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"We love our livestock": relational care-based One Health in pastoral drylands

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Pastoralist communities in the Horn of Africa face intensifying health and livelihood challenges driven by climate change, infectious disease outbreaks, and conflict. One Health (OH) has gained prominence as a holistic approach capable of addressing these interconnected socioecological risks. Yet gendered OH research in pastoral settings has narrowly focused on zoonotic disease. As a result, little is known about how pastoralist men and women themselves conceptualize OH–what aspects are most important and how they understand the relationships between them. To address this gap, we aimed to generated locally grounded, gendered understandings of OH to inform more equitable and effective OH policy and practice. We employed a mixed methods approach that combined fuzzy cognitive mapping (FCM) with grounded theory qualitative analysis. We conducted 15 small-group mapping sessions with pastoralist men and women across one village and five kraals in Turkana County, Kenya. Maps were aggregated by gender and analyzed using network metrics, while mapping transcripts were analyzed using the One Health Coding Paradigm–applied for the first time to gender analysis. Women's maps had more components and connections, while men and women shared the same top ten most central components in their maps. These included human and livestock health, nutrition, access to services and natural resources. Within shared components, women emphasized drought, workload, nutrition, and education, while men emphasized veterinary service delivery tradeoffs, income, and conflict. We found gendered roles, institutional access, and power relations shaped how men and women conceptualized OH in distinct ways. Women understood OH through embodied labor and care, while men had a governance and risk perspective. Women also demonstrated less knowledge of zoonotic diseases due to their exclusion from formal and customary decision-making and governance spaces. We argue that care-based OH represents a paradigm shift capable of expanding OH beyond its biomedical focus, and that gender is not only an equity concern but a fundamental analytical entry point for more effective and equitable OH policy and practice in pastoral drylands.

KEYWORDS
care-based epistemology, fuzzy cognitive mapping, gender analysis, grounded theory, One Health

Introduction

Pastoralism is a livelihood and way of life practiced by over 200 million people globally (Baird, 2024). Pastoralists rely on strategic mobility, flexible herd structures and livelihood strategies, and extensive social networks to access variable natural resources (Food and Agriculture Organization of the United Nations, 2018). In dryland regions, pastoralists manage most of the livestock, make a significant contribution to national GDPs, and play a vital role in regulating ecosystem services and biodiversity conservation (African Union, 2013). Despite these significant contributions to national systems, pastoralists remain politically and economically marginalized, with significantly poorer health and development outcomes compared to sedentary populations (Krätli and Koehler-Rollefson, 2021; Zinsstag et al., 2016).

Gender norms, roles, and responsibilities play a key role in these health outcomes, for example, shaping infectious disease risk and healthcare seeking behavior (Bagnol et al., 2015; Barasa and Virhia, 2022), access to human health and veterinary services and information (Gammino et al., 2020; Serra et al., 2022; Wulifan et al., 2022), and access to resources–including land, livestock, and income–that are critical for nutrition and livelihoods (Eba et al., 2020; Jode and Flintan, 2020). In East African pastoral systems, men own livestock, directing herd movements and making decisions about when to sell animals (Stites, 2023). In contrast, women oversee livestock at the household level, including milking activities, care of young animals, and in some contexts decision-making power over small ruminants and poultry (Gitungwa et al., 2021; Stites, 2023; Yurco, 2024a). Women also manage household water, food, and child health, and often engage in alternative economic activities (e.g., charcoal production and basket making) that make a key contribution to adaptive capacity and resilience (Ash et al., 2025; Opiyo et al., 2015).

Pastoralists face a range of health and sustainability challenges, including climate change, infectious disease outbreaks, and chronic food insecurity (Hesse and Catley, 2023). One Health (OH) has gained prominence as an approach capable of addressing these issues in pastoral rangelands (Griffith et al., 2020b). OH aims to sustainably balance and optimize human, other animal, and environmental health by mobilizing multiple sectors, disciplines, and communities at varying levels of society to work together (Adisasmito et al., 2022). One Health Initiatives (OHIs) in pastoral areas have primarily taken the form of integrated service delivery and joint disease surveillance programs (Griffith et al., 2020a; Kessely et al., 2024). While some initiatives have developed gender mainstreaming strategies (Mor et al., 2024; Mumin et al., 2026), others remain gender-blind[1] (Osman et al., 2023).

Existing gendered OH research in pastoralist settings has narrowly focused on infectious disease, particularly gendered disparities in zoonotic disease awareness and exposure (Babo et al., 2022; Lemma et al., 2025; Mutambo et al., 2025). As a result, little is known about how pastoralist men and women themselves conceptualize OH–what aspects are most important and how they understand the relationships between them. Knowledge is always situated in lived, embodied experience (Liu and Heinonen, 2025), yet Indigenous and local voices, and women, lack epistemic authority[2] in OH (Pollowitz et al., 2024; Redvers et al., 2025; Robbiati et al., 2025). Pastoralist women face dominant Western knowledge systems and patriarchal structures in which women's knowledge is discounted or rendered invisible (Fricker, 2007; Yurco, 2024b) – a type of 'double marginalization' in research (Eneyew and Mengistu, 2013).

To address this gap, we employed participatory fuzzy cognitive mapping (FCM) and grounded theory (GT) qualitative analysis to examine how men and women pastoralists in Turkana County, Kenya conceptualize OH, and how gender roles, institutional access, and power relations shape this knowledge. In doing so, we aim not only to generate a locally grounded, gendered understanding of OH that can inform more equitable and effective OH policy and practice, but also to advance epistemic justice.[3]

Materials and methods

Study area

We conducted this study in Turkana County, Kenya. Turkana has a total area of 77,000 km^2 (Figure 1). Pastoralists make up the majority of the 1,256,152 people who live in Turkana (Turkana County Government, 2023a). Other livelihoods practiced include fishing, artisanal mining, crop farming, and small-wage labor (Turkana County Government, 2023a). Livestock herds are large and diverse, with an estimated 2.8 million cattle, 6.7 million sheep, 6.9 million goats, close to 1 million camels, 600,000 donkeys, and an estimated 160,000 Indigenous poultry (Griffith et al., 2024; Kenya National Bureau of Statistics, 2015).

The climate in Turkana is classified as arid and semi-arid (ASAL) with mean annual rainfall ranging from 400–600 mm. Vegetation is shaped by rainfall and soil characteristics, consisting of annual grasses and shrubs in the plains and perennial grasses and trees in the highlands (Olang, 1984). Larger rivers that flow into Lake Turkana support acacia and other socio-ecological important species.

