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A Qualitative Study of Traditional Bone Setters in South India: A Case Series

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ABSTRACT

Introduction. There are approximately 60,000 Traditional Bone Setters (TBS) in India, who have no formal education or training in modern medicine but treat approximately 60% of bone related trauma. This study investigated the history of TBS, why they are so popular, and their methods.

Methods. From a list of TBS from four states in South India, a purposive and convenience sampling method identified participants. One lead TBS from each state was interviewed. With recommendations from these TBS, a total of six participants were interviewed on Zoom® in their native dialect and these interviews were transcribed into English. The data were analyzed using a constant comparative method which included several iterations to refine common themes and determine counterfactual and specific focal points from each interview.

Results. Six overarching themes emerged: (1) history of traditional bone setters, (2) occupations outside bone setting, (3) training, certification, education, accolades, (4) patient characteristics and success stories, (5) infrastructure and approach to diagnosis/treatment, and (6) limitations of practice, challenges, and social relevance. The history of traditional bone setting is thousands of years old and passed down within families generationally.

Conclusions. In rural India, where a large part of the population lives in poverty and without access to modern medicine, traditional healers provide a much-needed service, often without charge, and consequently, the income is not sufficient without other occupations such as farming. They follow a similar approach to diagnosis and treatment of simple fractures and dislocations as modern medical practitioners. Most would like to share their knowledge and collaborate with ayurvedic and allopathic practitioners and simply want to be respected and supported.

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INTRODUCTION

Traditional Bone Setters (TBS) are so called "un-qualified practitioners" who have no formal education or training in medicine and treat dislocations and fractures using methods that have been passed down for generations. Reportedly, these traditions have survived for as long as 3,000 years.[1,2] There are approximately 60,000 TBS in India, and they treat approximately 60% of bone related trauma cases.[3] Accessibility is one of the main reasons for the popularity of TBS especially in rural areas, where a large population of the country resides, and where there are almost no orthopedic services available.[1,2]

Despite rapid urbanization and many advances in modern medicine, TBS continue to be a popular choice for many who do not want to undergo surgical intervention, or for whom the cost of seeing an orthopedic surgeon is too high.[3] Education level was not a factor in who patronized TBS.[4] With the widespread use of TBS, there has been concern that many complications such as malunion, compartment syndrome, and gangrene may be consequences of the methods employed by TBS.[5-18] These complications invariably require surgical intervention to fix, and the chance of good outcomes is reduced considerably.

The practice of traditional bone healing is popular in many developing countries such as some African countries,[19-21] China,[22,23] and the Indian subcontinent.[3,24-27] One such method is known as "Puttur Kattu" which literally translates to "bandage of Puttur," a town located in Chittoor District of Andhra Pradesh in South India.[2] Puttur also is popular for its numerous TBS practitioners. There are about 60 TBS despite its small population of 54,092. This traditional method has a legacy dating back to the late 19th century. They use splints made of bamboo sticks and a paste of an herb called "Kasamarda" that they gather in the wild.

The purpose of this study was to (1) explore why the art of traditional bone healing continues to flourish and the reasons for their success and failure and (2) investigate if there is a physiological basis to their methods, what processes and rigors of training they undergo to practice their art, their key skills and infrastructure requirements, and if there are processes of accreditation and verification of services by the State and by patients.

METHODS

This project was approved by the Institutional Review Board at the University of Kansas Medical Center. A qualitative study was designed to explore the history of traditional bone setting and the basis behind the methods used by TBS in South India. Interviews were conducted by the first author (SI-P) with TBS to learn more about their current practice of bone setting. The Foundation for Revitalisation of Local Health Traditions (FRLHT) and The University of Trans Disciplinary Health Sciences and Technology (TDU) in Bangalore collaborated to identify representative TBS interviewees.

The sampling frame was a list of TBS from the four south Indian states of Andhra Pradesh, Kerala, Tamil Nadu, and Karnataka shown in Figure 1. This list was provided by Mr. G. Hariram Murthi, Head of the Centre for Local Health Traditions at TDU. With the help of TDU collaborators, an introductory webinar for TBS was held to explain the purpose of the study and to build rapport, as many were reluctant to participate in a project conducted by a U.S. medical student. TBS typically experienced bias from the allopathic medical community which added to their apprehension. However, with the help of Mr. G. Hariram Murthi, whom they trusted and held in high regard, a sizable turnout resulted.

