuable and powerful source of wealth. Umbilical cord blood refers to the blood found in the vessels of the umbilical cord and placenta [4]. Umbilical cord has relevance in treatment of diseases with the first use of cord blood in 1972 by clinicians in the United States to treat lymphoblastic leukemia, and thereafter, used for transplantation in hematology for bone marrow replacement [5,6]. With approximately 4 million births per year in the USA, and approximately 400,000 births in Canada, UCB represents a substantial source of regenerative cells for numerous clinical applications [7,8]. The intersection of cultural significance and biological utility found in UCB has positioned it as a uniquely valuable resource for genetic research, offering scientists a pristine, birth stage sample through which inherited variation, disease causing mutations, and gene environment interactions can be studied [9,10].

Globally, umbilical cord blood banking has grown substantially over the past three decades. It is estimated that more than 800 public and private cord blood banks operate worldwide, collectively storing hundreds of thousands of publicly available units and millions of privately banked units [11, 12]. Since the first successful cord blood transplant in 1988 for a child with Fanconi anaemia, more than 40,000–50,000 cord blood transplants have been performed worldwide for the treatment of over 80 malignant and non-malignant disorders, including leukemias, lymphomas, sickle cell disease, thalassemia, severe combined immunodeficiency, and metabolic disorders [13].

The global market value of cord blood banking reflects a propensity for rapid expansion. Industry and academic analyses estimate that the global cord blood banking market was

valued in the tens of billions of U.S. dollars in the early 2020s, with projections suggesting continued growth driven by increasing awareness, expanding clinical indications, and advances in cellular therapies [14]. Asia represents another major hub of cord blood banking activity. Japan, China, South Korea, and India have rapidly expanded public and private banking facilities in response to large birth cohorts and growing demand for stem-cell therapies.

The swift rise and expansion of umbilical cord blood banks have introduced significant challenges, including securing informed consent from donors, verifying ownership, addressing claims of medical benefits, managing commercialization, protecting personal information, and navigating interpersonal relations [15,16]. In the same manner, there exist controversial debates on the source of stem cells for continued research and clinical applications, while the limited available options include the use of embryonic stem cells, adult stem blood cells and cord blood cells. [17, 18]. Although, each of these stem cells has one advantage over the other, UCB cells have been found as more preferred due to its potential use for treatment of many diseases and disorders for which the current form of treatment is inadequate [19]. In order to harness the manifold benefits from use of UCB, a readily available supply of cord blood in abundance is required.

Despite the global growth recorded in other jurisdictions, Africa remains significantly underrepresented in genetic research, cord blood banking and transplantation infrastructure. Although the continent accounts for nearly one-fifth of the world's population and tens of millions of births annually, it contributes only a small fraction of global cord blood inventories. In Nigeria particularly, the propensity for access to cord blood use is very high given the high fertility rates across the country, hence Nigeria can guarantee the supply needed to sustain genetic research using cord blood and its derivatives in the country. The National Demographic and Health Survey, 2018, indicated the Total Fertility Rate (TFR) in Nigeria as 5.3 children per woman [20]. Although this rate may have possibly gone lower in more recent time due to a number of factors such as increased education for women, better access to and use of family planning amongst other factors [21], there is guarantee for access to UCB in Nigeria.

The collection and use of cord blood for genetic research, however raises several ethical, legal, and social issues (ELSI). Previous studies in Nigeria such as Olabode, Okunade, Ajie, Olorunfemi, and Oyedeji [22]; Alexander, and Olayinka [23]; and Duru, Oyeyemi and

Adesina [24] have documented diverse aspects of research on placental/cord banking applications and uses, but few, including studies by Olayanju, Nkanga, Olayanju, Oluwatayo, Adesina, Enitan, and Oladele [19] have focused on the ELSI emanating therefrom. Even these have not examined, in an integrated way, how informed consent is obtained and understood by those who donate cord blood, how cultural beliefs about the placenta, umbilical cord, and birth-related tissue shape willingness to donate and expectations about its use, and who is regarded, legally and socially, as owning cord blood and its genetic derivatives once collected. Nor has the literature considered these questions in Ibadan, where genetic research using cord blood is expanding.

This gap matters because cord blood is collected at a uniquely sensitive moment, often from mothers who are in labour or have only just delivered. Whether consent is meaningful, whether donors' cultural understandings are respected, and who controls the sample and its downstream uses are therefore central to the legitimacy of cord blood research. These questions are being left to emerge in a regulatory vacuum, governed only by a patchwork of principles in the National Health Act of 2014, which does not directly address ownership or consent for genetic research uses of cord blood.

This study adds value in three ways. First, it provides context-specific evidence from Ibadan, southwestern Nigeria, on how cord blood is used in genetic research. Second, it examines informed consent, cultural beliefs, and ownership of biological materials together rather than in isolation. Third, it assesses these findings against the existing legal framework to show where regulation falls short. It addresses the following questions: (1) How is UCB used in genetic research in Ibadan, southwestern Nigeria? (2) How are informed consent, cultural beliefs, and ownership of cord blood understood and handled in this context? (3) What regulations govern the use of UCB for genetic research? (4) What ELSI does genetic research using UCB give rise to?

2. Materials and Methods

Study design: This exploratory research adopted a qualitative approach to examine the ELSI from the conduct of genetic research on UCB and cord blood banking for genetic research in Nigeria. This study elicited data from different sources in Ibadan, southwestern Nigeria on the propensity of UCB use and banking in Ibadan, Nigeria. It also examined regulations governing the use of cord blood for health and genetic research. The study was conducted mainly in Ibadan, the Oyo State capital, Nigeria. Ibadan lies in Nigeria's south-western part

and it is about 145 km north of Lagos. It has eleven Local Government Areas (LGAs), with five LGAs situated in the metropolitan core of the city and six LGAs located in the outer core, which are predominantly peri-urban or rural settlements. The estimated population of Ibadan in 2016 was 3.16 million [25]. By the year 2030, Ibadan is projected to have around 5.2 million people [26].

Study area*:* Ibadan has been selected for this particular study because it is historically recognized as the largest traditional city in sub-Saharan Africa, making it culturally rich and socially diverse. This provides a meaningful context for this study as it explores social, and cultural practices on cord blood use. In addition, Ibadan is home to the University College Hospital (UCH), the foremost health institution in sub-Saharan West Africa where a lot of research on UCB has been and is still being carried out [27]. In particular, UCH, Ibadan has a very large maternity unit and renders services to many pregnant women, making it a suitable site for examining cord blood collection practices due to the high volume of deliveries conducted at the facility [28]. As a major city in south-western Nigeria, research findings in Ibadan can provide insights relevant to other cities or regions in Nigeria with similar socio-cultural and economic structures. Ibadan's large and heterogeneous population ensures ample participants and diverse perspectives, enhancing the validity and generalizability of the study findings.

Study population and Participant selection*:* The population in this study was made up of 25 participants sampled across five study categories. Participants for Key informant interview (KII) were purposively selected to comprise 9 medical doctors sampled from two tertiary health facilities, three secondary health facilities and three private hospitals, all in Ibadan. The participants for in-depth interview (IDI) comprised 6 recently delivered parents comprising three mothers and their partners, 3 pregnant women, 2 female researchers who work in biomedical research institutions, and 5 randomly selected community members.

