One Health 18 (2024) 100689

Contents lists available at ScienceDirect

One Health

journal homepage: www.elsevier.com/locate/onehlt

A qualitative study on wildlife contact and healthcare-seeking behaviors among a cluster of Mani ethnic group in Manang district, Satun province of Thailand

Paisit Boonyakawee [a], Kanokwan Suwannarong [b,c,*], Thanomsin Ponlap [c], Kannika Thammasutti [b,c], Phitsanuruk Kanthawee [d], Nisachon Bubpa [e], Chularat Boonyakawee [f], Bagus Pradana [c], Songsak Sokamol [g]

[a] Trang Sirindhorn College of Public Health, Ministry of Public Health, Trang, Thailand
[b] Center of Excellence for Emerging and Re-emerging Infectious Diseases in Animals, Chulalongkorn University, Bangkok, Thailand
[c] SUPA71 Co., Ltd, Bangkok, Thailand
[d] School of Health Science, Mae Fah Luang University, Chaing Rai, Thailand
[e] Faculty of Nursing, Khon Kaen University, Khon Kaen, Thailand
[f] Krabi Provincial Health Office, Krabi, Thailand
[g] Ban Manang Health Promotion Hospital, Satun Provincial Health Office, Satun, Thailand

ARTICLE INFO

Keywords:
Ethnicity
Mani
Maniq
Sakai
Thailand
Wildlife

ABSTRACT

Mani, or Maniq, or Sakai, are recognized as indigenous hunter-gatherers. Some are nomadic, while others have settled and modernized. Our knowledge of this ethnic group's healthcare-seeking and wildlife contact is limited. Thus, this qualitative study examined healthcare practices and wildlife interaction among a cluster of Mani ethnic group members in Manang District, Satun Province, Thailand, from November to December 2022.

Four key informant interviews (KIIs) and focus group discussions (FGDs) were carried out, and the selection of the study respondents was based on information from a gatekeeper and local health officials. Coding, thematic, content, and triangulation analyses of audio transcriptions were implemented based on the study objectives.

Mani's beliefs and lifestyle are deeply rooted in the forest, which significantly impacts numerous aspects of their lives. They encountered challenges such as food scarcity, legal issues, and access to modern healthcare. However, since obtaining national identification cards, their mobility has decreased. Their way of life has also changed, as they've become more dependent on outsiders. Nevertheless, they continue engaging in traditional practices such as gathering food, hunting in the forest, and treating illnesses with herbal remedies. They rarely develop serious illnesses. They have decided to seek treatment only if their condition persists or worsens. In addition, their knowledge of COVID-19, zoonotic diseases, and emerging animal-borne diseases was limited. In this regard, relevant governments and organizations should improve their health literacy about zoonotic diseases spread by wild animals to promote appropriate wildlife contact practices and reduce the potential risk of infection.

1. Introduction

The Mani, also known as the Maniq or Sakai, are an ethnic minority group in southern Thailand, inhabiting the Bathat mountain area in Trang, Phatthalung, Satun, Songkhla, Yala, and Narathiwat provinces. They exhibit distinct physical characteristics, including dark skin, short stature, and curly hair, which anthropologists classify as part of the Negrito ethnicity [1]. The term 'Negrito' refers to the first ethnic group from Africa to migrate to Asia, from South India to Southeast Asia [2]. Some anthropologists estimated that the population of the Mani inhabited the Banthat mountains in southern Thailand ranges from 140 to 400 individuals [3].

The Mani are indigenous mobile hunter-gatherers who have lived in isolated forest areas at the foot of the Bathat mountains for centuries.

* Corresponding author at: Center of Excellence for Emerging and Re-emerging Infectious Diseases in Animals, Chulalongkorn University and SUPA71 Co., Ltd, Bangkok, Thailand.
E-mail address: kanokwan27@yahoo.com (K. Suwannarong).

https://doi.org/10.1016/j.onehlt.2024.100689
Received 25 October 2023; Accepted 29 January 2024
Available online 2 February 2024

Their communities spread across the forest, comprising around 25–35 presumably related people. They live in makeshift camps built out of wood, called 'Ha Ya,' with women and young children usually spending most of their time in these camps while the men are occupied with daily hunting and gathering activities [3].

The Mani people have sustained their daily needs by hunting and gathering food from the forest, earning them the moniker' forest people'. For hunting, the Mani typically used a blowpipe made of bamboo called a 'bolau', loaded with poison-treated darts to paralyze the target animals. Apart from eating what they hunted, they also consumed tubers, wild fruits, and honey collected from the forest on a daily basis. At times, they engaged in trade with outsiders, exchanging forest products for rice and other foods from different ethnic groups. In addition, they sometimes received food donations from tourists visiting the Bathat mountains [1,3].

With the influence of modernization, many Mani preferred to live in permanent or semi-permanent residences and to work as wage laborers. Nonetheless, the majority still maintain their traditional lifestyle as hunter-gatherer tribes [3]. For several decades, the Mani ethnic group experienced various forms of multi-sectoral discrimination. Their unclothed lifestyle led to them being perceived as the lowest uncivilized social class. Moreover, local officials sometimes coerce Mani children into attending schools to improve their literacy and life prospects [2,3].

The World Health Organization (WHO) describes One Health (OH) as a comprehensive approach that aims to achieve a sustainable balance and enhance the well-being of individuals, animals, and ecosystems [4]. This perspective is critical when considering the Mani people's migration, interactions with wildlife, and the environmental changes they confront. OH recognizes that these interconnected factors can lead to the emergence of new diseases, including zoonotic diseases that can be transmitted from animals to humans [5].

