



# Getting the message across: Characterizing a need to bridge public health messaging for tuberculosis across a rural/urban and CHW/traditional healer divide in Madagascar (A review)

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## ABSTRACT

The urgent need and extremely limited resources available for public health messaging to prevent and treat tuberculosis (TB) in Madagascar mandates a search for identifying additional low- or no-cost channels able to deliver such information to the widest demographic of urban and rural message recipients alike. However, despite increased interactions between community health workers (CHWs) and indigenous/traditional healers (ITHs) as one such potential channel for cost-effectively amplifying public health messaging, a review of the public messaging literature for TB in Madagascar yielded effectively no studies addressing this potential. A main finding of this study, then, was identification of three key divides (urban/rural, western/traditional, and male/female) that impact interactions between CHWs and ITHs and thus the capacity for message delivery. Recommendations for how to bridge these key divides in order to increase the reach of TB public health information in Madagascar are discussed.

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## Introduction

This paper explores the capacity for broader tuberculosis public health messaging in Madagascar's existing health-care infrastructure as one way to better reach the clinics, patients, and the public who would most benefit from such messaging. Given Madagascar's extremely limited resources for adding any *new* assets for addressing the ongoing and significant health problems of TB in the country, however, this paper investigates what other potential channels of information might already exist that can be better utilized (or utilized at all) for delivering TB public health messaging.

One long-standing international strategy for enhancing public health messaging in general has involved the use of "community health workers" (CHWs), as formal or informal, often medically untrained, local people or volunteers who can serve as informational conduits for delivering key public health messaging to local populations [79]. Two basic strategies then emerge within this approach: (1) public health messaging might be delivered by CHWs directly (in person) to local people, whether in clinics or through local campaigns, with such CHWs being either community outsiders or locally recruited and trained [63,135]; or, alternatively, (2) CHWs might deliver health messaging to an authoritative proxy, such as a local

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indigenous/traditional healer (ITH), who can then personally deliver the messaging to local people [80]. While the majority of what limited CHW health messaging there is in Madagascar generally relies on the first approach—albeit almost none of it for tuberculosis messaging—this paper investigates what opportunities already exist in Madagascar for drawing upon and amplifying interactions between CHWs and ITHs as a way to increase the reach of TB public health messaging. Specifically, our research question asks, “How can interactions between CHWs and ITHs be better realized in order to increase the reach and effectiveness of public health messaging for TB in Madagascar?”

A detailed review of the literature, however, revealed only one study that partially addresses the research question (without addressing tuberculosis at all). In the following, then, while we maintain as much of a focus as possible on Madagascar exclusively, in order to address each of the components implicated in this study’s research question—i.e., CHWs, ITHs, their potential interaction, tuberculosis in Madagascar, and public health messaging generally—it has been necessary to draw from more widely ranging research around the world that generally addresses each of these main factors. The purpose of this introduction, then, is to provide frameworks and a broad background for each of these main elements as they inform the research question.

### *Community health workers (CHWs) and indigenous/traditional healers (ITHs)*

Both a lack of agreed-upon definitions, as well as changing definitions over time, can create ‘apples and oranges’ problems of comparison [59]. In this paper, the key terms *community health workers* (CHWs) and *indigenous/traditional healers* (ITHs) both suffer from this problem of shifting and/or not agreed-upon definitions. For ITHs, the anthropological literature is already “guilty” of abstracting specifically cultural local traditions into the sorts of general terms—like “shaman,” “medicine man,” “spiritual healer” and so on—that we might implicitly associate with ITHs [42]. From anthropological studies in Madagascar specifically, the term “ombiasa” (typically “spiritual diviner”) has been used to capture the broad sense of ITHs across a range of Malagasy tribes and people [39,62,121,128]. Kaufmann and Elvin-Lewis [71] have also identified three levels of care-expertise within the indigenous healthcare system of people in Madagascar, with “ombiasa” specifically referring only to the third (highest) level of such care-expertise; ombiasa are “experts in the use of powerful plant medicines in healing, sorcery, and magic ... professionals (usually men) who are recognized for their vast knowledge of medicinal plants” (p. 216). While we use ITHs as an umbrella term to encompass all forms of indigenous/traditional healing in this paper, we also note in advance that Lyon [80] explicitly identifies linkages that already exist between ITHs (ombiasa) and CHWs (as western-trained healthcare-providers generally) in Madagascar.