Inclusion and Exclusion criteria

Recently delivered parents: The inclusion criteria for recently delivered parents were women who had given birth within the nine months preceding the interview and their partners, who were aged 18 years or above, resident in Ibadan, and willing and able to provide informed consent. The nine-month period was selected to ensure that participants had relatively recent experiences of pregnancy, childbirth, and cord-related practices,

thereby enabling them to provide relevant perspectives on UCB collection, use, storage, and associated ethical and social considerations. Parents who had not given birth within the specified period, were below 18 years of age, were unable to provide informed consent, or declined participation or audio-recording were therefore excluded.

Pregnant women: Pregnant women were considered eligible if they were aged 18 years or above, currently pregnant at the time of recruitment, resident in Ibadan, and willing and able to provide informed consent. Their inclusion was intended to capture the perspectives of women who were currently making or considering decisions relating to childbirth and potential UCB collection. Pregnant women who were below 18 years of age, were not currently pregnant, were unable to provide informed consent, or declined participation were excluded.

Medical doctors: Medical doctors were eligible for inclusion if they were aged 18 years or above, currently practising in either a private, secondary, or tertiary healthcare facility in Oyo State, and had professional experience relevant to maternal, reproductive, neonatal, obstetric, paediatric, or related healthcare services. Their inclusion was intended to obtain professional perspectives on existing practices, awareness, feasibility, ethical concerns, and regulatory issues relating to UCB collection and use for genetic research in their respective facilities. Doctors who were not currently practising in an eligible healthcare facility, were not involved in relevant clinical practice, or were unable or unwilling to provide informed consent were excluded.

Biomedical researchers: Biomedical researchers were eligible if they were aged 18 years or above, actively engaged in biomedical research within a research or academic institution, and possessed professional knowledge or experience relevant to biomedical, genetic, stem-cell, or related health research. Individuals who were no longer actively engaged in biomedical research, had no relevant research experience, or were unable or unwilling to provide informed consent were excluded.

Community members: Community members were randomly selected to provide perspectives independent of professional involvement in healthcare or biomedical research. Community member participants were recruited through a community town hall meeting held in Ibadan, which was open to all residents of Mapo/Beere area and attended by approximately 140 individuals. Names of consenting attendees who met the inclusion

criteria of being adult residents of the study community were drawn from the attendance registers, collected and placed in a container, from which five names were drawn at random (a lottery method) by a research assistant who was engaged for this particular purpose. This approach was intended to give all attendees an equal chance of selection and to reduce the risk that participants would be chosen based on their visibility, forthrightness, or prior familiarity with the research team. Eligible community participants were adults aged 18 years or above who were resident in Ibadan, and had no professional involvement in healthcare, biomedical, genetic, or genomic research, were able to understand the study information and provide informed consent, and were willing to discuss their perceptions of UCB use, cord blood banking, genetic research, and related ethical, legal, social, and cultural issues. Community members who were healthcare professionals or biomedical researchers, were below 18 years of age, were unable to provide informed consent, or declined participation were excluded.

While purposive sampling is more commonly used in qualitative research to select information rich cases, random sampling was considered appropriate for this subgroup because the aim was to capture a broad, unbiased cross-section of general community perspectives as distinct from the other 20 participants, who were purposively selected for their specific roles/experience. Combining purposive sampling for key informants with random sampling for general community members allowed the researchers to triangulate expert/insider perspectives with more representative community views, strengthening the credibility of findings.

Theoretical sampling perspective, meant for qualitative research, was adopted. In this case, sample size was guided by data saturation rather than fixed (statistical sampling) in advance. Data collection and analysis proceeded concurrently, with transcripts reviewed and coded in batches of 5 interviews / after each interview to identify emerging themes. Saturation was considered to have been reached in this study when the last three to four interviews yielded no new codes or themes relevant to the research questions. The researcher achieved the data saturation point as close engagement with the data and preservation of narrative nuances through repeated reading for familiarization was ensured, even as data collection continues.

Instruments for data collection*:* The study utilised both KII guide and IDI guide to generate data from the participants. The instruments were designed and guided by extensive literature review on the subject matter. IDI guides was used to gather data from the recently delivered

women and their spouses, as well as the pregnant women, while KII guide was used to obtain information from the medical doctors and researchers. Both guides addressed questions on practices relating to cord blood use for genetic research, cultural and social perspectives on the same, and other ethical and legal considerations.

***Ethical considerations**:* All ethical considerations were observed in this research. Ethical approval was obtained from the Oyo State Ministry of Health Ethics Committee. Before the commencement of the interviews, adequate time was taken to explain the nature of the research to the participants in clear and unambiguous terms. The focus of the study was explained to all the participants and their consent was sought for participation. Participants were assured of their confidentiality and anonymity. Where any participant did not understand any aspect of the work, the researchers ensured this was explained again until the participants were satisfied to make a decision on the informed consent. Participants were also informed that they could decide to end their participation whenever they no longer wished to continue. All the interviews were conducted in English, as all participants were literate and understood the questions put across to them. Also, no name was required, while the interviews were recorded using a midget recording device after consent for recording was obtained from the participants.

***Data collection period and Interview procedure**:* Data were generated over a period of five weeks by the researchers through individual, one-on-one, in-depth and key informant interviews. Each interview was conducted in a different location, chosen to suit the participant and to ensure privacy. Interviews with the doctors took place in their consulting rooms at times when no patients were present, while interviews with the other participants were held at venues of their choice. Each interview lasted approximately 30 to 35 minutes.

***Data analysis and management**:* Information obtained from the interviews were carefully reviewed and checked for accuracy. Electronic data information was saved in well protected digital software to ensure confidentiality of information obtained. Narratives from all the interview sessions were audio recorded, transcribed, and de-identified. All transcripts were read, and reviewed by two members of the research team including the analyst to ensure adequate interpretation of statements and construction of accurate meanings. The analyst (KKS) thereafter processed the data with Atlas.ti version 20 software designed for qualitative data analysis. Atlas.ti is a specialized software designed for qualitative data

analysis. The software facilitated the organization, in-depth exploration and retrieval of data for a comprehensive analysis process. The analyst utilised both deductive and inductive approaches in coding the data, transcribed narratives of interviews verbatim, and undertook a thematic analysis in consonance with guides by Braun and Clarke [29] and through the framework approach by Spencer, Ritchie, and O'Connor [30]. The framework enabled both deductive and inductive theme identification achieved using an exploratory "grounded" approach [31] through two phases comprising five main steps. The first phase consisted of managing the data/narratives cropped from all the various transcripts in this study through familiarization with the data, development of a thematic/coding framework, and indexing. The second phase consisted of data explanation including data charting and data mapping. A preliminary analysis of the interviews identified major themes and variations within the participants' narratives that described their perception of cord blood use. Emerging themes were further based on major points of agreement, contrasting views, and striking and salient points of the participants.

Comparisons and trends were then identified using data matrices [32]. Both phases enhanced theory-driven and data-driven analysis [33]. Thematic analysis is highly beneficial and appropriate when investigating an under-researched area or while working with participants whose views on the topic are unknown. Credibility in qualitative research is measured by the extent to which the data gathered reflects the perspectives and circumstances of the study participants. To enhance the trustworthiness of qualitative data, Anney [34] recommends approaches such as prolonged engagement in the field, peer debriefing, triangulation, member checking, and providing 'thick' descriptions. As the themes were identified from the narrative data, peer debriefing was used to ensure agreement on the identified themes.