In this regard, this study was implemented with the objective to determine their wildlife contact characteristics and possible health risk disease transmission dynamics. It also aimed to assess healthcare practices and explore the patterns of wildlife interaction among a cluster, including 35 Mani who live in the remote area of Manang District, Satun Province, Thailand. The findings of this study are expected to provide evidence-based information for promoting health literacy and planning communication interventions with ethnic groups by adopting the OH approach. Furthermore, the findings may have significant implications for future global health security efforts and pandemic prevention.

2. Methodology

2.1. Study design

This qualitative study employed focus group discussions (FGDs) and key informant interviews (KIIs) to collect data on the healthcare practices and wildlife contact characteristics of a cluster of Mani ethnic groups in Satun Province. This cluster was selected based on their activities that rely on foraging and hunting to sustain their livelihoods. This is to note that KII is a qualitative in-depth interview with people who know what is going on in the community [6].

2.2. Settings and respondents

The FGDs were conducted with 12 Mani respondents from a remote area in the Manang district of Satun Province, representing approximately 50% of the 35 Mani population residing in the remote forest area, as shown in Figs. 2, 3, and 4. Additionally, 4 KIIs were conducted with a local Mani gatekeeper who is Thai, a village health volunteer, and relevant government officials. The inclusion criteria consisted of individuals belonging to the Mani ethnic group residing in rural or remote areas of Manang District, Satun Province, for at least 12 months before the data collection. The respondents were aged between 20 and 65 years and presented their willingness to participate in this study throughout the process. This study used purposive sampling for respondent selection, which relied on information provided by local health officials and authorities and a gatekeeper familiar with the ethnic group to identify potential respondents with direct experience with wildlife. A trusted Mani gatekeeper extended invitations to eligible respondents to join the study using the gatekeeper approach [7].

2.3. Data collection procedures and study tools

This study implemented qualitative data collection methods, including key informant interviews (KIIs) and focus group discussions (FGDs). The respondents were selected purposively based on suggestions from a gatekeeper and local health officials who have been involved and in contact with the Mani. A total of 12 FGD respondents and 4 KII respondents participated in this study.

The discussion guides were designed based on the results of literature reviews to gather information based on the study objectives. The discussion guides were designed by university experts and were pre-tested with a few of Mani before the actual data collection to ensure local context and cultural sensitivity. Since some Mani could not speak Thai, we recruited two Mani who are able to speak Thai to be translators. They were instructed to keep confidentiality before the data collection.

2.4. Data analysis

Coding, thematic, content, and triangulation analyses of audio transcriptions were implemented. This process involved transcribing the qualitative data and applying coding techniques to identify key themes and interpret the significance of the findings. The content analysis method allowed for an enhanced understanding of the data, leading to a holistic interpretation of the results [8]. The researchers followed the standards of rigor and reliability in qualitative research to ensure data quality [9]. These steps involved establishing qualitative data analysis procedures such as ensuring data consistency, validating findings with respondents and relevant stakeholders in the study locations, and having multiple researchers and experts review the data and results to reduce bias and misleading information.

3. Results

3.1. Profile of the respondents

A total of sixteen respondents took part in this qualitative study, comprising eight men (50.0%) and eight women (50.0%), with a mean age of 47.3 years (ranging from 18 to 65 years). The FGDs involved twelve Mani respondents, with an equal gender. KIIs were conducted with two men (50.0%) and two women (50.0%), which included a local Mani gatekeeper (1, 25.0%), a village health volunteer (VHV) (1, 25.0%), a national park official (1, 25.0%), and a public health official (1, 25.0%).

3.2. Profiles of the study site

Satun is a province located on the Andaman side of southern Thailand. Its distance from Bangkok is approximately 973 km [10]. Within Satun Province, three groups of indigenous Mani people have settled in different areas, including a group in the Banthat Mountain Range near the headwaters of Khlong La Lon in Palm Pattana Subdistrict, Manang District, another group in the upstream area of Khlong La Ngu, Nam Phut Subdistrict, La Ngu District, and the third group in the upstream area of Khlong La Lo Fai, Thung Wa Subdistrict, Thung Wa District [11], as shown in Fig. 1. The natural environment significantly influences the settlement and migration decisions of the Mani ethnic group. Thailand's southern region is abundant in tropical rainforest resources, historically the primary reason for the Mani people's nomadic lifestyle as hunter-gatherers [12].