Since devolution, service delivery is under the purview of the Turkana County Government, supported by national ministries and NGO development partners (Griffith et al., 2020a). Health and development indicators remain poor: The under-five mortality rate is 65 per 1,000, infant mortality is 39 per 1,000 live births, and global acute malnutrition is at emergency levels of 34.8% (Global Burden of Disease Collaborative, 2024). OH activities are coordinated through the County One Health Unit (COHU) chaired by the health, veterinary, and environment department directors, alongside designated focal persons from each department (Turkana County Government, 2023b).

Social life in Turkana can be characterized by familial structures and mobility patterns. The immediate family makes up the *awi* (i.e., homestead) that can stay in one place (e.g., in a village or the

1 Gender-blind approaches fail to consider how gender roles, responsibilities, and power dynamics shape differential experiences, risks, and needs of men and women (https://archive.unescwa.org/gender-blindness).

2 Epistemic authority refers to whose knowledge is considered credible and legitimate within a given system.

3 Epistemic justice refers to fairness in how knowledge is produced, valued, and whose perspectives are included in decision-making.

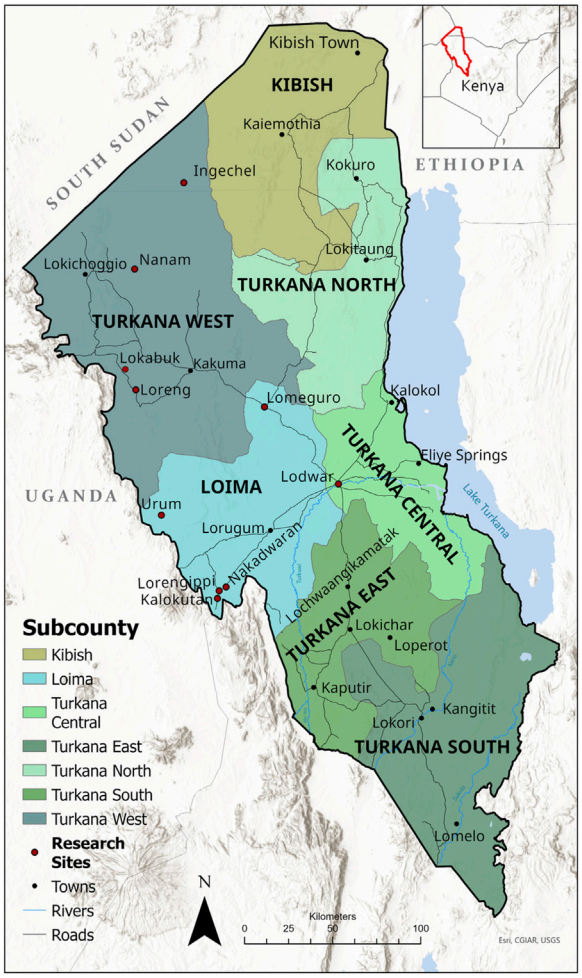

FIGURE 1
Map of Turkana County, Kenya. Research sites. Created in Arcmap GIS (10.8.2).

ere–home area), or join an *adakar* (*ngadakarin pl.*). Adakar are groups of households that come together to graze their livestock, for example, migrating to access dry season grazing areas. These groups have designated leaders, often an *emuron* (seer), ex-chief, or important businessman and council of elders that make decisions (Akabwai, 1992). Adakar will often disband during the rainy season when people and livestock return to their ere. In highly insecure areas along the border, these groups of adakar are referred to as *arigan* (or *arum rum* in Turkana South; C. Bode, personal communication, May 7th, 2026) and remain mobile year-round for protection and access to water and pasture that is often across international borders. In this study, we used the term "kraal" to refer to these mobile groups, distinguishing them from villages, which constitute more settled administrative units, consistent with local usage across the county.

Study design

This study employed a mixed-methods approach combining participatory FCM and GT qualitative analysis to examine gendered conceptualizations of OH in Turkana County, Kenya. We purposively sampled participants based on defined inclusion criteria. Eligible participants were 18 years or older and involved in daily livestock management and livelihood activities. No restrictions were placed on livestock species, and the range of species participants managed emerged through the mapping process itself.

Data were collected across one village and five kraals spanning three subcounties (Turkana West, Lokichogio, and Loima; Figure 1). We specifically targeted kraals to capture the perspectives of transboundary pastoralists along the border with South Sudan and Uganda. These communities represent some of the most underserved and mobile populations in the county and are the focus of OHIs like Kimormor (Griffith et al., 2023). Nanam village was included to provide comparison with a more settled population and was selected opportunistically as the research team was stationed there during a Kimormor activity.

To ensure representation, we aimed for gender parity across small-group mapping sessions and diversity of age (e.g., elders, adults, youth) where possible. We conducted a total of 15 small-group mapping sessions, consisting of seven women's groups and eight men's groups (Table 1). Each group produced one fuzzy cognitive map that was subsequently aggregated into a gendered map for analysis.

Data collection

We collected data over a six-week period in January and February 2024 through community small-group mapping sessions. Sessions were facilitated in English and Kiswahili, with real-time translation to and from Nga'turkana by trained trilingual field translators. Recordings were subsequently translated into English and transcribed by trilingual research assistants. All participants provided informed verbal consent after the purpose, procedures, voluntary nature, and data handling were explained. Participants were also provided the PI's and local team members' contact information for questions or concerns.

Each session lasted approximately an hour and was audio-recorded for accuracy and transcribed for further analysis in Delve (www.delvetool.com).

Fuzzy cognitive mapping protocol

Gendered fuzzy cognitive map construction followed three main steps (Griffith et al., 2026a):

1. Concept identification and map construction–Facilitators guided participants to identify components (nodes) and relationships (edges) between people, animals, including livestock, and the environment, with a focus on health-related processes and outcomes. Facilitators assigned edge "weights" based on participant responses, asking follow-up questions when necessary.
2. Data treatment and homogenization–We transcribed hand-drawn maps into Mental Modeler (www.mentalmodeler.com) for refinement, including standardizing node names, collapsing or expanding nodes where necessary, and cleaning and formatting data for aggregation.

TABLE 1 Participant characteristics for community small-group mapping sessions. Transcripts from each mapping session (MS) were analyzed using grounded theory (GT).