Analysis of the ELSI of cord blood use in genetic research has not been explored in recent studies especially through cross section of community members, and triangulated with data from recently delivered mothers, pregnant women, medical doctors and researchers in biomedical research institutions. Overall, the research team, two of whom are members of institutional research ethics committee, provided oversight in the analysis and interpretation of the final data to ensure analytical rigour [35]; thus, queries were raised and cleared with insights into statements and data, hence ensuring identification of patterns in the data set. Quotations were extracted and used to substantiate the narratives, while quotes were also

referenced and or attributed to identifiers by data sources. The overall results from the analysis are discussed.

The analysis combined three complementary traditions, each serving a distinct function. Braun and Clarke's thematic analysis provided the overarching logic for identifying and developing themes. The framework approach provided the procedural structure (familiarisation, development of a coding framework, indexing, charting, and mapping), which allowed systematic management and comparison of narratives across the different participant groups. An exploratory grounded approach was used only as an inductive orientation, allowing themes to emerge from the data in addition to those anticipated deductively. The three are compatible because all are interpretive, flexible in their theoretical commitments, and support combined deductive and inductive coding. We combined them because the ELSI of cord blood use is under-researched and participants' views were unknown: this required a structured procedure for cross-group comparison and openness to unanticipated themes.

3. RESULTS

Socio-demographic characteristics of respondents

Table 1 shows the socio-demographic characteristics of the 25 study participants, including their sex, age distribution, and category of participation across the key informant and in-depth interviews conducted. Table 1 indicates that there were nine male participants across the five categories. Participants were aged between 18 and 69 years, with those aged 40-49 years being the most common age group. Participants were single, married or divorced. Their level of education ranged from primary to postgraduate, and participants were either Muslim, Christian or adherents of traditional religion.

Table 1: Socio-demographic characteristics of respondents

Participant Characteristics	Medical Doctors	Biomedical researchers	Pregnant women	Community members	Recently delivered mothers and partners
Sex					
Male	4	0	0	2	3
Female	5	2	3	3	3
Total	9	2	3	5	6

Age range (years)					
18-29			2		1
30-39	1	1	1		2
40-49	4	1		1	2
50-59	3			2	1
60-69	1			2	
Total	9	2	3	5	6
Marital status					
Single	1				
Married	8	2	3	4	6
Divorced				1	
Total	9	2	3	5	6
Educational status					
Primary				1	1
Secondary			1	3	2
Tertiary	6	1	2	1	2
Postgraduate	3	1			1
Total	9	2	3	5	6
Religion					
Islam	2		2	3	2
Christianity	7	2	1	1	4
Traditional				1	
Total	9	2	3	5	6

Cord blood*: Perceptions on its donation in Ibadan*

Cord blood was culturally considered a by-product with the potential of containing the future "destiny of newborns". Donation of cord blood was perceived sacrilegious and a practice to be wary of and avoided much as possible. Donating cord blood was not projected by most participants, other than the doctors and researchers. Community members described cord blood as highly sensitive and spoke of the 'regret one is likely to have' if it fell into 'wrong hands'; they therefore felt that donation should be discouraged. 'Wrong hands' was explained as the 'hands of bad people' who could use the cord blood to 'afflict the future destiny' of the newborn. A community member expressed that "Cord blood is a very sensitive material, even where it is donated for a just cause, it can still fall into the wrong hands. This is enough reason for me to discourage any donation" *(IDI -22/Community member/Female).* The medical personnel and researchers affirmed the importance of cord blood in the medical field attributing its usefulness to the treatment of diseases. While

recently delivered women also considered cord blood a waste-product after delivery and nothing more, they expressed concerns about the safety of the cord blood for cultural reasons.

Knowledge about cord blood: ***cultural relevance, usefulness in the treatment of diseases and regulations governing use***

Narratives indicated a very high level of knowledge of umbilical cord blood, which participants regarded as culturally significant and treated with great respect and care in the life of a newborn. Women, in particular, described it by the local names such as "*iwo*, *ibi*…"; A strong view among the women was that cord blood should be kept safely after delivery and then 'buried', in order to protect the baby's 'destiny' and ward off any evil lurking in the child's path in life. For example, a woman expressed the kind of cultural attention that people pay on cord blood:

> In our tradition, this cord blood is very important, in fact it is a taboo in my community where I come from to openly discuss cord blood of the baby, hmmm, if it is not kept safe, it can be used for witchcraft purposes, you know cord blood is still blood after all and blood connotes power and life (IDI-22/Community member/Female).

Another participant attributed cord blood as *carrying* the destiny of a child spiritually, saying '*Cord blood has spiritual significance in this part of the world; all that a child will become in life is encapsulated in that cord blood, and that is why everyone guards it with a lot of caution*' (IDI-24/Community member/Male). Contrarily, physicians expressed the knowledge of cord blood in relation to its relevance for treatment of genetic diseases. Although it was considered a waste by-product after delivery, doctors channeled its usefulness towards medical discoveries for genetic diseases. A medical doctor expressed:

> ……. we do not necessarily keep the cord blood, immediately. Immediately after delivery, the umbilical cord is clamped. I quite agree that the cord blood can be useful for certain genetic medical discoveries particularly where there are indications, for instance, when the baby is still in the womb, samples can be taken via a procedure known as chorionic villus sampling which enables us to screen for medical disorders when the baby is still in utero, other than for this, we do not encourage keeping or storage (KII-02/Medical doctor/Male)

In another narrative, a physician who was mainly concerned about the 'banking issue' surrounding storage of cord blood, opined that "there is no need for collection of cord blood in Nigeria since we have no facilities for keeping the same. So why collect when you cannot properly keep? (KII-05/Medical Doctor/Female).

When doctors were asked how cord blood use was regulated in their hospitals, there was general consensus that medical ethics guided everything they did, including their handling of cord blood and other afterbirth products from patients in the clinic. Participants held varying views on whether cord blood was waste or a useful tissue after delivery. The recently delivered mothers and fathers viewed cord blood as a by-product of delivery. One, however, stressed the importance of keeping the placenta and cord blood safe, even though, to her, it was a waste. A female participant recounted a recent marital dispute in which her husband threatened her and her children, saying he knew where he had buried the children's placenta and cords and would exhume them to harm the family if they did not cooperate with him. The woman queried the practice of giving cord blood to fathers of newborns, since fathers can also have ulterior motives with their children's cord blood. The participant was of the opinion that it should be incinerated in the hospital and not given to anybody in particular. This particular assertion was borne in relation to the fear of 'having the baby's cord blood fall into the wrong hands'. Another recently delivered mother considered cord blood a waste product of delivery, since it is usually handed to the newborn's father, who may even choose to flush it down the drain. In her words '*my husband told me that he flushed it down the drain when I asked him what he did with the placenta that was given to him after my delivery in the hospital*' (IDI-15/Recently delivered mother).

Participants who were researchers affirmed that cord blood can be promoted for research uses but it must be strictly regulated. This, according to a participant, is much respected, else, they "*could only be caught up by the laws if they were found abusing the rights of their patients,*" (KII-06/Medical doctor/Female). A researcher opined that even though Nigeria as a country has many legal provisions and laws, most of these laws are not followed, hence, it could be a reason why there isn't much emphasis on laws on cord blood. In her words:

> I do not know about laws on cord blood, however I know that before I take out anything from anyone's body, I must inform the person before any other thing. To me, this is what matters most and not knowing about the laws. What if I know the law and I don't respect or obey it? (IDI-10/Researcher/ Female).