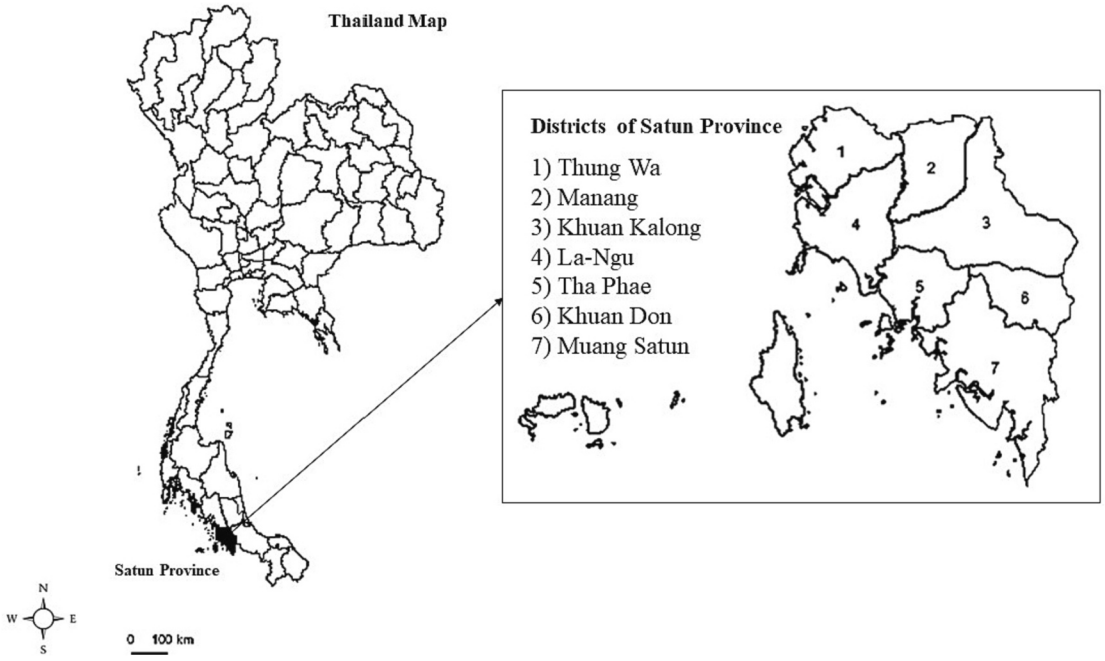

Fig. 1. Map of Districts in Satun Province, Thailand.

3.3. Profiles of the Mani ethnic group in Manang district in Satun province

In Manang District in Satun Province, the Mani ethnic group relied on foraging and hunting for sustenance. Their main food sources were taro roots, cassava, and various types of meat. They have lived in small clusters and occasionally migrated to areas with abundant food and natural resources. The reasons for their migration are often related to food scarcity or the loss of community members. In the past, the Mani did not have specific burial rituals. However, before relocating, they began conducting a burial ceremony at their current residence or temporary shelter. During their movements, the Mani people used leaf-made sheds called "tap" for shelter, as shown in Fig. 2. During migrations, children accompanied their parents to the new settlements.

A member of the Mani ethnic group noted,
We'd move to all sides – to Phatthalung, to Wang Sai Thong Waterfall, to Kong Ra, all over the place. Our father moved and brought us with him. (ST_MN_FGD_001).
Another member of the Mani ethnic group noted,
Once it becomes difficult to find food, we'll move. Move to where it's easier to find stuff to eat. (ST_MN_FGD_002)

Fig. 2. Shelters of the Mani Ethnic Group in Manang District, Satun Province.

The traditional movement of the Mani people was limited due to various factors. For instance, security concerns and the depletion of food resources in the forest restricted their ability to move freely, as they did in the past. Moreover, the government intervened to support the Mani community in abandoning their nomadic lifestyle by promoting the establishment of permanent settlements in designated areas. This led to some members of the Mani community losing their motivation to search for food through migration, as they had the option to settle in government-provided areas.

A national park official reported,
In the past, they'd move along the Banthat Mountain Range according to the hunting season. Where there were fertile trees, they would move there in line with the season. But now it's not much of a problem because they've settled in permanent dwellings. (ST_MN_KII_004)

Based on interviews with the Mani, it was found that they were dispersed across the forests of Phatthalung, Trang, Satun, and Yala provinces. The Mani people preferred to refer to themselves as "Mani" or "Manni" rather than other names, as these words mean "human". Another acceptable term was "Orang Asli," which holds significance as it represents their native identity. Conversely, the terms "Sakai" and "Ngo Pa" were associated with the connotation of "savage" or "barbarian." In terms of characteristics, the Mani people had well-proportioned physiques and a strong affinity for music and songs. They were typically non-aggressive, introverted, shy, and cautious around strangers. However, they became more acquainted with local Thai villagers and outsiders.

A national park official reported,
They're not aggressive. When they meet people, they're usually shy and reserved. (ST_MN_KII_004)

The primary occupation of the Mani community centers around gathering wild products like honey and herbs, which they sell to outsiders. While they also hunt for food, they generally do not sell the animals they catch. Many Mani women excel at foraging for wild products and are skilled at weaving bags from wild pandanus. In addition, some Mani individuals work as laborers, often in the agricultural sector, in rubber tapping, and in palm plantations and orchards. Furthermore, they cultivate fruits such as rambutans, mangosteens, and durians, obtaining seedlings from neighboring Thai villagers. These diverse occupations enable the Mani to generate additional income and sustain their livelihoods in areas with limited natural resources.

A member of the Mani ethnic group noted,
Our work includes finding wild items, making herbs, and making handicrafts for sale. Any interested Thai people can buy them (for resale). (ST_MN_FGD_001)

In the past, the Mani people used to wear clothing made from bark and leaves, with both men and women mostly topless and children wearing nothing. However, with the influence of local Thai villagers and outsiders, they have begun wearing clothes similar to Thai villagers. Some younger Mani also adopted similar beauty standards as the other villagers, using cosmetics or accessories obtained from the villagers. This allowed them to recognize and share different experiences, fostering a sense of togetherness within the community.

3.4. Residential areas of the Mani ethnic group and their problems

3.4.1. Main problems faced by the Mani

The Mani residing in this study site have encountered challenges with food scarcity due to changes in ecosystems and land use. This resulted in reduced available food sources from the forest, making it difficult for them to find sufficient sustenance. Most respondents expressed concerns about the lack of rice and other food sources, and during times of scarcity, they resorted to hunting hog badgers as an alternative food source.