Mapping session	Subcounty	Town/Village/Kraal	Women	Men
2	Turkana West	Lokabuk kraal	0	8
3	Turkana West	Lokabuk kraal	8	0
8	Lokichogio	Ingechel kraal	0	8
9	Lokichogio	Nanam village	9	0
10	Lokichogio	Nanam village	0	8
11	Lokichogio	Nanam village	8	0
12	Lokichogio	Nanam village	0	8
13	Loima	Urum kraal	0	8
14	Loima	Urum kraal	0	8
15	Loima	Urum kraal	6	0
16	Loima	Urum kraal	8	0
17	Loima	Nakadwaran kraal	8	0
18	Loima	Nakadwaran kraal	0	8
19	Loima	Kalokutan kraal	0	8
20	Loima	Kalokutan kraal	8	0

3. Transitive closure and aggregation–We applied fuzzy transitive closure–a mathematical procedure that identifies indirect relationships between map components–to each adjacency matrix using CIET Map 2.2 (https://ciet.org/fcm/) and aggregated individual maps into gendered maps by using the FCMapper package in R (Posit team, 2024).

Data analysis

Network analysis of fuzzy cognitive maps

Fuzzy cognitive maps include concepts (nodes) connected by signed, weighted edges that denote how much influence one concept has over another. Positive and negative edges represent direct (as A increases, B increases) and indirect (as A increases, B decreases) influence, respectively. Edge weights range from 0 to 1, with values closer to 1 indicating a stronger influence (Papageorgiou and Kontogianni, 2012).

For each aggregated gender map we calculated the number of components and connections, density, connections per component, and the distribution of transmitter, ordinary, and receiver nodes.

At the component level, indegree (ID) and outdegree (OD) are defined as the absolute sum of incoming/outgoing edge weights for each component. Components are classified as transmitter (positive OD, no ID), ordinary (positive ID and OD), or receiver (positive ID, no OD). Degree centrality is calculated at the absolute sum of ID and OD and represents the components' overall importance within the map (Özesmi and Özesmi, 2004).

Because map structures differ, we calculated the standardized degree centrality within each map using z-scores (Griffith et al., 2026b).

Grounded theory

We used a Straussian GT approach that included open and axial coding to analyze the causal relationships identified in the FCM process and examine how stakeholders conceptualize OH (Corbin and Strauss, 2015). Mapping session transcripts were uploaded to Delve for qualitative analysis (www.delvetool.com). To systematically analyze these data, we developed and applied the One Health Coding Paradigm (OHCP) to examine how socioecological conditions influence action and interactions among people, other animals, and the environment with health- and wellbeing-related consequences (Figure 2; Griffith et al., 2026b).

Coding was conducted iteratively, with regular memo-writing to capture emerging insights and to refine categories as analysis progressed. To enhance rigor, coding was conducted by three researchers, with regular cross-checking of coding decisions and emerging categories. Discrepancies were resolved through consensus to ensure analytic consistency.

Ethics statement

Ethical approval for human subjects research was obtained through the University of Nairobi Biosafety, Animal Use and Ethics Committee (REF: FVM BAUEC/2023/447), the Kenyan

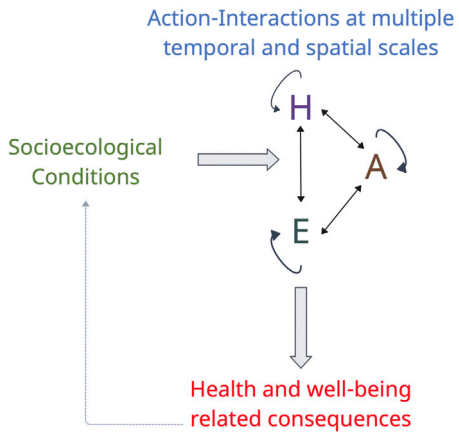

FIGURE 2
The One Health coding paradigm (OHCP) includes socioecological conditions, action and interactions at multiple temporal and spatial scales, and health and wellbeing related consequences. Action-interactions are coded across humans (H), other animals (A), and the environment (E). Solid black arrows reflect relationships between and among people, domestic and wild animals, and the natural environment. The dashed gray line represents feedbacks and causal relationships through which consequences reconfigure socioecological conditions over time, shaping subsequent actions and interactions in a continuous, dynamic process. Made in Creately (www.app.creately.com).

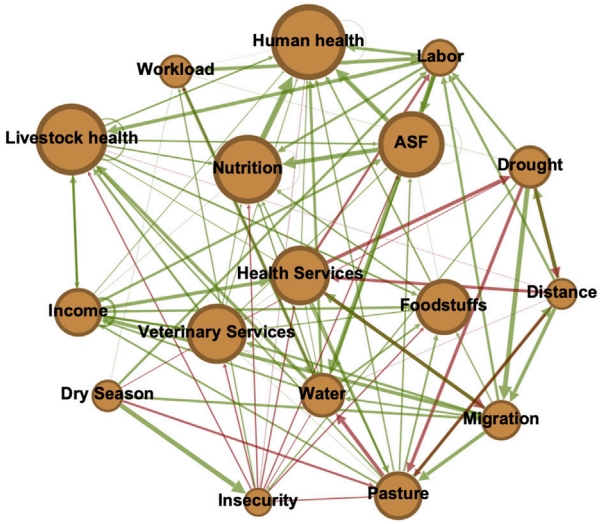

FIGURE 3
Women's aggregated fuzzy cognitive map. Node size represents degree centrality. Green and red arrows represent positive and negative relationships, respectively. Arrow width corresponds to edge weight. Only nodes with centrality >9 and edges >0.5 are displayed for clarity of visualization. Created in Gephi (version 0.10.0).

National Commission for Science, Technology, & Innovation (NACOSTI; License No: NACOSTI/P/23/30716), and the Tufts University Human Subject Institutional Review Board (IRB ID 00004210). Prior to each mapping session, all participants were informed about the purpose, procedures, data handling, and confidentiality of the study. Verbal consent was documented and witnessed by a member of the research team.

Results

Aggregated fuzzy cognitive maps by gender

Figures 3, 4 present the aggregated fuzzy cognitive maps for women and men, respectively. Node size reflects degree centrality (i.e., importance), while arrow width represents edge weight (i.e., strength of perceived relationships). These figures provide a visual overview of system composition and connectivity. Quantitative comparisons of map structure and component importance are presented below.

Structural characteristics of gendered maps

To examine the gendered conceptualization of OH, we assessed the structural characteristics of each map (Table 2). The aggregated women's cognitive map contained 66 components and 515 connections, with a density of 0.12 and an average of 7.8 connections per component. Of the 66 components, 32 functioned as driver nodes (outgoing connections only), 0 as receiver nodes (incoming connections only), and 34 as ordinary nodes (both incoming and outgoing connections).