Contrarily, a pregnant woman felt that she may be exploited for her ignorance where the cord blood is collected and kept. She stated that "laws may not adequately protect pregnant mothers because medical doctors have their ways and could wriggle out of any compromising situation" (IDI-13/Pregnant mother/Female).

Practices relating to cord blood collection and use in Ibadan, Nigeria

Medical practitioners maintained that the placenta is regarded as a waste by-product but carries an important cultural identity. These cultural connotations made them very reluctant to keep the cord at health facilities for any reason. A doctor who worked in a secondary health facility noted the lack of any means of preserving the placenta and cord blood, and therefore always advised the midwives on duty to hand them over to the newborn's father as quickly as possible. A doctor in a private health facility in the study area corroborated this. Even where facilities were available, heavy patient loads were seen as a barrier to blood banking, especially in public health facilities. For example, a doctor's narrative indicated that:

> no matter how laudable the use of cord blood may be for regenerative medicine, the fact still remains that our existing facilities for blood banking in public hospitals are overstretched and cannot possibly accommodate cord blood storage in addition to storage of blood. It may not be wise to collect for keeping what cannot be preserved in optimal conditions. (KII-08/Medical doctor/Male)

Participants demonstrated knowledge of the possible use of cord blood in treating diseases. They also described misuse of cord blood by 'bad people' for preternatural or mystical purposes. Because of this, the cord is culturally expected to be handled with care. One participant stated that the cord should be handed to the father as a sensitive product, one often linked to the newborn's 'destiny'. A particular father narrated his experience:

> I fully understand the need of keeping the cord blood safe from unwanted people so I did not wait for it to be handed down to me, I demanded for it as soon as my wife put to bed and I discarded it in a safe place. No member of my family can tell where exactly I had it buried. (IDI-16/Recently delivered partner/Male)

Culturally, cord blood was observed as having strong attachment to the *future destiny* of newborns, hence need for its protection. For example, a community member noted:

> Cord blood has connections with longevity in Yoruba land. Whether you agree with me or not, no one would want anything that could ensure an elongation of his or her life to be used anyhow, and so cord blood storage for me is a *no-go* area (IDI-21/Community member/Male)

Another participant corroborated the assertion of associating cord blood with longevity and life span of newborns. In the words of a spouse of a recently delivered mother:

> Cord blood can be used to prolong the life of the progenitor, and that is why some herbal medicine practitioners use it, some can also use it for

> diabolical purposes…..so you can imagine, where it is used for diabolical means, the long life span a new born should enjoy can be manipulated diabolically for another person, we live in a wicked world….. I'd rather not allow my baby's cord blood be used for any means no matter how beneficial to the society. I have said my own. (IDI-19/Recently delivered partner/Male)

Narratives indicated poor knowledge of the laws regulating cord blood use in Nigeria, although participants emphasised the importance of informed consent throughout the process. When physicians were asked how cord blood use was regulated in their hospitals, there was general consensus that medical ethics guided everything they did, including their handling of cord blood and other afterbirth products from patients in the clinic. Figure 1 below is a graphical representation of research results.