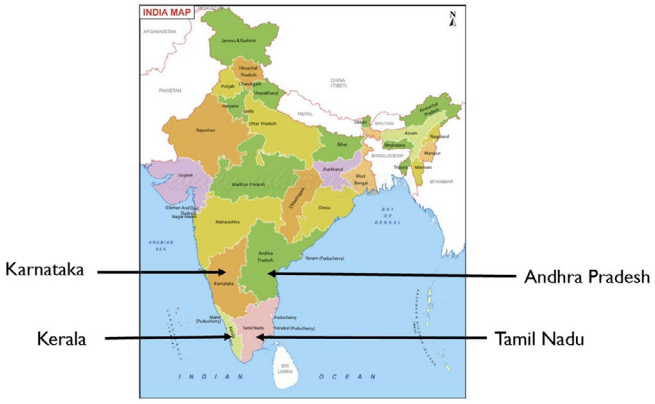

Figure 1. Map of South India.

Purposive and convenience sampling methods were used to identify TBS who met inclusion and exclusion criteria. Inclusion criterion included a TBS practicing in South India who was willing to do a virtual interview on Zoom®. Interviews were conducted on Zoom® and recorded with permission of the interviewees. Prior to the start of the interview, participants were given an information sheet and consent form which was signed by the field researcher, a local researcher/interpreter in India. These forms were written in English as well as translated in to the four south Indian languages, Telegu, Malayalam, Tamil, and Kannada. The interviews were conducted as a collaboration with field researchers from TDU who were fluent in these local dialects, using an interview guide with general questions regarding TBS practices (Appendix). The guide consisted of open-ended questions to gather data. These interviews were transcribed into English by the first author (SI-P). The interview guide was piloted with one lead TBS from each state of south India. Snowballing was used by asking these pilot interviewees to recommend additional TBS interviewees.

Data analysis was managed using the software program, NVivo®. This program allowed the use of a constant comparative method, which included several iterations to determine common themes and counterfactual/specific focal points from each interview.

RESULTS

Six TBS were interviewed from the four South Indian states (Table 1). Six themes emerged from the interviews.

Table 1. List of interview participants.

Subject	Location	Language	Generation	Years in Practice
Participant 1	Andhra Pradesh	Telegu	4th	37
Participant 2	Kerala	Malayalam	2nd	35
Participant 3	Tamil Nadu	Tamil	5th	39
Participant 4	Karnataka	Kannada	3rd	50
Participant 5	Andhra Pradesh	Telegu	4th	40
Participant 6	Tamil Nadu	Tamil	6th	32

Theme 1: History of Traditional Bone Setters. Participant 1 trained as an apprentice to his grandfather for 17 years, since he was 12 years old. His grandfather started bone setting in 1890 on cattle and as he found success, he began doing the same on humans. His fame grew by word-of-mouth. After learning from his grandfather, Participant 1 practiced with his father and passed the knowledge on to his own children and grandchildren. Two of his sons assisted him and another was studying to be a physiotherapist and helped in the clinic when not at school. His daughter assisted with herbal preparations. His wife apprenticed with him after their marriage. Thus, a sub-theme developed involving women TBS. Participant 1's wife was the reason he could travel to satellite facilities to see patients in remote areas, as she managed the patients in the clinic at home. His mother treated patients with jaundice using traditional medicines which she learned from her mother. Because of his family history of treating livestock, Participant 1 continued to get calls from veterinarians for bone setting of animals.

Participant 2 learned the tradition from his father who was a traditional venom healer (e.g., snake bites). He also trained in various schools of the Kalari martial art of Kerala, preparing medicated oils to use for massage as part of the martial arts, as well as practicing traditional bone setting which in turn he learned from his father. His early apprenticeship included collecting herbs to prepare "Thailams", the oils used in massage. His sister, wife, and daughters practiced TBS with him, and he had many students, both male and female.

Participant 3 learned this tradition from his father and grandfather. While his father treated animals, Participant 3 did not learn to treat animals. TBS was known by different names in different regions, and in this area of the state, called Sathuvachari, it is known as "Elumbu Murivu Vaidyar".

Participant 4 learned the tradition from his grandfather whose occupation was agriculture and treated animals before he used the same techniques on humans. He taught TBS to all his children and grandchildren, including women.

Participant 5's father was the first to establish a TBS clinic in their small village. Since then, their large family of several brothers, sisters, children, grandchildren, and in-laws practiced TBS all over the state of Andhra Pradesh. The roots of TBS in his Kshatriya warrior community were based on his ancestors hunting in forests where they collected herbs and plants for medicinal purposes, initially to use on domestic animals and later humans.