A member of the Mani ethnic group reported,
There's an issue with stuff to eat, like not having enough rice and difficulties finding food. Sometimes, we tried to find it, and we could. But sometimes we couldn't. However, if we have nothing, we'll go find hog badgers. (ST_MN_FGD_001)

At times, when the Mani could not find food from the forest, they resorted to picking fruits from the Thai villagers' fields/gardens without permission. This situation resulted in conflicts between Mani and the villagers. To address the issue, national park officials, VHVs, and a Mani gatekeeper have been working to convince the Mani community members not to pick the villagers' fruits while simultaneously fostering mutual understanding between the Mani and the villagers. In addition, fruit saplings were distributed to the Mani people to encourage them to plant their own fruits. Consequently, the fruits grown in these conditions did not yield enough produce to meet Mani's needs. Hence, Mani had yet to find a viable solution to address their ongoing food shortage problem.

A local Mani gatekeeper commented
The problem between the forest people and the villagers is difficult to solve. I've bought durian, mangosteen, and rambutan saplings for them to plant, but the soil – what it's called – is in an area that's too shady. So, fruits rarely grow. (ST_MN_KII_001)

A VHV noted that,
It's not exactly stealing. They just didn't know. They thought it was like wild products that could be collected. We have to build understanding and view them as part of the community. (ST_MN_KII_003)

Furthermore, the Mani community faced significant barriers due to their legal status, which resulted in limited access to fundamental rights and government support. The practice of listing all Mani individuals under a single house number hindered their ability to receive welfare and government assistance, even though most of them possessed national identity cards. This situation created difficulties in accessing resources, and not all entitled Mani members could benefit from government support and welfare programs.

A local Mani gatekeeper noted,
It's also a problem because there's only one house number. It's a problem because when the government distributes something, they usually just distribute one to each household. It's difficult for the livelihood of the Mani. (ST_MN_KII_001)

3.4.2. Health issues of the Mani

Mani often encounters common health issues, including pneumonia, flu, cavities, and skin diseases like dermatophytosis. The majority of individuals do not experience any significant health problems. Based on information gathered from the key informants, individuals who went into forests and got caught in the rain experienced various common cold symptoms, including itching, sore throats, watery eyes, and dizziness. Most Mani had good overall health, and malaria was not prevalent due to their use of smoke to repel mosquitoes. Unfortunately, some Mani individuals contacted dengue fever due to their studies and work outside their community.

A member of the Mani ethnic group noted,
I got dengue, but it wasn't severe. I recovered after treatment. (ST_MN_FGD_001)

A public health official noted that,
During the malaria outbreak, none of the Mani was found to be infected. No other diseases were detected either. Nobody has high

blood pressure because they go to the forest daily. They exercise every day. (ST_MN_KII_002)

Nonetheless, according to information provided by the public health official and the VHV, it was possible that the Mani community would be at risk of developing chronic disease health issues, such as high blood pressure, diabetes, or other non-communicable diseases, similar to the Thai villagers in the future. This was due to the Mani community's changing lifestyle and dietary habits, including increased consumption of flavor enhancers and sweets, which put them at risk of developing health conditions.

A public health official noted that,
In the future, it's uncertain because now their way of life has changed. They eat more sweets. They eat more MSG (Monosodium glutamate). This could lead to diseases. (ST_MN_KII_002)

The public health official and VHV reported that when members of the Mani ethnic group fell ill, they conducted health checks, usually finding only common cold symptoms. They trusted and notified the local Mani gatekeeper for any health-related issues, including childbirth. In some cases, forestry officials and village authorities were also informed to provide necessary care and assistance. However, based on the interview data, most Mani people still lacked knowledge regarding zoonotic diseases as relevant officials rarely came to raise awareness on the subject.

3.5. The interactions between wildlife and the Mani ethnic group

3.5.1. Wildlife-related livelihoods and activities

The Mani mainly have engaged in subsistence hunting, primarily targeting small animals and aquatic creatures such as tree monitors, squirrels, birds, fish, turtles, snapping turtles, frogs, hog badgers, wild boars, monkeys, langurs, pangolins, and pythons. They rarely hunt large animals like tigers and bears, and they do not engage in hunting for commercial purposes. The Mani hunt only enough to meet their food needs and are not considered cruel hunters.

A member of the Mani ethnic group noted,
We eat hog badgers, monkeys, and langurs. As for bears, we've seen them but never shot them. The bears don't chase us, either. If we don't hurt them, they don't chase us. (ST_MN_FGD_001)

Another member of the Mani ethnic group noted,
We eat monkeys and pythons but not other snakes. (ST_MN_FGD_002)

A local Mani gatekeeper commented,
The Mani only hunt animals for eating, not for sale. They rarely eat large animals. But they eat all kinds of small animals. (ST_MN_KII_001)

The Mani people do not seek sacred blessings for hunting but rely on their own skills. When hunting land animals, they would use the bolau, made from male bamboo, to blow darts treated with poison from Strophanthus, as shown in Fig. 3. The poison is applied to the dart's tip, rendering it capable of causing pain and death to the targeted animal. When hunting, the Mani must ensure that they cut off the meat taken from the dart before cooking the rest, as the poison from Strophanthus is lethal and incurable.

A local Mani gatekeeper noted,
Strophanthus, which is used for hunting, is a poisonous sap. When [an animal] is hit with it, it will die. And if the dart is poisonous, they'll cut off the part hit by the dart and eat the rest. (ST_MN_KII_001)

In addition to using the balou with Strophanthus-treated darts, the Mani people employed various other hunting methods, including blowing non-poisonous darts, rounding and beating, spearing, and stone-throwing. Hunting was primarily the responsibility of men, often in the company of their families or small groups. Generally, only the elderly and children, who could not travel easily, would be left behind. During the hunting process, the group's male members would split into smaller teams to hunt quietly, avoiding making loud noises that could alert the animals. Hunting success relied partly on skills and luck, as not every attempt would result in a catch. When they successfully caught an animal, the meat would be shared equally among the group, with the catcher receiving the best portion.