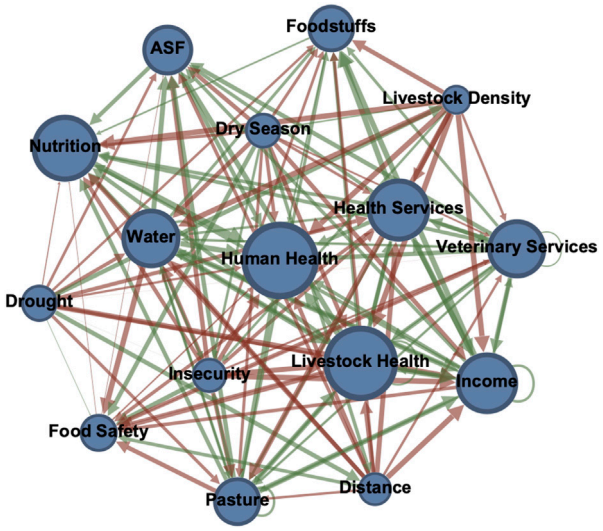

FIGURE 4
Men's aggregated fuzzy cognitive map. Node size represents degree centrality. Green and red arrows represent positive and negative relationships, respectively. Arrow width corresponds to edge weight. Only nodes with centrality >10 and edges >0.5 are displayed for clarity of visualization. Created in Gephi (version 0.10.0).

The men's cognitive map contained 55 components and 410 connections, with a density of 0.14 and an average of 7.5 connections per component. Of the 55 components, 28 were driver nodes, 2 were receivers, and 25 were ordinary nodes. Drivers made up approximately 48.5% of the women's map and 50.9% of the men's map. Ordinary nodes accounted for 51.5% and 45.5% of the respective maps.

TABLE 2 Structural characteristics of aggregated gender cognitive maps. Driver components have outgoing connections only, receiver components have incoming connections only, and ordinary components have both incoming and outgoing connections.

Structural characteristics	Female aggregated fuzzy cognitive map	Male aggregated fuzzy cognitive map
# Components	66	55
# Connections	515	410
Density	0.12	0.14
Connections per component	7.8	7.5
Number of transmitter/receiver/ordinary	32/0/34	28/2/25

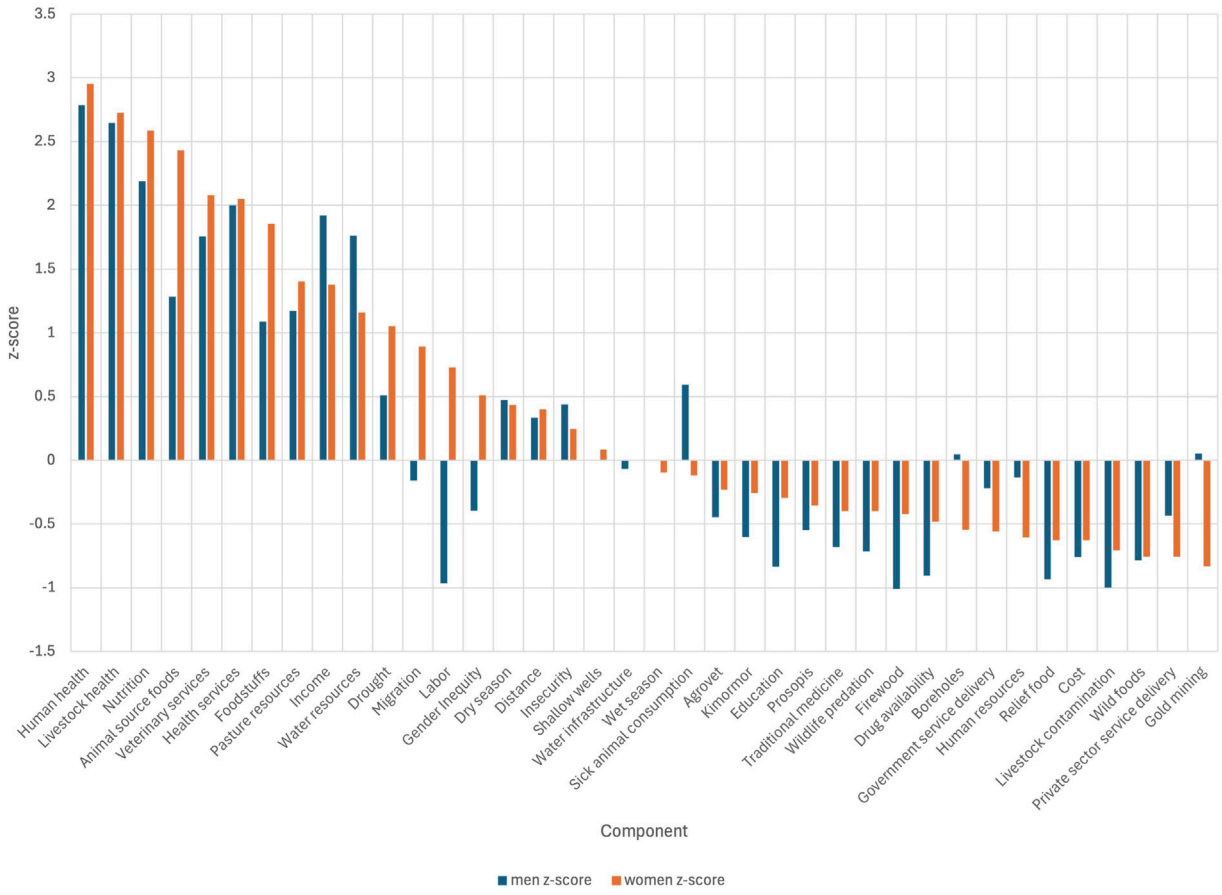

FIGURE 5
Standardized centrality scores (z-scores) for components shared across male and female cognitive maps. Orange bars represent female z-scores and blue bars represent male z-scores. The standard deviation of raw centrality scores was 9.26 in the male map and 7.86 in the female map, reflecting differences in the distribution of influence across concepts.

Standardized centrality scores in gendered maps

Women and men shared thirty-eight components across their aggregated cognitive maps. To compare the relative importance of these concepts, we calculated standardized centrality scores (z-scores) for each gender group. Standardization allowed us to control for differences in map size and structure, enabling meaningful comparisons across gender. Figure 5 presents z-scores for all shared components, highlighting differences in the relative centrality of each concept within women's and men's maps.