Participant 6 began his apprenticeship at the age of four years from his uncle who raised him. As a young apprentice, he climbed into barrels of Arishta and Asava (fermented Ayurveda formulations) to titrate these mixtures as he was small enough to fit in the barrels. Ayurveda is a traditional source of medicine combining various products such as plants, animals, and minerals. As Participant 6 advanced in age, he collected plants and made the medical pastes and oils. His sisters also learned this art from their uncle. Two of his sisters practiced with him, while other sisters and their children had their own independent establishments. He estimated that within his family they were probably the 6th or 7th generation in this tradition and the story in his family was that the teacher of his ancestors was a guru named Putru Maharishi.

Theme 2: Occupations Outside Bone Setting. Participant 1 and his family were farmers. They grew crops and had mango orchards.

These crops were their main source of income. They had a TBS clinic in Puttur and conducted camps in various underserved areas around the state.

Participant 2 worked as a salesman in the Middle East for several years, but now was involved full time in practicing and teaching martial arts and TBS. He had a registered martials arts academy at his home. He also had two TBS clinics.

Participant 3 had no other occupation outside of TBS. Participant 4 and his family were engaged in agriculture. Participant 5 was the headmaster of a primary school. Participant 6's father passed away when he was very young, so he did manual labor to earn enough while he was an apprentice until he established an independent practice. Now, TBS was his only occupation.

Theme 3: Training, Certification, Education, Accolades. Participant 1 learned medical terminology from looking at x-rays or reports that patients brought into his office. He read books to learn more. He had been invited by ayurvedic universities to talk about traditional bone setting practices and received honorary certificates. He was a member of an organization known as a Traditional Vidya Sangha which is an open forum of traditional healers who get together and share knowledge of their respective fields. He was writing a book about the various techniques used in bone setting along with case studies/success stories. While he did not have a formal degree/certificate for traditional bone setting, in his 37 years of service he had never been asked for these credentials.

Participant 2 completed a basic high school education, while learning Kalari, a traditional martial art and traditional bone setting from his father as his apprentice. As mentioned, he had a licensed martial arts academy which included students who learn Kalari and traditional medicine and he went through a rigorous process with the sports counsel to acquire and maintain this license. His students were expected to master Kalari first before they learned traditional bone setting practices as he believed that it set the foundation on which to learn more. They learned human anatomy, movement, and kinesiology and built the mental and physical strength required to do the procedures. He participated in the World Ayurveda Congress in New Delhi and was involved in research about medicinal plants and Kalari. He also was a member of an association of traditional bone setters who met monthly for conferences where they shared their skills, methods, and cases. He had a certificate from this association, but no other formal credentials. He was a Gurukul or disciple of Kalari. Many of his patients referred to him as "doctor" but he told them that he was simply "Vaidyar" or "Traditional Healer".

Participant 3 acquired his skills from his father, and in turn imparted them to his children. His education was through the "gurukula" system where the "guru" imparted his knowledge to a "shisya" or student, and in turn the student's duty was to be a guru to the next generation. It was a sacred relationship and was how most traditional medicine practices were passed down. He learned TBS this way and had over 30 students/apprentices whom he mentored over the years. He always was learning new things from them, as well as from other bone setters and believed that continuous learning was the only way to improve one's skills.

Participant 4 learned this tradition as an apprentice and had several students including his own children. He was a member of several associations of bone setters and other traditional healers, as well as associations related to ayurvedic medicine. He served on a forestry department board and taught others about medicinal plants. He had a certificate from FRLHT endorsing his status as a traditional healer and received many awards for his service. He had been consulted by many because of his knowledge of medicinal plants.

Participant 5 had a bachelor's in science and education. When he was a young college student, he would assist his father at the TBS clinic after class. It initially was a hobby to him, but he found that he had a passion for it.