Throughout different seasons, the Mani people have maintained consistent hunting practices. In the dry season, they hunt wild animals and forage for their sustenance, occasionally selling fruits, vegetables, or wild herbs to local communities. Their honey-gathering and tuber-digging methods are sustainable, allowing resources to regrow. During the rainy season, they focus on hunting wild boars and hog badgers, employing a method of blowing smoke into hollows to flush out the animals for capture. Hog badgers are particularly popular as a source of wild meat for the Mani people. Their approach showcases a balanced approach to forest and wildlife conservation. The Mani reported that when they captured wild animals, especially larger ones located far within the forest, it became challenging to transport the animals back to their shelter. Therefore, they would kill and butcher the animals on-site, dividing them into pieces before bringing them back. On the other hand,

Fig. 3. Bolau (a Blowpipe) Used for Animal Hunting by the Mani Ethnic Group.

smaller animals would be killed in the wild and brought back to their shelters for butchering.

A member of the Mani ethnic group noted,
We killed [and butchered] them in the forest because it's far away. And then we took the pieces. (ST_MN_FGD_001)

The Mani had a specific approach to cooking and consuming monkeys. After killing the monkeys, they would burn the fur and coat their bodies. They used the whole monkeys for cooking, roasting the meat over low heat using a split stick, or stuffing it inside a bamboo tube (the 'larm' method). They generally preferred bland flavors and used kitchen utensils like pots, pans, and knives from local villagers or markets.

A member of the Mani ethnic group noted,
Suppose we've caught a monkey, right? We'll burn the whole body, remove the fur first, dissect it, and eat all the parts. Every part of a monkey can be eaten. (ST_MN_FGD_001)

3.5.2. Wildlife-related beliefs and rituals

The Mani people did not practice a specific religion, but they showed respect for their ancestors and deceased members of their community. They commemorated the departed and obeyed the guidance of their elders. Their leader served as an arbiter or representative in dealings with outsiders. While their practice of hunting and consuming wild animals was not based on religious beliefs, the Mani strongly feared ghosts and fierce creatures like tigers, bears, and elephants.

A member of the Mani ethnic group noted,
Actually, it's about showing respect to the deceased. The Mani people don't follow any particular religion, but they have their way of honoring spirits like their ancestors. (ST_MN_FGD_001)

A local Mani gatekeeper noted,
They don't really worship any deities, angels, or ghosts—only fear. The Mani are very afraid of ghosts and fierce animals like tigers and bears. (ST_MN_KII_001)

However, the Mani believed that consuming monkeys or wild animal meat when sick would help them recover and provide them with greater strength. Additionally, they included fish, frogs, tree monitors, turtles, or snapping turtles in their diet, which they believed would help treat cold/flu symptoms. If they encountered a tiger while hunting or searching for wild items, they tended to stop their hunting activities, considering it bad luck. They feared being bitten by the tiger since they perceived the animal as too dangerous to fight.

A member of the Mani ethnic group who was interviewed noted,
Sometimes, the Mani encounter tigers. That's bad luck. It's considered bad luck for anyone who comes across them. And they might be bitten. Whoever meets a tiger is seen as having bad luck. (ST_MN_FGD_002)

In the past, the Mani people used to consume large bats, particularly those who were 35 years and older. After thorough washing, the bats were prepared by grilling or cooking them inside a bamboo tube (larm) to remove the distinct fishy smell. However, the younger generation no longer eats bats, reflecting a shift in food preferences and practices.

A member of the Mani ethnic group noted,
Bats. We ate them in the past, but now we can't stomach them. In the past, we used to eat with them when we were as teenagers. But nowadays, it's like, even my mom got a lot of bats.; but we don't eat them anymore. (ST_MN_FGD_001)

In terms of prohibitions, the Mani had a prohibition against eating wild animals that consume 'look bao', a fruit that can cause intoxication and lead to symptoms like vomiting and dizziness. Additionally, park officials allowed the Mani to hunt for sustenance but prohibited them from hunting wild gibbons and gorals, as they are protected wildlife. The Mani themselves did not hunt these two species, and they did not have any religious beliefs or traditional rituals related to hunting. These practices indicate their awareness of environmental conservation and adherence to rules set by authorities to protect certain species.

A member of the Mani ethnic group interviewed noted,
Gibbon. Forest officials don't allow hunting gibbons. Moreover, gorals are another thing we know we can't hunt. (ST_MN_FGD_002)

3.6. Knowledge, attitudes, and beliefs of the Mani ethnic group towards healthcare and COVID-19

3.6.1. Healthcare and COVID-19-related beliefs and practices of the Mani ethnic group

In their folk healing practices, the Mani ethnic group has beliefs in the power of various medicinal herbs passed down from their ancestors. They have used these herbs to make remedies for various diseases and symptoms. For instance, they boiled and consumed the bark of Ya Nu (a wild herb known to the Mani people) for medicinal purposes, including during childbirth. Moreover, when they experience a headache, they tie Plai (*Zingiber cassumunar*) to the affected area to alleviate the pain.

A local Mani gatekeeper noted,
They (the Mani) all learn about wild medicine. They learn it from their ancestors. (ST_MN_KII_001)

The Mani faced unfamiliar diseases like COVID-19, as well as communicable and non-communicable diseases. If they could not treat the illness with traditional herbs, they sought local medical services, including the health promoting hospital (HPH) and the district hospital near their living area. Some women also chose hospital births for safer childbirth.