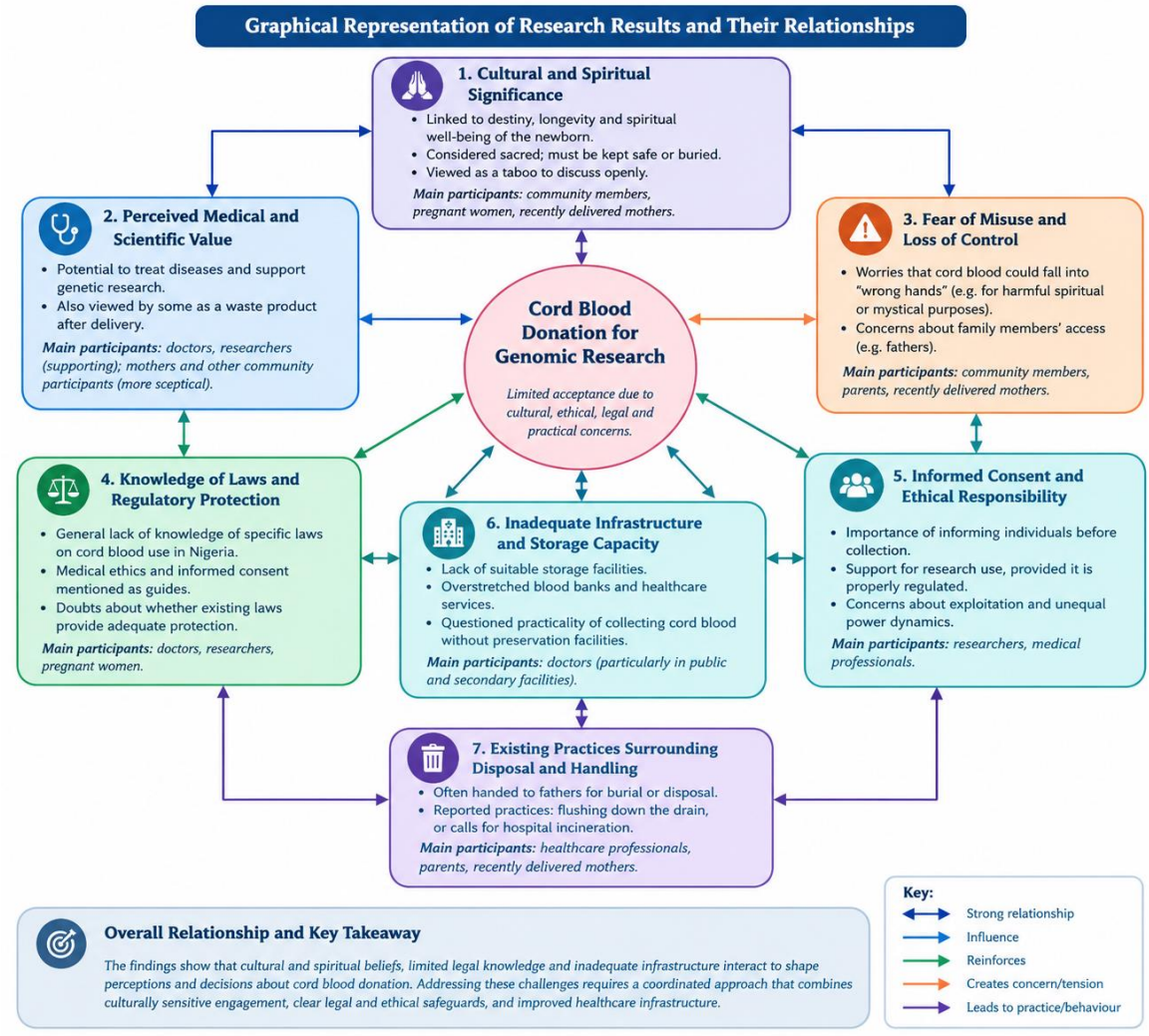


Figure 1: Graphical representation of research findings

Table 2: Table showing themes mapped to research questions

Research question	Relevant themes	Key findings	Main participants	How the findings answer the question
RQ1. How is UCB used in genetic research in Ibadan, southwestern Nigeria?	**Theme 2:** Perceived medical and scientific value **Theme 6:** Inadequate infrastructure and storage capacity **Theme 7:** Existing practices on disposal and handling	UCB is seen as having potential to treat diseases and support genetic research, but some also see it as a waste product after delivery. Suitable storage facilities are lacking, blood banks and health services are overstretched, and collecting cord blood without preservation facilities is seen as impractical. In practice, cord blood is often handed to fathers for burial or disposal, flushed down the drain, or sent for hospital incineration.	Doctors and researchers (supportive); mothers and community members (more sceptical); doctors in public and secondary facilities; healthcare professionals; parents and recently delivered mothers	Use in genetic research is limited. Its scientific value is recognised, but infrastructure gaps and routine disposal mean that most cord blood is not collected or retained for research.
RQ2. How are informed consent, cultural beliefs, and ownership of cord blood understood and handled?	**Theme 1:** Cultural and spiritual significance **Theme 3:** Fear of misuse and loss of control **Theme 5:** Informed consent and ethical responsibility **Theme 7:** Existing practices on disposal and handling	*Cultural beliefs:* cord blood is linked to the destiny, longevity, and spiritual well-being of the newborn, is considered sacred (to be kept safe or buried), and is taboo to discuss openly. *Ownership and control:* people worry that it could fall into "wrong hands" (for example, for harmful spiritual purposes) and about family members' access, such as fathers. In practice, it is often handed to fathers. *Consent:* informing individuals before collection is seen as important, and research use is supported if properly regulated.	Community members, pregnant women, recently delivered mothers, parents; researchers and medical professionals	Consent is valued in principle, but cultural and spiritual beliefs shape whether and how people will donate. Ownership is understood as family and spiritual control rather than institutional control, and in practice cord blood is handled informally, often through fathers. This leaves donors, especially mothers, with limited control.

Research question	Relevant themes	Key findings	Main participants	How the findings answer the question
		Concerns remain about exploitation and unequal power dynamics.		
RQ3. What regulations govern the use of UCB for genetic research?	**Theme 4:** Knowledge of laws and regulatory protection **Theme 5:** Informed consent and ethical responsibility (supporting)	There is a general lack of knowledge of specific laws on cord blood use in Nigeria. Medical ethics and informed consent are mentioned as guides. Participants doubt whether existing laws offer adequate protection, and support for research use depends on proper regulation.	Doctors, researchers, pregnant women; researchers and medical professionals	No specific, widely known regulation governs UCB in genetic research. Practice relies on general ethical principles and consent, and participants regard the legal protection as inadequate or unclear.
RQ4. What ELSI does genetic research using UCB give rise to?	**Themes 1, 3, 5** (ethical and social) **Themes 4, 7** (legal and practice) **Theme 6** (practical)	*Ethical:* risk of exploitation, power imbalances, and consent concerns. *Social and cultural:* sacred and taboo status of cord blood, fear of misuse, and family tensions over control. *Legal:* lack of awareness of the law and doubts about protection. *Practical:* weak infrastructure, and informal disposal that bypasses any consent or oversight.	All participant groups	The ELSI are interlinked. Cultural and spiritual beliefs, limited legal knowledge, and inadequate infrastructure together shape perceptions and decisions, producing limited acceptance of cord blood donation for genomic research.

4. DISCUSSION

Subsequent themes highlight significant cultural, social, and practical barriers to cord blood use in genetic research in Ibadan, Nigeria. The research findings reveal a stark contrast between cultural and community perceptions of UCB as a spiritually sensitive material tied to the destiny and longevity of the newborn, while the professional views of medical doctors and researchers recognise its biomedical potential for treating genetic diseases and advancing healthcare While community members, pregnant women, and their spouses overwhelmingly expressed reluctance toward donation, collection, or banking due to fears of misuse, spiritual harm, or exploitation, healthcare providers emphasised practical limitations (e.g., inadequate storage facilities) and the need for strict regulation. These divergent perspectives underscore broader ethical, legal, and social issues (ELSI) for cord blood use in genetic research in Nigeria, particularly in Southwestern contexts like Ibadan where cultural beliefs remain deeply influential. Hence, narratives exemplified cord blood use issues, including challenges to informed consent, confidentiality, property rights, and the absence of specific regulatory frameworks, while considering pathways toward greater acceptance and ethical advancement. In a study conducted by Usoh and Yusuf [36] public awareness of stem cell therapies for sickle cell disease was critically low, with only 32.5% of respondents in Lagos and 18.7% in Kano reporting prior awareness, while acceptance was hindered by cultural beliefs, ethical concerns, financial constraints and misinformation. Similarly, researcher participants affirmed that cord blood can be promoted for research uses but it must be strictly regulated. This, according to a participant, is very much necessary respected, else, they (the researchers) "*could only be caught up by the laws if they were found abusing the rights of their patients,*" (KII-4/Medical doctor/Female).

Findings from this study revealed cultural inhibitions to cord blood collection, banking and use by the cross-section of the participants. Collection and storage of cord blood was encouraged by the doctors and the biomedical researchers. Conversely, this was vehemently opposed among the community members, pregnant women and their spouses. Opinions were raised pertaining to socio-cultural acceptance, informed consent, confidentiality, and property rights over human tissue. Generally, participants expressed the tendency for most people to reject sharing cord blood of their newborns for banking and use, unless they were exposed to its biomedical relevance, and assured of its safekeeping for use. For instance, a 53-year-old male medical doctor stated, 'I quite agree that it may be relevant for medical

research and discoveries, but then, this is Nigeria o! Anything can happen if we are not careful. If things go wrong, who will be held responsible for it?'

Informed consent*: a mechanism to incorporate participants' options*

Informed consent is the permission granted by a patient in full knowledge of the possible consequences of the course of treatment he or she is about to undertake and knowledge of the possible risks and benefits of the course of treatment. Informed consent is the primary mechanism used to incorporate prospective patients' preferences, values, fears and expectations into decisions about treatment and treatment options [37, 38]. The Nigerian Code of Medical Ethics provides ethical guidelines for medical and dental practice in Nigeria. Rule 19 provides for informed consent by stating that practitioners involved in procedures requiring the consent of the patient, their relative or the appropriate public authority must ensure that the appropriate consent is obtained before such procedures, either for surgery or diagnostic purposes, are done, be they invasive or non-invasive. It also provides that consent forms should be in printed or written form, either as a part of case notes or in separate sheets with the institution's name boldly indicated. Similarly, Part VI, Section 8(1) of the National Health Act 2014[39] states that a person shall not remove tissue, blood, or blood products from the body of another living person for any purpose except with the consent of the person from whom the tissue, blood /blood product is removed and granted in the prescribed manner.

This provision raises uncertainties in its applications. Standard models of tissue donation assume that the process of informed consent must involve the person from whom the tissue is being taken (in living donation), or their representative (in some types of posthumous donation) [40] Such an assumption is problematic in cord blood collection and use because it is not clear whether the mother or the child is the donor. This is also without prejudice to the father of the child whose reproductive materials were involved in the formation of the neonate. The issue of consent is closely linked with ownership, thus the question that readily comes to mind then is 'who provides consent for cord blood collection'? Should it be the father, or mother or both parents? Or rather should it be either the father or mother giving consent on behalf of the newborn who is still a minor and unable to provide informed consent? Participants in this study had various responses on the rightful owner of cord blood to whom informed consent is due. Generally, narratives indicate that the cord blood rightfully belonged to the mother and not to the child, and reasons adduced for this was that

the mother is the source of the umbilical cord and not the child. Contrarily, a doctor opined that 'this cord blood belongs to the baby although it is found in the placenta bed.' *(*KII-9Medical doctor/Female).