Participant 6 studied civil engineering for a few years but due to the death of his father he had to stop his college education. He expressed some regrets about not completing his degree. He apprenticed with his uncle from the age of 4 and began independently practicing as a TBS at age 25. He was certified in "varma" which was an Indian traditional art of vital points and "marma" which was a special massage technique. He traveled to Thailand where he participated in workshops about these techniques. At Vivekananda Kendra in Kanyakumari, which was a social and religious organization, he was a respected teacher of marma where he had taught more than 5,000 students. He had a certificate from the Red Cross Society and from FRLHT endorsing his status as a traditional healer. He was awarded an honorary doctorate for his expertise in marma. He had several apprentices, who undergo a screening process which involved teaching them how to "behave" like a vaidyar, by abstaining from alcohol and tobacco. He had both male and female students, and the bulk of the education was hands-on learning in the clinic. There was some didactic teaching for which he used ancient manuscripts written on palm leaves, as well as modern textbooks on ayurveda. He also taught them how to collect medicinal plants and to make them into preparations used for treatment. He claimed this was the "weed-out" exercise for his students as many do not want to go through the trouble of foraging for plants. He was a student of "Silambam", a weapon-based Indian martial art originating in South India and taught it to his students. He founded an organization to unite Indian folk healers including tribal healers. They participated in knowledge exchange forums periodically and formed a co-operative trust. He received several awards by the state bio-diversity board for his work. He envisioned an academy on 400 acres of land that they have acquired through this trust, where students will receive a rigorous education from age 4 to 18. After which, students may stay and teach or leave and serve their communities.

Theme 4: Patient Characteristics and Success Stories. About 90% of people treated by Participant 1 lived in poverty. He saw approximately 200 patients a month. Medical students have visited him for treatment, but once they finish their studies, he thought they developed "an attitude" and no longer visited him. However, there was a primary care doctor in their village who sent patients to him and his brother. His charges were between Indian Rupees (INR) 100 - 500 (based on

the current exchange rate = $1.33 - $ 6.66), but if someone could not afford it, he would not only treat them for free, but also give them food and bus fare. Hence, a sub-theme of cost of treatment was developed. Participant 1 was confident that his son will continue this charitable work despite growing up and living in a more capitalistic society.

Participant 2 did not provide an estimate of his patient volume but as his popularity increased by word-of-mouth advertising, he saw more patients. He made house calls and traveled considerable distances if his services were requested. His fees were in the range of INR 100 - 500, though he sometimes asked his patients to buy some of the items such as bandages and herbs, in which case he charged less. He also provided free services to patients who could not pay.

Participant 3 estimated that approximately 75% of his patients lived in poverty or were lower middle class, but he also saw a few patients who were affluent. He did not have a set fee. He allowed his patients to donate what they could, but typically provided free services. He also relied on word-of-mouth advertising and had only good responses from his patients.

Participant 4 saw between 5 - 15 patients a day. They were not only from his village but from many nearby towns and villages. Many of his patients came to him after they had been treated by an orthopedic surgeon, sometimes because their previous treatment was unsuccessful, and other times to supplement their treatment/recovery with herbal remedies and massage. His fees only reflected the cost of some of the raw materials in the range of INR 50 - 100 but he did not charge for his services/time.

Participant 5 had the highest volume of patients of all participants in the range of 400 or more a day. He started 6 am and continued until 10 pm. He appeared to be very popular and claimed that many celebrities have visited his clinic. He had not heard a bad report from any of his patients. His fees were in the range of INR 100 - 500. However, he had an x-ray machine and charged extra for the cost of films but claimed that his prices were much lower than an allopathic facility. There were four orthopedists within a reasonable distance to his town, but people chose to go to him because of his lower cost.

A large percentage of patients visited Participant 6 because they had failed treatment in other systems of medicine especially allopathic, and he was able to treat them successfully. He also gained popularity by word-of-mouth publicity. His patients honored him with gifts and considered many of his treatments to be "miracles" as many of his cases were those that modern medicine was not able to fix. He also was developing a project, funded by donations, that would enable him to provide free treatment for those who cannot afford it.

Theme 5: Infrastructure and Approach to Diagnosis/Treatment. Participant 1 had one clinic at his home in Puttur, as well as clinics in other locations. He also traveled to conduct bone-setting camps. He did not have an x-ray machine but many of his patients brought various imaging and radiology reports, which he sometimes used to aid in diagnosis. His approach to diagnosis was by inspection, palpation, and testing range of motion. For rib fractures, he asked the patient to breathe and inspected the chest and back. He conducted various musculoskeletal tests to test for specific joints. He diagnosed 95% of his cases by this method, although he sometimes recommended that they have an x-ray or magnetic resonance imaging for a definitive diagnosis. Aside from bone setting, he also treated kidney stone and jaundice. In general, his approach to treatment included reducing the fracture, splinting, and bandaging. He used an ointment made from several native plants, coconut oil, camphor, and other ingredients. He also gave oral herbal supplements that may have analgesic properties. For young children, he recommended only gooseberry juice. He also made a powder with ayurvedic herbs and egg-shell powder. He was not sure if this provided calcium supplementation, but it yielded good results. He made these ointments and powders on his own. Originally, these ingredients were sourced from forests, but with deforestation this has been a challenge. Some ingredients were grown on tribal lands, and others were bought at local shops. He emphasized a healthy diet as key to recovery, which included local fruits, vegetables, sesame seeds, honey, whole grains, chicken, and clarified butter. He did not recommend eating root vegetables as they seemed to increase blood glucose due to their starch content.