A public health official noted that,
The Mani often rely on herbal remedies to treat illnesses themselves. However, if they don't recover, then they'll go to the hospital. They'll go when it's severe.
(ST_MN_KII_002)

Moreover, some Mani expressed their willingness to receive medical care at a local HPH or district hospitals through a gatekeeper, a VHV, or a village headman. These community leaders would then accompany the Mani to the medical facility for treatment.

3.6.2. Accessibility of health facilities and awareness of COVID-19

During the study, the Mani ethnic group received nationality verification and official recognition as Thai citizens, enabling them to access health insurance programs like the Universal Health Insurance Card or the 30-baht gold card, providing comprehensive medical coverage. They could seek medical treatment at any hospital, aligning with their lifestyle and migration patterns and adapting to changing food availability. This recognition granted them access to state welfare and healthcare benefits.

A public health official noted that,
They are eligible for state welfare. They get the 30-baht health benefits. (ST_MN_KII_002)

Despite progress in healthcare access, Mani faced challenges in fully utilizing the healthcare system, including distance to remote facilities and communication barriers. However, they were well-informed about the importance of COVID-19 vaccination, leading to high vaccination rates. Due to limited interactions with outsiders and precautionary measures like mask-wearing, no reported COVID-19 cases occurred among the Mani. Some even sought further protection by fleeing more profoundly into the forest.

A local Mani gatekeeper noted,

None of us [the Mani people] in the community has COVID-19 because they are obedient, wear masks, and get vaccinated. Everyone's got three doses (of vaccination) already. (ST_MN_KII_001)

A national park official reported,
As for the Mani, they live in the forest, so there's no disease unless the [Thai local] villagers bring it to them. Once they knew about it [COVID-19], they fled from the [Thai] villagers. (ST_MN_KII_004)

However, health officials noted that most of Mani still lacked knowledge and understanding about COVID-19 and zoonotic diseases. Limited access to information and medical services in the area contributed to this lack of awareness, especially for those Mani who were constantly on the move, making communication challenging. Promoting knowledge and understanding about COVID-19 and zoonotic diseases among Mani is thus crucial for improving their health outcomes and preventing the spread of diseases within their community.

4. Discussion

The way of life of the Mani people is deeply intertwined with the forest, impacting various aspects of their daily existence. Forests serve as a vital source of sustenance for the Mani, influencing their movements across different parts of Thailand. This study's findings on Mani's movement in Manang District, Satun Province, aligned with the research conducted on the Mani in Phatthalung Province, which was found that the Mani community would relocate when their current area could no longer provide enough food, and when someone passed away within their settlement [13]. Such practice is rooted in their spiritual beliefs, as they consider spirits and ghosts present in darkness [13]. In addition, this contributes to constantly maintaining a bonfire in their settlements without completely extinguishing the fire [14]. Separately, another study was found that the Mani had the basic knowledge of how to plant crops, but they could not maintain and sustain crops or livestock [15].

However, in recent times, the Mani community in Manang District, Satun Province, began to settle in more locations due to the acquisition of identity cards and their children attending schools more regularly. Consequently, they can no longer move as freely as they did in the past. This observation aligned with the study conducted in 2016, which found that most settled Mani groups obtained identity cards and resided in government-designated areas [16]. Additionally, many became agricultural workers, and their hunting practices gradually decreased as they established more permanent homes [16].

Regarding their beliefs, the Mani people adhere to animism and also believe in a spirit in the form of a tiger, which punishes those who commit offenses such as adultery, taunting game animals, careless tree-cutting, and other harmful practices [2,3]. However, the Mani people in Manang District, Satun Province, did not have specific religious/traditional beliefs or rituals passed down through generations. This finding is in line with a report from the Princess Maha Chakri Sirindhorn Anthropology Centre (Public Academic Organization), which did not observe any important annual traditions or rituals among the Mani people in the Banthat Mountain Range but found the Mani's beliefs and way of life to be intertwined with nature [17]. On the other hand, the study on the Mani people of the northern Khlong Tong group in Palian District, Trang Province, revealed that the Mani had a firm belief in ancestral spirits [18]. They believed these spirits continued to exist and reside in various natural elements such as trees, sky, water sources, mountains, land, and even some animals [18]. The Mani in Palian also held beliefs about dreams, sin, livelihood-related rituals, and the meaning of life [18]. This indicated that their beliefs varied across different regions.

Moreover, the Mani people in our study expressed fear of spirits and dangerous animals like tigers, bears, and elephants. As mentioned, they considered it a bad omen to encounter tiger footprints. This observation somewhat aligned with the findings of the previous studies, which revealed that the Mani refrained from speaking of fierce animals while in the forest, as they believed that this would lead them to encounter the animals [13,17]. In addition, they believe that they should change directions if they stumbled or fell while hunting and that they needed to avoid mentioning which path they would take next, as this might harm animals or spirits [13].

Regarding their interactions with wildlife, the Mani people in this study led a simple lifestyle and actively participated in forest conservation activities. They engaged in activities like digging for tubers, collecting honey, and subsistence hunting. These findings aligned with reports by the Indigenous Peoples' Foundation for Education and Environment (2015) and Kricheff and Lukas (2015), which stated that the Mani people do not have specific preferences for particular animals to forage or hunt; instead, they focus on finding enough food to satisfy their daily needs [3,19]. This was also in line with Chantrakul's study (2001), which stated that the Mani people in the Banthat Mountain Range in Trang, Phatthalung, and Satun provinces lead a simple and subsistence lifestyle, seeking just enough taro, potatoes, and animals to fill their stomachs [13]. While they did not have any particular wildlife-related traditions or rituals, the Mani people in Manang District, Satun Province, do believe that consuming wild animals will strengthen their bodies. This belief also aligned with the studies of the Mani ethnic group in 2003, which found that most Mani preferred eating wild animals such as turtles, snapping turtles, monitor lizards, fish, frogs, birds, monkeys, and wild boars [20]. They used various hunting methods, including bolaus, slingshots, snare traps, poisoned darts, hooks, and trapping nets [13,20].