These findings highlight uncertainty regarding the appropriate consent arrangements for cord blood collection, banking, and genetic research, reflecting divergent views on maternal, paternal, and child interests. The Nigerian policy and research governance frameworks ought to clarify the roles of relevant family members while protecting the best interests of the child and respecting the autonomy of the mother.

Genetics could provide a leeway in determining this question. If one seeks an answer via genetics, one could argue that the child is more entitled to ownership of the cord blood, but then, other siblings could also lay claim because of the shared nature of genetic information contained in the cord blood. According to Stewart et al [41] there seems to be no dominant ethical or religious position as to who the donor is as cord blood is genetically identical to the child but, depending on the method of collection and type of birth, may be collected from the mother or child, or from the cord when neither child nor mother is connected to it. Stewart et al however recommended that consent processes in cord blood collection, use and banking should be inclusive and representative of different familial interests in the cord blood. Stewart's argument arises from the multiplicity of interests in the genetic information contained in cord blood cells. He argued that based on the mode of collection of cord blood, consent can be given by either the mother, father of the child or even the other siblings whose genetic information are also contained in the cord blood cells. Thus, in instances where the parents give consent, they should note that they are giving consent on behalf of their child.

The National Academy of Science [42] in its draft recommendations stated that Cord blood collection centers should have clear policies about who must provide consent for donation and a plan in place to address paternal objections to the donation of cord blood. The Institute's recommendation also indicated that consent from the mother should be obtained in instances when the blood is removed while the placenta is still in uterus, because at such times, it is believed that the cord blood is an extension of her body. Where the cord blood is removed after the placenta has been taken from the mother's uterus then the father's wishes may also become relevant.

Another important consideration in the informed consent process is the nature of information given out to patients before such cord blood can be collected and kept [43,44]. Historically, the focus of informed consent had been paternalism which had the physician more in focus and recognised that the physician had the right to determine what was in the best interest of the patient. A dramatic shift later occurred in the late 1950's and the 1960's wherein judges began to propose opinions which focused on patient's autonomy and the right of the patient to determine what was in their own best interest, arising from sufficient information given to the patient [45]. In the case of *Salgo v Leland Stanford Jr University Board of Trustees* [46], the court identified the need to focus attention on fulfilling the requirements of providing patients with information on any medical procedure to be carried out.

Narrative from a medical practitioner in this study established, that consent is central to medical practice, yet in reality, it is not always genuinely obtained. Blood samples are often routinely collected from the placenta immediately after delivery, at a point when the mother is not in a position to give consent, even though her consent is required for this procedure.

As stated by Arinze and Okeke [47], a number of factors have been identified as being a challenge to the practice of informed consent in Nigeria. One of these is trust, and in this context, trust is both intrinsic and instrumental. It is critical to a patient's willingness to seek care, reveal sensitive information, submit to treatment, and follow a physician's recommendations. Effective treatment of a patient depends on the ability of the physician to elicit trust from him or her. Whether the physician succeeds in doing this depends on the patient's perception of physicians in general and on the archetypal features of being a physician.

Other factors that militate against the practice of informed consent in Nigeria are the level of illiteracy and poverty. Obtaining informed consent in Nigerian medical practice can be affected by the degree of literacy and economic capacity of the patient. The effect of poverty and illiteracy on patient understanding, medical decision-making and compliance with treatment has been well researched and documented [48]. Persons who lack social and economic power are likely to be occupied with meeting their material needs rather than be engaged in abstract ideals of rights and autonomy. Studies have shown that poor and illiterate persons tend to accept authority without question [49]. Nigeria is a lower-middle-income country with severe economic disparities among its population. It is estimated that

70% of Nigerians live below the poverty line. This does not automatically mean that getting informed consent from uneducated or poor persons is impossible. Rather, it means that the process of doing so may be more tenuous and demanding on the physician, and may not make much difference. This is because, first, poverty and illiteracy foster class differences and may lead to a feeling of reduced self-worth in patients of the lower class. In turn, it may compel them to accept and comply with a physician's treatment decision. Second, because poor and illiterate patients lack the means to institute and sustain a legal action for breach of their rights, there is no real reason to fear legal liability for failing to follow the consent process in Nigeria.

Ezeome and Marshall [50] captured the nexus between an improved literacy level and enhanced informed consent practice. They pointed out that the patient's level of education seems to be an overriding factor in all the influences on informed consent in [Nigeria]. It not only neutralizes the various cultural and social factors, it bridges the gap between the doctor and the patient, encourages discussion on medical matters and also puts the physician on guard.

Informed consent necessitates that full and adequate information is given before any sample is collected from the donor. It is important to explain to potential donors the potential benefits and risks of collecting cord blood, as well as how the blood will be used for research [51]. Similarly, the donor should be informed that they have the right to opt out of whatever decisions they have made without any adverse consequences for whatever decision they have made [52].

Petrini and Farisco [53] stated that in most instances, cord blood collected and from a person may not be useful in treating regenerative diseases and disorders in the same person later on in life. The implication is that cord blood stored on behalf of 'X' may be more useful for another individual 'Y'.

Another consideration is the timing of consent for cord blood collection and storage. Practices on the timing of consent varied in the hospitals visited in this study. For instance, a doctor informant reported that he was unaware of instances where the cord blood was used after delivery. The informant also noted that although consent was a paramount consideration, there had been instances where cord blood was collected to conduct tests on the baby immediately after birth without the mother's consent, largely due to her state of

health following delivery. For some others, the timing is irrelevant insofar as the consent is eventually obtained.

According to the Gilmour [54], the optimal practice is to promote and ensure respect for a pregnant woman's autonomous choice; her informed consent for the collection, storage, and use of her cord blood should be given late in the pregnancy but before labour and delivery and after adequate disclosure of information on the potential uses of the donated cord blood. Other medical personnel interviewed in the study agreed that during delivery, aspects of informed consent focused more on when there arose a need to carry out emergency caesarean operations to deliver the unborn child. This implied that what is carried out as routine practice in majority of the clinics did not include informed consent in delivery operations.

Authors in this paper note that consent in cord blood research is not a single decision but a series- consent to collection at delivery, to storage, to use in research, and to any later clinical use, each of which may require its own authorisation. The findings highlight uncertainty about the appropriate consent arrangements for cord blood, and about whether participants distinguished the separate decisions involved: consent to collection at delivery, to storage, to use in genetic research, and to any later clinical use. Because a newborn cannot consent, these decisions are made by the mother, as the patient at delivery, acting in the interests of the child, with any future independent consent sought from the child on reaching adulthood where appropriate. Participants' references to fathers' involvement in the results reflect cultural and family practice rather than an independent legal right to consent to or object to the use of cord blood.