Participant 2 had two clinics in different towns. Dislocations and fractures were the majority of cases. He believed that before he can start any treatment, gaining the trust of the patient was most important. His approach to diagnosis involved taking a thorough history. Then, he used "Darshana", which was inspection and "Sparshana" which was palpation. If a joint was dislocated, he repositioned it and wrapped it with a bandage. Fractures were reduced before dressing. He took care to make sure that the pressure point of the bandage was not over the nearby nerves. He did not have an x-ray machine at his clinic. He did not use x-rays for diagnosis as he believed that speedy first-aid and treatment will benefit the patient more than imaging. However, if the patient chose, he encouraged post-treatment x-rays. He checked "vital points" of the patients to assess their humoral status and assessed which class of medicines should work.

Once the issues had been diagnosed, Participant 2 applied an oil which he made from the juice of various medicinal leaves. This juice was added to a paste of sesame oil, clarified butter, sambrani (a natural resin), and incense. Next, Participant 2 prepared an ointment with various ingredients and applied it. These medicines were custom made based on what he determined the patient needed and might include 10-12 ingredients. Next, medicinal leaves were applied before splinting and dressing. He used bamboo sticks and coconut palm stalks as splints. He also sometimes used a wood ruler to splint. They were held in place with cloth bandages, and knots were placed strategically based on the nature of the injury (Figure 2). The dressing was changed every 3-4 days. The ingredients in his preparations were sourced from forests and shops that sold folk medicine. As availability of certain ingredients have dwindled, he has altered some of his recipes. He helped patients with the traditional medicine methods of physical therapy. He advised patients to drink goats' milk, and to consume a broth made from mutton bones, especially the bone marrow and believed that the collagen helped with faster recovery. He emphasized a healthy diet and active lifestyle. For pain relief, he did not recommend allopathic over-the-counter

medicines, but instead recommended a tea made with ingredients that included nuts and seeds. Some patients took acetaminophen if they could not handle the pain, however, he did not prescribe it as it is illegal for him to prescribe Western medicines.

Figure 2. Patient with probable subluxation of the patella. Shown are materials used for the treatment which includes medicinal oils and pastes, plus cotton and bandages which the TBS used to treat this patient.

Participant 3 believed it was important to gain the trust of his patients before treating them. Inspection and palpation were also the mainstays of his approach to diagnosis. He used a soft cotton bandage to treat fractures and dislocations. If the pain was unbearable, he asked patients to consult an allopathic doctor. Massage and physiotherapy were part of his treatment. Besides TBS, Participant 4's scope of practice included treating gastrointestinal ailments, asthma, fistulas, and abnormal vaginal discharge. He ran his clinic out of his home. Diagnosis involved inspection and palpation. Range of motion and special tests further localized the injury. Treatment included oil massage, which aided in reducing the dislocation or fracture. He used bamboo sticks to splint and tied it with a cotton cloth bandage. It required a series of dressing changes. He also gave patients supplements prepared mostly from plant-based products. Some ingredients used in his remedies were bought from local markets, some were sourced from nearby forests, and some were cultivated on his own land.

Participant 5 had a busy clinic in which he treated a wide range of fractures and dislocations. He began with inspection, then palpation to diagnose a problem. He had an x-ray in his clinic to aid in diagnosis. He used sandbags to stabilize a fracture if needed. He also used an oil that he concocted using herbal ingredients to massage the affected area. He then applied another herbal preparation. He believed that these help in reducing swelling and pain and have antibiotic properties. He sourced these plants from his native village, which he visited 2-3 times a year. His relatives who lived there collect these plants from the forests and dry them. Some items were bought from local shops. He used eggs in his bandage, but it was unclear as to what the exact purpose was. His treatment included physiotherapy, and he prescribed over-the- counter calcium and multi-vitamin supplements. He emphasized following a healthy diet that included whole grains and adequate protein. He was emphatic about eating no white rice.