The Mani people hunt for livelihood, focusing on small animals, which pose a risk of zoonotic disease transmission because contact with and consumption of wild animals was widely recognized as a means for spreading zoonotic pathogens to humans. Fortunately, no prior evidence of zoonotic infectious diseases among Mani or wildlife in the current study area has been found. However, Mani was infected with dengue fever by outsiders while studying or working. However, a study found SARS-CoV-2 delta variant infection in domestic dogs and cats in Bangkok and the surrounding provinces [21]. This could be evidence-based data indicating the possibility of transmission between humans and animals [21].

The Mani reported consuming a variety of wild animals, including non-human primates such as monkeys and langurs. These wild animals could be carriers of viruses and other pathogens, posing a risk of zoonotic disease transmission. Nevertheless, *Plasmodium knowlesi,* the latest human malaria parasite, was found in Thailand [22,23]. Recently, 46 cases of *Plasmodium knowlesi,* the latest human malaria parasite, were reported between October 2021 and May 2022, in which Yala province had the most cases, followed by Songkhla and Satun [24]. Fortunately, there was no direct report or studies of *Plasmodium knowlesi* infection or from consuming or contacting with wild animals among Mani in this current study area.

The Mani belief in healthcare is rooted in their ancestral knowledge of using herbal medicines to treat and alleviate illnesses. This traditional practice has been passed down through generations. It was in line with the studies conducted on the Mani ethnic group, which revealed that herbal medicines were not effective in healing chronic and fatal illnesses, leading the Mani to appreciate the benefits of modern medicine increasingly [20,25]. The influence of social, cultural, and the way of life of local Thai villagers and outsiders has played a role in shaping Mani's approach to healthcare. As a result, the Mani adopted new practices, such as taking better care of their bodies and clothing and incorporating modern medicine alongside traditional treatments when sick. Additionally, they now have improved access to public health services [25]. Notably, Mani women have started seeking antenatal care and giving birth in hospitals, a shift from the past when births were often conducted by experienced elders or husbands [17,20].

Despite possessing equivalent access rights to the health system as Thai villagers, the Mani encounter challenges in accessing health

facilities, aligning with the OH principle that emphasizes the interconnectedness of human, animal, environmental, and wildlife health. Traveling to these facilities proves difficult for them, unveiling a vulnerability that has not been explored in prior studies regarding the impact of the COVID-19 pandemic on Mani's life. The delicate balance of the ecosystem, encompassing both their environment and local wildlife, plays a crucial role in their well-being, creating an intricate web of health connections. Additionally, a substantial lack of awareness and comprehension exists concerning COVID-19 and zoonotic diseases among the Mani. This is attributed to insufficient information and language barriers, underscoring the importance of integrating OH concepts into their health education. To address these issues comprehensively, collaboration between the government, relevant agencies, and local communities is essential to cultivate a comprehensive understanding of COVID-19 and zoonotic diseases among Mani, promoting resilience against potential future pandemics while safeguarding the broader ecosystem.

5. Limitations of the study

There were 35 community members of the Mani population residing in the study site, and we were able to conduct the study with 50% of the population due to the challenging accessibility of the area, as shown in Fig. 4. However, the data became saturated with information from 12 Mani respondents, and no new information was observed from the additional interviews [26]. Additionally, a language barrier posed a limitation in this study, as some Mani individuals could not speak Thai. To address this issue, Mani interpreters were carefully selected from their community to gain trust to share the information, and an agreement was established to ensure the confidentiality of the interviews, enabling all respondents to express their thoughts effectively.

6. Conclusion

The beliefs of the Mani people are deeply intertwined with the forest, influencing various aspects of their daily lives. However, their nomadic practices have been impacted by settlement and improved access to education for their children, leading them to be unable to move as freely as in the past. Their beliefs encompass a fear of spirits and dangerous animals, while subsistence hunting and conservation activities are essential for their sustenance. Nevertheless, they encounter challenges such as food shortage, legal status, and access to healthcare facilities, which have posed additional difficulties. There is also a lack of awareness about zoonotic diseases within the Mani ethnic group. Therefore, government authorities, public health officials, and relevant agencies must implement effective communication strategies to address the lack of knowledge about COVID-19, zoonotic diseases, and potential future pandemics among Mani. In addition, improving the health literacy of the Mani individuals and community through the OH concept and communication interventions should be considered to adapt to the cultural characteristics of Mani's beliefs and ways of life. The intervention should emphasize the importance of preventive measures, such as proper hygiene practices for both human and animal contact behaviors, to minimize the potential risks of zoonotic infectious diseases [27,28]. The interventions should employ local languages, visuals, and storytelling techniques to convey health information effectively [4]. Moreover, further studies on the immune response to Mani wildlife consumption should be undertaken.

Ethics approvals

This study was approved by the Human Research Ethics Review Board of Chulalongkorn University in Thailand (approval no. 150.1/64) on December 14, 2021, and May 2, 2023. All respondents provided written informed consent prior to participating. The study conformed to ethical guidelines, thereby ensuring the study's integrity and safeguarding the respondents' rights and welfare.

Fig. 4. The Setting of the Mani Ethnic Group in a Remote Forest Area.

Funding

The author(s) received no financial support for the research, authorship and/or publication of this article.