Confidentiality

The National Academy of Science in their book, further stressed the importance of disclosing a wide range of information to the potential donor. This information includes who has access to the cord blood once it is donated, where it is stored, how it's stored and how the donor's privacy is protected. All these raise issues on confidentiality. Confidentiality becomes an issue when cord blood is stored in biobanks. It has been observed that the cord blood collected and preserved on behalf of an individual may not necessarily be the cord blood that may be required for treatment later on in life. This undoubtedly raises ethical concerns about confidentiality. Cord blood is not only a therapeutic resource but also a source of genetic information that is identifiable and shared

with biological relatives. Disclosure about who may access donated or banked samples, where and how they are stored, and how donor privacy is protected is therefore central to meaningful consent. These questions become more pressing once cord blood is stored in biobanks, where samples and associated data may be retained for long periods and reused for purposes beyond the original donation. Our findings suggest that the safeguards that should address these risks are poorly understood by the people they are meant to protect. Participants had limited knowledge of the laws governing the use of cord blood, which may weaken the ability of prospective donors to give adequate informed consent or to judge how their genetic information would be protected where and whenever reused. Participants also expressed considerable cultural resistance to cord blood use, which indicates that confidentiality was understood not only as a legal duty but as a matter of trust, family reputation and control over bodily materials. By contrast, the doctors and other medical personnel in the study generally supported the use of cord blood for genetic research. This departure matters for data governance. Where those who collect samples and seek consent are more supportive of research use than the communities they serve, and where the public is largely unaware of its legal rights, protection cannot depend on professional discretion. Genetic data are classified as sensitive personal data under the Nigeria Data Protection Act 2023, and the National Health Act 2014 imposes duties of confidentiality in respect of health records according to Sections 26 -28. However, neither instrument clearly addresses secondary research use of banked cord blood, familial interests in genetic data, or long-term biobank governance, leaving a gap between participants' expectations and the protection the law provides. Effective protection of genetic data in this setting therefore requires clear legal rules on access, de-identification and secondary use, independent ethical oversight of biobanks, and public education and community engagement, so that legal safeguards are understood and trusted [55]. Given the small, purposively selected sample from Ibadan, these findings are indicative and transferable rather than representative of the wider Nigerian population.

Property rights over human tissue

Property law may be quite beneficial in controlling cord blood banking since it establishes a model for comprehending conditional donation. Property laws may help to explain how cord blood could be gifted to a public bank on the condition that the donor parent(s) have the option to withdraw donated cord blood if the donor's child or their sibling requires the

cord blood for their own medical use, and that the family is contacted before the cord blood is used in treatment or research. These issues were interrogated in this study. Participants were averse to donations or gifts of cord blood to strangers, researchers or to blood banks for the cultural and religious beliefs earlier adduced.

Control over one's own body and the right to maintain one's bodily integrity are widely accepted and highly prized societal ideals [56]. An underlying issue in discussions about human biological tissue, such as cord blood, is whether this type of biological material can be owned. This issue is crucial since ownership is a precondition for (the standard forms of) economic transactions. That which cannot be owned, such as the air we breathe, cannot be sold or bought. However, that which can be owned can be transferred, sold and disposed of in a wide range of circumstances.

Traditionally, under common law, property rights in human tissue were not recognised except some level of skill or expertise has been involved in preserving the human tissue. Under this approach, it was seen that property rights could be given to the persons who had expended some form of labour on the tissue such as persons involved in the storage of the cord blood in private banks. The implication of this position is that the researcher who has conducted extensive research on cord blood or the individual who has ensured the storage of the cord blood in the banking facility can lay claim to its ownership.

On the flip side, this approach was rejected by the Supreme Court of California in *Moore v Regents of University of California* [57] where Mr. Moore who was undergoing treatment for leukemia had had extensive amounts of blood, bone marrow aspirate and other bodily substances withdrawn from his body in order to confirm the diagnosis of leukemia. At that time, the doctors were aware that certain blood products and components were of value in certain commercial and scientific efforts and that a patient whose blood had all these substances would provide some commercial and competitive advantages. Mr. Moore was also informed that the removal of his spleen would slow down the disease progression. Based on this, Mr. Moore gave consent for the surgical procedure. Before the operation, the physician’s team decided to take portions of Mr. Moore’s spleen, and have it taken to a separate research unit. Mr. Moore was not informed about this development. After the operation, the doctor, at other subsequent visits of Mr. Moore, removed additional samples of blood, blood serum and bone marrow. All the while, the doctor and his team had the intention of conducting research on Moore’s cells to benefit financially and competitively,

which they did and also sought to patent cell lines derived from Mr. Moore's tissue sample. An aggrieved Moore, in an action against the doctor and his team for conversion, breach of fiduciary duty, lack of informed consent among other things, contended that the law of torts protected his ownership interest in personal property and that he, Moore continued to own cells even after they were removed from his body and that he never consented to their use in lucrative medical research and as such unauthorised use amounted to conversion.

The court saw Moore's claim as tantamount to asking the court to impose a tort duty on scientists to investigate the consensual pedigree of each human cell sample used in research, and that imposing such a duty would have policy concerns far from the traditional common law approach of skill and expertise expended on the tissue prior to storage. An exception to the adoption of this position is where there is any identifiable trait in the cord blood or tissue that links the tissue or cord blood to a particular person; then informed consent must be obtained from such individual before the tissue or cord blood is used. This exception recognises possession of identifiable traits in tissue grants the donor some proprietary rights in the same.

Within the Nigerian legal context, however, the question of property rights over cord blood remains largely untested. The National Health Act (NHA), 2014 which provides regulatory framework on blood and human tissue and related matters in Nigeria provides the closest statutory guidance by prohibiting the commercialization of human tissue, blood, and blood products under Section 48, and criminalizing the receipt of financial reward for donation beyond reasonable cost reimbursement under Section 53. By implication, this framework regards tissue as being outside the purview of ordinary property, being something that can neither be bought or sold without affirmatively assigning ownership either to the donor, the collecting institution, or the state. At present, Nigeria has no reported case law directly addressing cord blood ownership or the property status of donated biological material. This leaves a significant jurisprudential gap which this study seeks to interrogate. In instances where there is adjudication before the law courts, the justice of common law is often adopted to fill in the lacunae where there is no direct law (Nigeria being a common law jurisdiction). While common law can be adapted, it can be quite unpredictable and stakeholders may not know the law beforehand until the first decision is made. In addition, common law in Nigeria has not evolved sufficiently to address the diverse issues that may arise concerning ownership and property rights on cord blood. The authors of this paper are of the opinion

that if litigation on such matters come before the Nigerian courts, the justice of the common law will be relied upon.

In more recent times, courts in the United Kingdom and Australia have begun to recognise property rights in tissue that are not dependent on the work and skill exception, giving rise to rights to its possession, use, bailment (a property relationship), and protection from negligent storage [58,59]. These cases indicate the potential for donors to have rights to deal with their tissue under both contract and tort law. This increased acknowledgment of property rights poses a challenge to those who regard human tissue donation as a sort of gift without proprietary rights. Indeed, the definition of a gift in law is a property relationship in which property is transferred without payment. Gifts can be given unconditionally, but property law recognizes that they can also be granted conditionally in ways that protect the donor's rights of control and access.

Recognition of property rights in cord blood also raises concerns on commercialization. This issue has been laid to rest by the provisions of the National Health Act in Part VI which prohibits all forms of merchandising in blood or blood products, and imposes very stiff penalties on defaulters. Thus, no form of financial reward for donation except for reimbursement for reasonable costs incurred during donation is allowed. Contenders for ownership rights in the cord blood can either be the mother, father, the newborn and the researcher (in cases where the cord blood is given out for research purposes). An answer to this query of who owns the cord blood will lie in the answer to the question ‘Is tissue or cord blood property?