Participant 6 treated not only fractures and dislocations, but also kidney stones, liver cirrhosis, and uterus related issues. He has had clinics in several locations, but his current clinic was acquired from a grateful patient who was a retired military captain. Participant 6 had treated the captain's psoriasis, and the grateful captain converted a piece of land under a trust and gifted it to him for his clinic. His treatment was focused mainly on marma points. Marma points are specific anatomical locations in the body through which the energy of these elements is believed to flow. Marma points therapy is the practice of stimulating these spots through gentle massage therapy. Participant 6 asked the patient to lie supine and palpated these points with his fingers which helped him identify fractures, spinal problems, and other conditions. He also used gait to make a quick initial assessment, specifically when they walked into his clinic. There are specific marma points to relieve pain at particular sites, and he claimed to be able to relocate the pain site. For instance, pain from the hand could be transferred to the spinal region and from there it could be relieved. This "vayu" point in spine stimulation was his "style" and it was known colloquially as Vayukkalam, one who treats using the vayu point. He also used pulse points to aid in diagnosis.

When a patient first comes to Participant 6, his primary objective was pain relief. He did not use x-rays in his diagnosis, but his patients were free to get one if they chose. Based on the injury, he used bamboo stick splints and bandages. For smaller bandages, he used stalks of a pine tree and sometimes parts of the coconut leaf. Most of the time, he used a gauze bandage. For a typical wrist dislocation, he provided pressure to a particular point at the palm and the fingers were pulled to reduce it back in place. He even used ice cream sticks as splints for some cases. He poured a generous amount of oil called kaya thirumeni, made from herbs on the skin, which aided in reducing inflammation. Some oils were ingested, along with Arishta or Asava so as to overcome the gastric uneasiness of consumption of a strong oil. His ingredients were of both plant and animal origin and he believed that all parts of plants and animals were useful. He sourced most ingredients from local markets, and from some local tribes. He also procured items from folk medicine raw drug shops as well as forests and villages. He was experimenting with growing certain plants indigenously and collaborating with a group to cultivate them.

Theme 6: Limitations of Practice, Challenges, and Social Relevance. Participant 1 did not treat humoral neck fractures as it had a high risk of avascular necrosis. He also did not treat spinal cord injuries. These cases were sent to allopathic hospitals. If he had anything more than a 10% lack of confidence in a particular case, he allowed them to decide if they wanted to continue with the treatment. Patients who consumed excessive alcohol or smoke and those with diabetes, hypertension, and other chronic problems were challenging and did not heal well. He faced considerable bias from the modern medical community. He believed that if people were patient and gave natural remedies a

chance, they would be surprised at the favorable results. He would like to expand the Traditional Vidya Sangha to include allopathic doctors and envisions more collaboration. He accepted that there were TBS who were untrained and gave their community a bad reputation. He had been instrumental in organizing training programs for those interested.

Participant 2 regretted to say that while he has had great success, he also had a few failures. He speculated that it was perhaps a mistake he made, but sometimes cases were complicated, or patients were allergic to certain items in the herbal remedies. He also knew his limitations and did not treat cases of cardiac arrest, patients receiving cancer treatment, or immunocompromised patients. In such cases, he might administer first-aid, then referred them to an allopathic hospital. If he thought that the patient could not afford to go to a private hospital, he sent them to a government hospital. He faced several challenges as a TBS. For example, it was difficult to procure certain rare ingredients. He was saddened by the lack of support from the Indian government. They did not provide any recognition, certification programs, or support. He had treated the chief minister of his state and other traditional healers with good success, but they did not do anything to advance their cause. He believed that TBS uses a holistic approach and healing was designed for the whole mind and body. He regretted that many traditional healers simply took their skills and knowledge to their grave as there was no documentation or official system to pass on this knowledge. He believed that TBS were relevant in India, where a large portion of the population lived in poverty or did not have access to modern medical care. There was a lot of politics between folk healers, ayurvedic doctors, and modern allopathic physicians and he wished that there was more collaboration.

Participant 3 remarked that cancer was a challenge, and he was interested in finding a medicine for this disease. He did not hesitate to refer a patient who required care that was beyond his expertise. The patient was the focus and pride should not cloud judgment. He found that patients have been more appreciative to him for guiding them to appropriate treatment, rather than regarding it as a failing on his part. He also echoed the thoughts of other TBS regarding government support. He did not care much about having a certificate to hang on a wall but wanted to legitimize folk medicine, so practitioners have good training and treat patients safely.