Declaration of competing interest

The author(s) declared no potential conflicts of interest with respect to the research, authorship and/or publication of this article.

Data availability

Data will be made available on request.

Acknowledgments

We would like to express our appreciation to the Manang District Health Office and Satun Provincial Health Office, as well as their respective local health officials, for their assistance and cooperation throughout the research implementation. We would like to thank Prof. Dr. Alongkorn Amonsin and Prof. Dr. Pratap Singhasivanon for their valuable guidances in this study implementation and manuscript preparation. In addition, we would like the Rachadapisek Sompote Fund and the Second Century Fund of Chulalongkorn University (C2F) for the first author's Postdoctoral Fellowship.

References

[1] Narumol Khunweechuay, Saowalak Roongtawanreongsri, Krongchai Hatta, Cultural Forest ecosystem Services of the Maniq Indigenous People in southern Thailand, Hum. Ecol. 50 (2022) 1–18.
[2] Apichaya Kaewuthai, Mani 'Sakai': representations, ethnicity and marginality, J. Thai Khadi Res. Institute 17 (2) (2020) 145–189.
[3] D.A. Kricheff, H. Lukas, Being Maniq, Hunter Gatherer Res. 1 (2) (2015) 139–156.
[4] WHO, One health, Available from, https://www.who.int/news-room/questions-and-answers/item/one-health, 2017.
[5] D. Destoumieux-Garzón, et al., The one health concept: 10 years old and a long road ahead, Front. Vet. Sci. 5 (2018) 14.
[6] L. Wisener, Key Informant Interviews, 2014 desLibris.
[7] J. McFadyen, J. Rankin, The role of gatekeepers in research: learning from reflexivity and reflection, GSTF J. Nursing Health Care 4 (1) (2016 Oct 21).
[8] S. Elo, H. Kyngäs, The qualitative content analysis process, J. Adv. Nurs. 62 (1) (2008) 107–115.
[9] Y.S. Lincoln, E.G. Guba, Naturalistic Inquiry, SAGE Publications, 1985.
[10] Satun Provincial Office, General information of the province, Available from, https://www.satun.go.th/content/general, 2018.
[11] Satun Provincial Agriculture and Cooperatives Office, Basic information of the agricultural sector in Satun Province, 2020, 2021.
[12] Siriporn Somboonburana, *Ethnic groups in the case of the Sakai or Mani group in Southern Thailand.* 2558, Princess Maha Chakri Sirindhorn Anthropology Centre (SAC): Bangkok.
[13] Wanchalerm Chantrakul, Sakai or Nichao of Thailand, Duangkamolsamai Company, Bangkok, 2001.
[14] Worrachai Wiriyaromp, Purin Naksing, Chattrawan Phonphet, Social And Cultural Changes Among The Sakai Ethnic, A case study of the Sakai Ethnic in Tamot District, Phatthalung Province, Parichart J. 27 (2015) 83–102.
[15] Chalermchai Chotisut, Bhumiputra: racialism policy in Malaysia, Parichart J., Thaksin University 27 (1) (2014) 78–97.
[16] Suwilai Premsrirat, Chumpol Phothisan, Mani (Sakai), an indigenous people in southern Thailand, Damrong J. 14 (1) (2016) 33–56.
[17] Sudarat Sriubon, Ethnic Group, *Mani*, in *Mani: Ethnic Rights and the Quarrying Concession in Satun Global Geopark*, Princess Maha Chakri Sirindhorn Anthropology Centre (Public Organization), Bangkok, 2021.
[18] Arporn Ukrit, A Study of the Relationship between the Continuation and the Change of Ecology and Society and Culture: A Case Study of the Sakai Ethnic Group of the Northern Canal Tong, Palian District, Trang Province, Office of the National Cultural Commission, Ministry of Education, 1993.
[19] IPF Foundation, Indigenous People (Mani), Indigenous Peoples' Foundation for Education and Environment (IPF), Chiang Mai, 2015.
[20] Ketsarin Maneenoon, Phuangpen Sirirak, *Sakai: A Minority in Southern Thailand*, in *Faculty of Science*, Prince of Songkla University, Songkhla, 2003.
[21] W. Jairak, et al., SARS-CoV-2 delta variant infection in domestic dogs and cats, Thailand, Sci. Rep. 12 (1) (2022) 8403.
[22] J. Traipattanakul, et al., A first case of plasmodium knowlesi malaria in Phramongkutklao hospital, J Infect Dis Antimicrob Agents 31 (2) (2014) 91–100.
[23] S. Shimizu, et al., Malaria cross-sectional surveys identified asymptomatic infections of plasmodium falciparum, plasmodium vivax and plasmodium knowlesi in Surat Thani, a southern province of Thailand, Int. J. Infect. Dis. 96 (2020) 445–451.
[24] Thai PBS. *46 people in the southern region infected with Plasmodium knowlesi* 2023 May 10, 2023; Available from: https://www.thaipbs.or.th/news/content/315381.
[25] Weerawat Sukwara, *Health behaviors of the Sakai people : a case study of ban Sakai, village no. 3, ban Rae sub-district, than to district, Yala Province*. 1996, Mahidol University: Nakhon Pathom.
[26] G. Guest, A. Bunce, L. Johnson, How many interviews are enough?: an experiment with data saturation and variability, Field Methods 18 (1) (2006) 59–82.
[27] J.P. Webster, et al., One health–an ecological and evolutionary framework for tackling neglected zoonotic diseases, Evol. Appl. 9 (2) (2016) 313–333.
[28] P.M. Rabinowitz, et al., Toward proof of concept of a one health approach to disease prediction and control, Emerg. Infect. Dis. 19 (12) (2018).