Men and women shared the same top ten most central components, including human health, livestock health, nutrition, animal source foods (ASFs), veterinary services, health services, foodstuffs, pasture resources, income, and water resources (Figure 5; Table 3). However, among these components, women prioritized animal source foods, access to veterinary services, and foodstuffs. In contrast, men prioritized income, water resources, and access to health services (Table 3).

TABLE 3 Rank of top ten components in the male and female aggregated maps.

Component	Men centrality rank	Women centrality rank
Human health	1	1
Livestock health	2	2
Nutrition	3	3
Health services	4	6
Income	5	9
Water resources	6	10
Veterinary services	7	5
Animal source food	8	4
Pasture resources	9	8
Foodstuffs	10	7

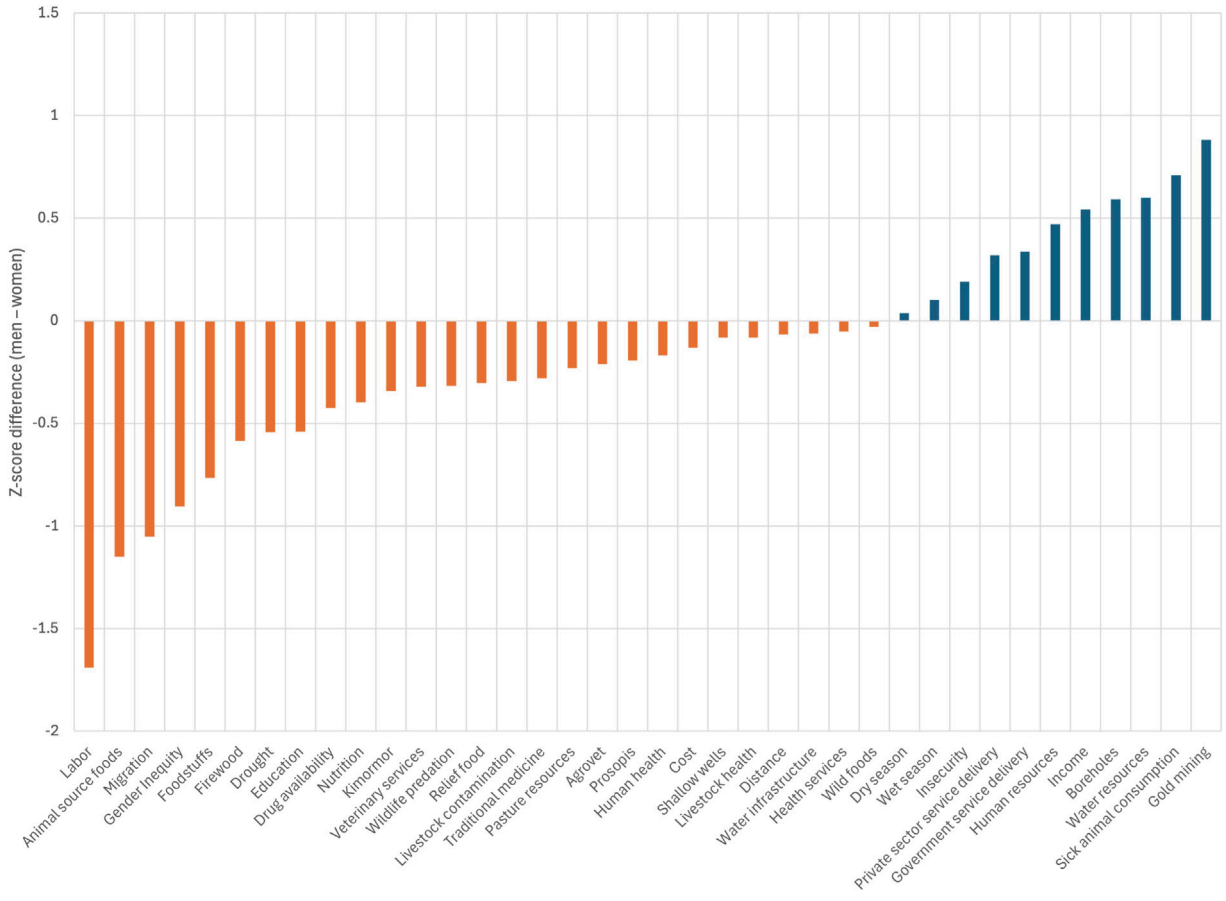

FIGURE 6
Difference in standardized centrality scores between men and women across shared components. Values were calculated as the difference between men and women's z-scores (men−women). Orange bars represent components with relatively higher importance in the women's aggregated map, while blue bars represent components with relatively higher importance in the men's aggregated map.

Figure 6 shows the difference in standardized scores (men minus women), illustrating the degree to which each shared component was relatively more (or less) central in one group's map than the other. Women prioritized labor, animal source foods (ASFs), migration, gender inequity (primarily represented as workload differences), foodstuffs, firewood, drought and education. In contrast, men prioritized human resources, income, water resources, sick animal consumption and gold mining. These

divergent priorities are explored in more detail through GT analysis below.

Gendered grounded theory results

GT analysis revealed how men and women perceive and respond to socioecological conditions, and the health and wellbeing consequences they emphasized. Here, we report four categories that highlight key gendered differences in how men and women conceptualize the OH system.

Environmental conditions, gendered labor, and health

A key finding from women's narratives was the direct impact of their daily and seasonal tasks and responsibilities on their own physical health and wellbeing. Women described their daily activities—including collecting water, caring for children and young livestock, securing food for the household, and gathering firewood—as physically demanding and exhausting:

> *"We truly get worked out with the amount of work we do. We carry water cans on the head as we carry the baby on the back, together with the daily routine chores in the homestead that internally affects our health and causes severe pain and aches in the whole body"* (MS 17).

Women also noted how these responsibilities continued during pregnancy, which they emphasized as adding to their physical demands and fatigue.

Environmental conditions were strongly linked to women's labor. During the dry season or prolonged droughts, gathering water, firewood, and wild foods became harder: *"We have to go farther in search of everything, because it is all dried up"* (MS 11). In response, households migrate so that livestock can access water and pasture–a process that women linked to increased labor, including building huts, constructing livestock enclosures, and digging shallow wells in each new location.