Participant 4 did not treat fractures with open wounds as he believed that needed to be handled in a sterile way, including sutures and internal fixation. He also did not have the confidence or expertise to treat head injuries. These cases were referred to an allopathic hospital. He also lamented about the lack of government support. He knew of several TBS who were very poor and did not have money to produce the raw materials for treatment. He wished that government would allow TBS to grow plants and be self-supporting.

Participant 5 referred complicated cases, especially multiple fractures and open wounds. He echoed the thoughts about government involvement.

Participant 6 let his patients know if he found that the case was too complicated and gave them the choice to visit other practitioners/other disciplines of medicine. Some of his challenges regarded procurement of raw materials. Many species of native plants have become impossible to find because of invasive species that have been introduced. For example, a factory in their area planted easy to grow plants which have destroyed the normal flora. He also would like to collaborate with ayurvedic and allopathic practitioners and envisioned an India in which folk healers were respected and supported.

DISCUSSION

Many TBS learned their skills by treatment of cattle and other animals and as they found success, they began doing the same on humans.[2] Many continued to treat both animals and humans. Puttur was considered a center of excellence for TBS and their method. Their history of bone setting stems from fixing fractures of soldiers in the battlefield. One significant contributor to TBS history was Mr. Subbarao from the Chittoor district.[2] Subbarao was known for pioneering newer methods and advancing the scope of TBS to more complex procedures. As his success spread, Chittoor also gained popularity as a center of excellence like Puttur. These methods spread to other states in south and central India. Subbarao established a clinic called Subbarao Orthopedic Center where he provided free food, lodging, and in-patient treatment for a large volume of patients. Legend has it that his patrons included Mahatma Gandhi.

TBS was multigenerational and our cohort ranged from 3rd to 6th generation TBS. The participants passed down the knowledge in their family including to women. Most had hundreds of years within the same family. Most participants had occupations outside TBS as their main source of income. While most TBS were apprentices to their parents, grandparents, or other family members, as medicine evolved, they were also self-taught by learning medical terminology from x-rays and radiology reports that patients sometimes brought in, and by reading textbooks.

Collaborators from TDU/FRLHT provided a certification program which two of our participants completed. All the participants were involved in "professional" organizations or associations, many founded by these participants. The main aim of these associations was to bring together various folk healers, meet periodically and exchange ideas, case studies, and hold workshops.

All participants were high school educated, and two had a bachelor's degrees. Most of their patient population lived in poverty and were from rural areas around the respective villages, though many traveled considerable distances because of their faith in certain bone setters or their reputation. While the majority fit this demographic, there were also patients from a higher socio-economic background and visited TBS because allopathic medicine treatment had failed, they had a bad experience, or chose to supplement their allopathic treatments with herbal remedies. Many TBS made house calls, traveled to remote areas, and held 2 to 3-day long camps in underserved areas.

The typical cost of treatment ranged from INR 100 - 500. They also provided free services to those who could not afford to pay. They did this work as a service to the needy. They also sometimes gave these patients food, clothes, and bus fare in addition to the free treatment.

The principles to diagnosis involved building rapport with the

patient, gaining their trust, taking a comprehensive history, inspection, palpation, checking range of motion, conducting special tests, and accessing gait. This approach was similar to that used by modern allopathic practitioners. One participant had an x-ray machine in his clinic, but the rest did not use imaging as a primary diagnosis tool. Approach to treatment included reducing the fracture, massage, splinting, and bandaging. Massage with medicated oils was key to their treatment.

Some TBS focused on marma points. They use oils and ointments made from several native plants, and each one had their own recipe. Many of them revealed the names of ingredients, but not the whole recipe as they do not have patents available to them and did not want to give away their secrets. Turmeric was an ingredient common to most of these preparations, and they affirmed its anti-inflammatory properties. These ingredients were sourced from folk medicine shops, local markets, and foraged from nearby forests, and some were cultivated. The pharmacological value of these plants were not investigated in this study and perhaps could be a topic of further research. While most TBS had homemade concoctions for analgesia and tonics for faster recovery, some asked their patients to take multivitamin and calcium supplements. They did not prescribe acetaminophen but did not discourage its use. Massage and physiotherapy were a major part of traditional medicine. They also emphasized a strict diet and active lifestyle.

All participants knew their limitations and did not treat complicated cases. They believed that the patient should be the focus and should get the appropriate treatment that was best for them. As in modern medicine, they also factored in comorbidities such as diabetes, hypertension, and heart disease into their treatments and experienced frustration when treating patients who smoked or consumed excess alcohol.