According to Mahomed et al [60], ownership of tissue samples donated for medical research is an ongoing subject of dispute. While some maintain that patients have ongoing ownership rights in their tissues, including an unfettered right to determine what happens to their tissue sample, researchers argue that giving patients property rights in their samples will turn the human body and body parts into a commodity and bring research to a halt. Presently in Nigeria, no law addresses ownership of tissues such as cord blood, thus, these queries can be examined in the light of common law using principles and precedents developed for other similar circumstances.

In contrast, international models such as the United Kingdom demonstrate structured public cord blood banking. The NHS Cord Blood Bank (part of NHS Blood and Transplant) has

operated since 1996 as the world's fourth-largest public bank, collecting donations primarily through selected maternity units. Women are approached antenatally, informed consent is obtained by trained staff, and collection is performed post-delivery by specialized operatives, ensuring quality and ethical safeguards [61]. This public, altruistic system contrasts sharply with the current Nigerian context of limited facilities, cultural reluctance, and absence of dedicated public banking infrastructure, highlighting potential pathways for policy development in Nigeria.

Our findings show that although use of UCB in genetic research in Ibadan is not supported due to cultural and religious beliefs previously identified, it is gradually being recognised as a potential source for treatment of diseases. This view contrasts with the global expansion of cord blood banking and research described earlier according to Ropa, Devi etc. Participants acknowledged its scientific potential, but inadequate storage infrastructure and routine disposal through burial, drains, or hospital incineration meant that cord blood was seldom collected or retained, suggesting that the barrier lies in infrastructure and practice rather than in unwillingness alone. Cultural and spiritual beliefs further shaped attitudes: cord blood was regarded as sacred, linked to the destiny and well-being of the newborn, and a taboo subject, which is consistent with earlier work on how African communities view the placenta and umbilical cord. Concerns that cord blood might fall into the wrong hands, and about fathers' access to it, indicate that ownership is understood as family and spiritual control rather than as an individual or institutional right, a view that differs from the property and donor-control models that dominate international ethical guidance such as the recommendations by the National Academy of Science. Although participants endorsed informed consent in principle, in line with established ethical guidelines, they also raised concerns about exploitation and unequal power dynamics, which are especially acute when consent is sought from women in labour or immediately after delivery. Limited knowledge of any specific law governing cord blood, and doubt that existing protections are adequate, supports earlier concerns about a regulatory gap in Nigeria's framework. Taken together, these findings imply that Nigeria needs explicit legal provisions on the collection, consent, ownership, and research use of cord blood, consent processes that are culturally sensitive and timed to avoid pressure on mothers, investment in storage capacity in public and secondary facilities, and community engagement that involves families, including fathers, and addresses spiritual concerns openly. Because the study was conducted in a single city, these issues should be treated as indicative rather than conclusive for the country as a whole.

Strengths and Limitations of the study

A strength of this study is its inclusion of participants with different perspectives on cord blood use, including medical doctors, biomedical researchers, pregnant women, recently delivered parents, and community members. This allowed the study to explore the ethical, legal, and social issues surrounding cord blood from both professional and community perspectives. The qualitative approach also provided an opportunity to examine cultural beliefs and concerns that may not be adequately captured through quantitative surveys.

The study has several limitations. First, it was conducted in Ibadan, Southwestern Nigeria, and involved only 25 participants. The findings therefore provide contextual insights rather than a basis for generalising to the Nigerian population as a whole. Cultural beliefs and attitudes in addition may differ across ethnic groups, geographical regions, socioeconomic groups, and healthcare settings. Second, the use of purposive sampling and the recruitment of community participants from a town hall meeting may have introduced selection bias. Third, the study relied on participants' self-reported perceptions, which may have been influenced by social desirability or recall bias. Fourth, interviews were conducted in English, which may have limited the participation of people with lower English proficiency and may have affected how participants expressed culturally and spiritually grounded ideas for which Yoruba terms carry nuances that are hard to convey in English. Findings on cultural and religious beliefs should be read with this in mind. Finally, the study examined perspectives and reported practices rather than directly observing cord blood collection or banking procedures. The findings should therefore be interpreted within the context of the study setting and its qualitative design.

5. CONCLUSION

This study shows that cord blood is rarely used in genetic research in Ibadan. Participants had limited knowledge of the legal and regulatory framework governing its collection, banking, and use, and were uncertain how existing Nigerian laws apply. Cultural and religious beliefs shaped their views on donation, and they raised concerns about consent, ownership, privacy, and commercialisation, including how the interests of the mother, father, and child should be understood. Together, these findings indicate that the absence of clear legal and ethical guidance leaves the interests of mothers and children inadequately

protected and limits the responsible development of cord blood research in Nigeria. We therefore recommend that policymakers and regulators issue specific guidance that:

(i) distinguishes consent to collection, storage, research use, and any later clinical use, with the mother as primary decision-maker acting in the best interests of the child;
(ii) sets standards for privacy, confidentiality, and the ownership, control, and commercial use of stored samples;
(iii) defines the responsibilities of researchers and cord blood banks, including transparency about how samples will be used and researchers and health institutions should also engage communities in culturally and religiously sensitive ways to promote public awareness.

List of abbreviations

ELSI	Ethical, Legal and Social Issues
IDI	In-depth Interview
KII	Key informant Interview
LGA	Local Government Area
NHS	National Health Service
UCB	Umbilical Cord Blood
TFR	Total Fertility Rate

Authors Contributions

Conceptualization: F.O.A. and K.K.S.; Methodology: F.O.A. and K.K.S.; Investigation: F.O.A.; Data Curation: F.O.A.; Formal Analysis: F.O.A. and K.K.S.; Writing – Original Draft: F.O.A.; Writing – Review & Editing: O.C.M. and K.K.S.; Supervision: K.K.S. All authors have read, approved, and agreed to the final version of the manuscript.

Ethics Committee Approval and Consent to Participate:

Ethical approval was given by the Oyo State Ministry of Health Ethics Committee, Ibadan, Nigeria (Protocol/reference code: [AD 13/479/2023]; date of approval: [September 2023]). Some of the interviews were conducted over telephone and for this category, verbal informed consent was obtained before the interviews were carried out and recorded. For the other participants with whom face to face interviews were done, written informed consent was obtained before participation in the study and before audio-recording any of the interviews.

Human Rights Statement:

This study was carried out in line with the Nigerian National Code of Research Ethics (2007) as well as the Declaration of Helsinki (2013).

Availability of Data and Material

The qualitative interview data supporting the findings of this study are not publicly available because they contain identifiable and sensitive information provided in confidence by participants. De-identified excerpts are included in the article. Additional anonymised data may be made by qualified researchers for purposes relating to replication of the study only. A formal data access request for this purpose can be made to the corresponding author for which fully anonymized transcripts can be supplied.

Conflicts of interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this article.

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AI-declaration:

The authors used AI solely to assist in formatting the references according to the required citation style. In particular, ChatGPT was used for this purpose. In addition, AI (Claude) was used in preparing the graphical illustrations for the study. The AI tools were not used to generate the research content, analyse data, interpret findings, or draw conclusions. All AI-assisted outputs were carefully reviewed, verified, and edited by the authors, who assume full responsibility for the integrity and accuracy of the manuscript.

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