Men described the same environmental conditions, including water scarcity and seasonal resource variability, but framed their consequences in relation to herd management rather than their own labor and health. For example, while women emphasized the time demands of water collection, men framed water scarcity as a fundamental constraint to herd management: *"Water is the main problem. But not pasture. We do not have* [water] *taps for our animals"* (MS 02). They also reported reserving dams during the dry season to ensure water access for their livestock. More broadly, they explained how reduced rainfall forces herds together as water and pasture dries up, increasing livestock density, grazing pressure, and disease transmission risks. Components found only in the men's map—including livestock density, forage quality, and soil minerals—further reflect their focus on herd health as a main outcome (Supplementary Material 1).

Livestock health, nutrition, and disease

Women consistently emphasized the central role of healthy livestock in household food security, particularly the importance of milk and meat for their families: *"Milk and meat are the most stable and important food source for our community, for our nutrition"* (MS 09). When livestock became sick, women highlighted the direct impact on milk production: *"We usually give milk to our children, but because of diseases, especially the tsetse fly, there is low milk production"* (MS 03). Women also noted that they exchanged goats for supplementary foodstuffs like maize, beans, sugar, and flour–either through direct sales, barter, or credit arrangements.

Men articulated a broader set of benefits tied to livestock that extended beyond nutrition to include income generation and social obligations: *"We need animals for bride wealth . . . and we also sell* them *to take children to school"* (MS 10). Unlike women, who highlighted the impact of livestock diseases on food security, men emphasized the economic implications of livestock disease: "*When we lose these animals [to disease] it impacts us negatively because it is our source of livelihoods"* (MS 08). Livestock body condition as a result of illness or access to water and pasture was also described as directly affecting market value: *"When they are emaciated, buyers are not available, or we sell on a throw away price"* (MS 18).

Men also emphasized the risk of disease transmission from sick animals to people. As one man from Kalokutan Kraal explained, "When livestock are healthy, people are also healthy. People can get diseases from eating meat or while drinking the milk of sick animals. That means when livestock are not well, people get sick too" (MS 19). Women mentioned the risk of consuming meat or milk from sick animals but did not name specific zoonotic diseases.

Veterinary service access and delivery

While both men and women emphasized the importance of veterinary care in maintaining livestock health, their experience accessing and evaluating these services differed markedly. When young livestock become ill, women described the physical burden of transporting animals or seeking treatment. Even when veterinary infrastructure exists locally, it was often non-functional, forcing women to travel long distances to the nearest agrovet (i.e., animal drug store):

> "When an animal gets sick, we have no option but to carry it back home and look for treatment. The agrovet for veterinary medicine is in Lokichoggio, which is far away. It will take some days to obtain medication and the right prescription, which is unfortunate for us and the animals" (MS 09).

Despite these constraints, women expressed a strong commitment to their animal's wellbeing: *"We are ready to buy veterinary drugs. We love our livestock"* (MS 20).

Men, in contrast, focused on tradeoffs between private and government services and the role of community animal disease reporters (CADRs). Local shops and agrovets were described as more accessible but expensive, while government services provided free, higher-quality drugs but less frequently:

> "The one from the [agrovet] is much easier, but the services from the government are more important. The government brings all the drugs, a variety of them, and the services are free of charge" (MS 18).

Men also emphasized the role of CADRs as a critical link between communities and government veterinary services. However, they pointed to key limitations related to mobility: "*CADRs from village centers are supposed to be responsible for specific households. Yet we are mobile, moving with the livestock, and leave* [the CADRs] *in the centers*" (MS 02). Men expressed the need for CADRs to accompany them during dry season migration because they "*know and understand certain diseases and how to treat them*" (MS 02).

Insecurity and resource access

Insecurity emerged as a major concern for both men and women. In Turkana, insecurity primarily refers to armed inter-ethnic conflict over livestock, water and pasture. Women linked conflict and violence to disruptions in their daily tasks and access to vital resources. Donkey theft was identified as a major hardship, as donkeys are essential for transporting water, carrying young animals and supporting domestic tasks. Women also emphasized the physical danger insecurity posed when traveling to water points and gathering wild fruits, forcing them to avoid these areas:

> "We are always running up and down to save ourselves. Sometimes the enemy is close, and we run the whole day until we become thirsty. There is no food for our children, and we fear to go to the water points because of insecurity" (MS 03).

Men, in contrast, framed insecurity primarily in relation to livestock management, mobility, and natural resource access. Accessing water and pasture during seasonal migration was described as dangerous, with men frequently losing livestock to conflict in new territories:

> "There is a challenge of insecurity from our neighboring Toposa from South Sudan. We often lose our livestock during migration in search of water and pasture in these territories" (MS 10).

They also described actively engaging in offensive warfare to protect and access resources: "*When insecurity is high, accessing pasture is a challenge. But we still access through communal fights*" (MS 10). Insecurity also disrupted access to markets, veterinary care, and health services: "*When insecurity is high it is hard to get medicine, because traders cannot come. Our animals get sick and die without medicine,*" one male participant explained (MS 13).

Discussion

To our knowledge this is the first study to empirically examine how men and women pastoralists understand OH. We found that both groups shared the same top ten most central elements of their cognitive maps, reflecting a common understanding of the socioecological system (SES). Notably, these shared components extend well beyond the biomedical focus of OH in Kenya, – a finding examined in detail in a companion study (Griffith et al., 2026a). Here, we explore how these components are prioritized, understood and connected differently by men and women. Women perceived OH relationships through embodied labor and care; men through governance and risk. These distinct perspectives reflect differences in gender roles, institutional access, and power relations.

The integration of FCM and GT was uniquely suited to reveal these differences. FCM captured the structural relationships, while GT explored the lived experiences and meanings behind those connections. Together, they produced a more complete picture of gendered OH conceptualization than either method would have captured alone (Griffith et al., 2026b). Gender-disaggregated FCM has been used to compare perceived causes of health outcomes between men and women in other contexts (Sarmiento et al., 2024b), but this is the first application to OH. Extending this approach to gender analysis demonstrates its value for advancing gender equity and social inclusion in OH by making gendered knowledge, perspectives, and inequities visible—an urgent need in OH research and practice (Garnier et al., 2022; Mettenleiter et al., 2023; Robbiati et al., 2025; Weiszhar et al., 2025).