All participants expressed facing considerable bias from the modern medical community because of their lack of formal education. They were frustrated by the lack of formal support from the government, as it did not provide formal recognition, certification programs, or tangible support to folk healers. Lastly, many species of native plants have become impossible to find because of deforestation, and lack of grants and land to grow/cultivate these plants. Invasive species were also a problem for native plants to thrive.

Limitations. The practice of TBS is an understudied field. This paper was a socio-cultural exploration through an in-depth case series of six TBS, and not a representative sample. A country-wide study of TBS from all parts of India with a larger cohort where data saturation can be reached would provide a more comprehensive view of this subject.

CONCLUSIONS

In rural India, where a large part of the population lived in poverty and without access to modern medicine, traditional healers provided a much-needed service, based on indigenous knowledge passed down generations of TBS. Many provided free care, and consequently, the income from their practice was not sufficient to support themselves and their families. Most did this work as a service to the underserved. At first glance, they followed a similar approach to diagnosis and treatment of simple fractures and dislocations as modern medical practitioners. Most would like to share their knowledge and collaborate with ayurvedic and allopathic practitioners and simply wanted to be respected and supported. The medicinal value of the ingredients used in folk medicine preparation was not explored but could be an interesting area of future research.

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APPENDIX

Interview Guide

Thank participant for their time. Introduce self and purpose of this study. Ask if any questions? Show Information Sheet and seek consent. Show Consent Form and seek consent for the use of an audio recorder and repeat voluntariness of the interview and ability to stop at any time. Additional material such as photographs, video recording of procedures, location and instruments will be welcome with privacy of individuals ensured and acknowledgement of sources as per the TBHs wishes.

Questions

1. Background Information, Family Inherited practice, Initiation into the practice
    1. How did you get into this work?
        a. Inter-generational (how many generations since this practice is passed on to you?)
        b. Which generation is yours?
        c. How long are you in this practice?
        d. Previous and other occupations if any
        e. Age of joining this profession
        f. Is it the sole occupation at present?
        g. What are the other occupations at present?

2. Practice methods, specialization, how does the uniqueness develop, what are standards that are sought/reached
    1. What does your practice cover?
        a. Presenting symptoms: fracture, dislocation, injury, trauma, etc.
        b. Process used to diagnose the problem: physical exam, xray, etc.
        c. Treatment: reduction, realignment, splinting, bandage, etc.
        d. Medicines: pastes, oils, herbal remedies, pain relieving or wound healing etc.
        e. Do you use herbs or animal products in your treatment? If yes, are they locally available for you to collect from the wild or do you buy them from raw drug shop? Do they cultivate them themselves?
        f. Rationale behind these therapies.

3. Form and coverage of training" the art of skill development and growth of knowledge.
    1. Membership with an Association/Medical College/Place of Affiliation/Accreditation.
    2. Was there any sort of apprenticeship or training? What did it cover and for how long?
        a. Where was the training?
        b. What subjects are covered (e.g., Anatomy, Pharmacology, Physiotherapy, Ayurveda)?
        c. Any certification processes? By whom?
        d. Any refresher training? Continuing education?
        e. Any interface with the formal schools of medical education (Western/English, Ayurveda, Yoga and Naturopathy, Unani, Siddha and Homeopathy (AYUSH))
    3. Have you taught the knowledge and skills to your children? If no, why? If yes, from when? Are they also trained in Allopathy, Ayurveda, Siddha, Physio-therapy, etc.?

4. Challenges faced at the level of individual practice, patients, society, government, etc
    1. What have been your key areas of success and key problematic treatments/conditions and why so?
        a. Specific successes: muscular, joint, ligament, others.
        b. Reasons for success: time of presenting the problem, ease of handling, lack of need for surgery, etc.
        c. Specific problematic situations: fracture, dislocation, injury, trauma, etc.
        d. Reasons for failure/problematic outcomes: time of presenting the problem, lack of skills, infrastructure, costs, need for surgery, etc.
    2. Are their situations where you refer your patients to a formal hospital set up? When, where, why?
        a. Does this referral help?
        b. Is there scope for this? Why, why not?
    3. How did you decide to set up your practice in this location? Who are your patients? How do they know about you? Do they ask for degrees, success stories, costs?
    4. What are your main challenges in this practice? Do you see it sustaining/flourishing over time? Why/why not?