Gendered conceptualization of One Health

Women's larger maps with more connections underscore a more integrated systems perspective rooted in daily labor and care across multiple domains of household, livestock management, and the environment. Their framing of livestock disease through downstream effects on caregiving and household nutrition, for example, reflects not only knowledge of how disease is a significant constraint on milk production (Adane et al., 2012; Griffith et al., 2021; Nthiwa et al., 2019), but also a deeper relational commitment to animal wellbeing–an ethic of care that extends across species (de La Bellacasa, 2017; Yurco, 2024b). This contrasted with how men described OH relationships–for example, talking about livestock as the source of their livelihoods. Interestingly, women placed more importance on education, likely reflecting the role that it plays in livelihood diversification and in some instances, increased access to income and decision-making authority in pastoral communities (Baird et al., 2024).

Men's smaller, denser map, in contrast, reflects a more governance and risk-based understanding of OH, organized around landscape dynamics, access to natural resources, and control of livestock–for example, linking rainfall to livestock density and disease transmission (VanderWaal et al., 2017). Anbacha and Kjosavik (2021) similarly found among Borana pastoralists in Ethiopia that men give more attention to governance and conflict stressors due to their traditional roles and responsibilities. It is worth noting, however, that men's herding decisions are ultimately driven by livestock nutrition and health needs–a form of traditional ecological knowledge that shapes mobility patterns and resource governance (Sharifian et al., 2023). Nevertheless, men's framing in our study operated at the level of herd and resource management rather than the household and interspecies relationships emphasized by women.

Insecurity further illustrates these gendered perspectives. While men described conflict as shaping livestock mobility and resource governance decisions, women experienced it as compounding their caregiving burdens by restricting access to water, wild fruits, and the loss of donkeys (Pike, 2019; Schilling and Werland, 2023).

Situated knowledge and power

Women in our study demonstrated extensive knowledge of livestock diseases encountered through daily caregiving. However, similar to previous studies, we found that women had less knowledge of zoonotic diseases compared to men (Babo et al., 2022; Tschopp and Kidanu, 2024). Men also placed much higher importance on the risk from consuming sick animals. Interestingly, in a previous participatory epidemiology study in Turkana using mixed-gender focus groups, zoonotic diseases were identified as an important community concern (Griffith et al., 2024), suggesting that group composition and social dynamics may influence what knowledge is expressed in participatory settings.

This difference reflects *situated knowledge* (Haraway, 1988), which argues that all knowledge emerges from embodied, material engagement with the world. Men's routine engagement with formal OH institutions, likely exposes them to zoonotic disease information, and knowledge transfer from veterinarians in pastoral communities has been shown to primarily target men (Babo et al., 2022). Women in pastoralist communities, and more broadly across Kenya (Kyotos et al., 2022), face additional barriers in accessing animal health services and information due to gendered power dynamics and social norms, including dependence on men's permission and restrictions on interactions with male service providers (Kamel et al., 2025; Mutambo et al., 2025). In a companion study, we found that women CADRs and community health promoters (CHPs), i.e., frontline animal and human health workers, demonstrated in-depth knowledge of zoonotic diseases and prevention methods, supporting that institutional access and training, not capacity, explains this knowledge gap (Griffith et al., 2026b).

Pastoralist women's exclusion from formal and customary governance spaces for rangeland management, mobility decisions, and resource allocation (Jode and Flintan, 2020; Kristjanson et al., 2014; Yurco, 2024b) is further reflected in Turkana's institutions. Customary decision-making is mediated through male-dominated institutions such as the *Tree of Men* (Turkana County Government, 2024), while men overwhelmingly fill political, administrative, and professional roles in formal governance (International Labour Organization, 2022). This illustrates how structural exclusion from governance spaces renders women's extensive care-based knowledge largely invisible within OH frameworks–a form of epistemic oppression in which marginalized groups' knowledge is systematically devalued regardless of its relevance or quality (Dotson, 2014). As a result, men's focus on zoonotic disease risk aligns with the dominant OH narrative in Turkana and Kenya more broadly (Turkana County Government, 2023b; Zoonotic Disease Unit, 2021). This reflects how institutional power shapes whose knowledge becomes legible within OH (Weiszhar et al., 2025). It is also worth noting that men may have emphasized these factors partly in response to the research context, perceiving the veterinary and OH background of the research team as signaling an interest in zoonoses. This dynamic itself reflects men's familiarity with veterinary and public health professionals.

In order to overcome this gap, increasing women's participation in formal and customary governance structures to at least 50% is an important first step (African Union, 2019), but these efforts must be grounded within collective pastoral institutions to avoid unintentionally reinforcing marginalization (Jode and Flintan, 2020). Participatory rangeland management, multistakeholder innovation platforms, and community conversations from the HEAL project offer promising models for pastoral areas–creating structured, legitimate spaces where women's priorities can shape OH agendas (Flintan and Eba, 2023; Mumin et al., 2026). Training women frontline workers and closing the gender professional gap in pastoral areas would further position women as legitimate OH knowers and decision-makers.

Expanding One Health

OH has been criticized for being too reductionist and biomedically focused, neglecting the environment and failing to consider political, cultural, social, and economic factors that influence multispecies health and wellbeing (Braam et al., 2024; Davis and Sharp, 2020; Meisner et al., 2024; Van Patter et al., 2023). Our findings demonstrate that pastoralists already hold a deeply holistic understanding of health that encompasses not only socioecological linkages but also a relational duty of care for the health of the whole system (Wingett et al., 2025), underscoring why a community-based approach is essential (Puppo et al., 2025).

Women's perspectives–what we term *care-based OH*–would represent a paradigm shift: rather than focusing solely on biomedical and surveillance systems in pastoral contexts, it would target everyday relational and material conditions that sustain health and wellbeing across people, animals, and environments (Kaiser-Grolimund et al., 2025). Critically, this would include women's own physical health as a direct consequence of their caregiving labor–a dimension that is largely absent from current OH frameworks. When gender and maternal health are recognized within OH, they are typically framed around access to health services or infectious disease risk rather than the physical toll of daily and seasonal labor (Cataldo et al., 2023; Griffith et al., 2023; Mor et al., 2024). The health and wellbeing consequences of caregiving labor have received more attention in the resilience literature (Ash et al., 2025; Fernández-Giménez et al., 2025; Walker et al., 2022), but care-based OH would go further and actively target these burdens as upstream determinants of health.

In practice, this would mean reducing the physical burden of water collection and other daily tasks, supporting access to veterinary and health services as part of household caregiving responsibilities and animal welfare, and mitigating the labor, nutritional, and safety challenges that accompany drought and migration. Prioritizing donkey welfare and health would simultaneously reduce women's physical burdens, expand economic opportunities, and improve multispecies wellbeing (Johnston, 2026; Valette, 2014).

Men's governance and risk perspective complements women's care-based framing by articulating key SES relationships across conflict, livestock mobility, and service delivery. Excluding either perspective would produce an incomplete understanding of how the OH system functions. Therefore, gender is not only an equity concern but a fundamental analytical entry point for OH research and effective practice (Galiè et al., 2024; Garnier et al., 2025).

Reflexivity statement

Reflexivity is defined as *"a set of continuous, collaborative, and multifaceted practices through which researchers self-consciously critique, appraise, and evaluate how their subjectivity and context influence the research process"* (Olmos-Vega et al., 2023). Central to this process is positionality–the ways in which the researcher's social identity, worldview, and assumptions shape how knowledge is produced and interpreted (Holmes, 2020).

This study is shaped by the positionality of the first author (EFG), a veterinarian and white male researcher from the Global North. His training in veterinary science and public health reflects a largely biomedical orientation, which may have subtly guided aspects of the FCM process, for example, by focus on infectious disease pathways and prioritizing structural over relational components of OH.

Knowledge co-production was also shaped by how participants and researchers perceived each other. Community members referred to EFG as an *mzungu* (i.e., a white person of European descent), a Kiswahili word that emerged through colonial encounters and today carries postcolonial meanings tied to the humanitarian and development state (Christian and Namaganda, 2023). Many initially assumed he was affiliated with an NGO or faith-based organization and might provide material assistance. Such expectations can create a dynamic where participants feel pressure to provide "correct" answers or emphasize needs in hopes of further support. We attempted to mitigate this through clear informed consent procedures, while members of the research team who work for the county government could help channel concerns appropriately.

Several participants also expressed broader skepticism toward research, with one woman stating: *"Now that he is here, he should help us. Not just asking my problems and going back"* (MS 15). This reflects well-documented forms of research fatigue in marginalized communities when research does not lead to tangible change (Patel et al., 2020). In response to early feedback, particularly from women asking why we focused mainly on challenges, we revised our facilitation guide to explicitly incorporate community-driven solutions.

Despite these complexities, several participants described the process as meaningful, emphasizing learning and dialogue rather than extraction. As one group of young women noted, "*We are grateful for this occasion as we have learned a lot from you. We have not gone to school, but we are learning from you and the questions you have asked*" (MS 09). These reflections underscore both the ethical responsibilities and the potential of participatory research to foster mutual learning, even within asymmetrical power relations.

Study limitations and next steps

This study has several limitations that should be acknowledged. First, it focused on gender differences but did not systematically examine how gender intersects with other social identities, including age, marital status, and religion that shape experiences and access to resources and power (i.e., intersectionality; Crenshaw, 2013), nor did it explicitly assess gendered livestock species ownership and management, although patterns were largely inferred from what men and women described during the mapping sessions. The study also did not capture intra-household dynamics, as group mapping of the broader system rather than the household was our unit of analysis. Although GT provided important contextual detail, ethnographic or formal gender analysis tools may be better suited to capture both intra-household dynamics and livestock ownership patterns in future studies.

Second, our study did not evaluate how county governments, NGOs or customary institutions include women's contributions in practice. Future research should examine the institutional conditions, including in OH planning and implementation, under which women's knowledge is not only heard but taken seriously. This includes testing approaches that foster gender-transformative change rather than symbolic participation.

Third, time and resource constraints meant we could not present the findings to participants, which would have helped to verify the findings and represents an important next step. Fourth, FCM studies ideally continue mapping sessions until concept saturation is reached—the point at which new sessions no longer produce novel concepts. Sarmiento et al. (2024a) recommend 12–15 maps to reach saturation, which we were unable to achieve due to time and resource constraints.

Finally, this study focused on pastoralist communities and did not include other livelihood groups present in Turkana County, such as fishing communities, or peri-urban/urban populations, which limits the representativeness of findings across the county's diverse population. More broadly, findings are specific to Turkana's pastoral context and comparative research examining gendered OH perspectives across pastoral communities in East Africa and beyond would strengthen their generalizability.

Conclusion

We found that pastoralist men and women conceptualize OH through distinct, yet complementary pathways shaped by gendered labor, institutional access, and power relations. Women's care-based, relational understanding of OH highlights socioecological dynamics that are often overlooked in dominant, technocratic OH approaches. Our integrated FCM-GT approach makes these forms of knowledge visible and actionable. Embedding care-based perspectives within OH policy and practice is therefore essential for developing interventions that are not only equitable, but better align with pastoral life in the rangelands.

Data availability statement

The original contributions presented in the study are included in the article/Supplementary Material, further inquiries can be directed to the corresponding author.

Ethics statement

The studies involving humans were approved by Tufts University Human Subject Institutional Review Board (IRB ID 00004210), the University of Nairobi Biosafety, Animal Use and Ethics Committee (REF: FVM BAUEC/2023/447), and the National Commission for Science, Technology, & Innovation (License No: 258 NACOSTI/P/23/30716). The studies were conducted in accordance with the local

legislation and institutional requirements. The ethics committee/institutional review board waived the requirement of written informed consent for participation from the participants or the participants' legal guardians/next of kin because of the minimal-risk nature of the study and contextual considerations, including low literacy levels and concerns that written documentation could cause discomfort or mistrust among participants. Verbal informed consent was obtained from all participants and documented by the research team in accordance with IRB requirements.

Author contributions

EG conceived and designed the study, led data collection and analysis, interpreted the findings, and drafted the manuscript. AO supported field data collection and contributed to data analysis. CK contributed to study planning, facilitated ethical approvals, and supported data collection as the in-country supervisor. EN, KR, and JM provided institutional supervision and supported data collection. JK contributed to field data collection. JL supported data analysis. JA secured funding for the study, supervised the research, contributed to study design and interpretation, and provided critical guidance throughout all stages of the study. All authors contributed to the article and approved the submitted version.

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Conflict of interest

The author(s) declared that this work was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Generative AI statement

The author(s) declared that generative AI was used in the creation of this manuscript. During the preparation of this manuscript, the authors used ChatGPT (OpenAI, GPT-4) to assist with language editing, clarity, and organization of the text. The tool was not used to generate original data, conduct analyses, or interpret results. All content was reviewed, revised, and approved by the authors, who take full responsibility for the accuracy and integrity of the work.

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Supplementary material

The Supplementary Material for this article can be found online at: https://www.frontierspartnerships.org/articles/10.3389/past.2026.16200/full#supplementary-material

SUPPLEMENTARY TABLE 1
Unique concepts generated during men and women mapping sessions.

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