Similarly, the term CHWs encompasses a history of shifting international strategies for health intervention delivery that includes “lay health workers,” “community care workers,” “community health volunteers,” “community health extension worker,” “close-to-community providers” and other terms [127]. Nor are these categories necessarily mutually exclusive in a region; in Madagascar, one can find projects with participants formally designated as either community health volunteers or community health workers [132]. While it is well beyond the scope of this paper to specifically detail these historical shifts, differences, and discrepancies, we use the term “CHWs” generally to address all of these categories severally as they relate to our research question.

With this caveat about CHWs noted, two generalities can be offered. First, CHWs typically serve as informational conduits for health interventions that were developed out of the perspectives, values, and approaches of the global North. For brevity, we refer to this as “Western” or “westernized” [following Huizer [68]], whether CHWs work in the global North or elsewhere [77,79]. Second, Lehmann et al. [79], in a review of the literature on CHWs in their most general sense, identified two broad categories: specialists and generalists. Acknowledging that no absolutely hard or fast line can be drawn in practice between these two categories, Lehmann et al. [79] noted that specialists tend to focus on mission-specific conditions (such as TB, HIV, malaria, and/or reproductive health) and have specific benchmarks or local goals to reach, while generalists most critically perform a key informational role—namely, bi-directionally bridging between the clinic and the community while also conveying public health messaging to patients and referring individual or public health conditions to the clinic and/or Ministry of Health. In their informational capacity (whether on a volunteer basis or not), these “Westernized” generalists offer a potentially strategic opportunity for channeling health messaging to, and from, local message recipients, including traditional healers. Any such information, moreover, could be delivered traditionally or use more recent digital information and communication technology (ICT) means to transfer, record, and redistribute it [16].

### *Tuberculosis in Madagascar*

Tuberculosis in Madagascar represents the country’s worst infectious disease, with 237 cases per 100,000 people [136]. Though the world’s fourth largest island, the country could fund only <1% of its anti-TB effort domestically, with another 28% funded internationally, and 72% remaining unfunded [136]. More than half of the country’s population of 25 million live in rural, often remote and/or less accessible areas and most (up to 80%) experience dire poverty and thus malnutrition that can increase the risk of TB infection. Although the World Health Organization (WHO) has committed to reducing the incidence and death of TB to 35% by 2020, shortfalls at all levels of resourcing for anti-TB efforts in Madagascar (like many places in Africa) complicate data tracking, distribution, access, and human resources. Even the simplest of anti-TB messaging, like “cover your mouth when you cough” or “ventilate rooms to prevent infection,” can often fail to be distributed.

From the 1990s, while national efforts in Madagascar pushed to establish country-wide surveillance measures for tuberculosis [11], funding and logistical problems hindered this effort [112]. Subsequent major studies of national tuberculosis control measures delivered dispiriting results [106,107]: specifically, “These findings indicate that tuberculosis control improved slowly over the study period. However, these data do not allow identification of strategies to improve program performance. This will require detailed review of data taking into account the context in which they were obtained” [106, p. 493]. Increased interaction between CHWs and ITHs represents potentially one such strategy for improving program performance.

Most tuberculosis research in Madagascar focuses on its urban prevalence and efforts to maintain treatment compliance, with a handful of exceptions [104,105,108, 116]. In particular, treatment attrition remains a major concern, due largely to the risks associated with the emergence of drug-resistant TB. Such attrition has specifically been shown to associate significantly with “transportation time, the sex of the patient, patient information and *the quality of communication between patients and health workers*” ([33, p. 891], emphasis added). Here again, increased channels of communication, such as between CHWs and ITHs, could potentially address at least a significant part of this major concern.

#### *Potential interactions between CHWs and ITHs for public health messaging*

While the research above highlights an oft-repeated call for improved public health messaging in general, one channel for supplying this improved communication is increased interaction between community health workers (CHWs) and indigenous/traditional healers (ITHs) [63,64,70,135]. Around the world, community health workers (CHWs) of many sorts constitute essential actors in public health efforts [66]. Specifically, they uniquely afford a *bridging* function:

CHW programmes have a role to play that can be fulfilled neither by formal health services nor by communities alone ... Perhaps the most important developmental/promotional role of the CHW is to act as a bridge between the community and the formal health services in all aspects of health development ([79], p. 4).

Moreover, in some places, “CHWs may be the only feasible and acceptable link between the health sector and the community that can be developed to meet the goal of improved health in the near term” [79, p. 5].

Kahssay et al. [70], among others, specifically proposed that CHWs should collaborate with ITHs: “CHW programmes must attempt to relate constructively to other prevailing systems of healing” [70, p. 41]. Citing successful collaborations or integrations of CHWs and traditional healing, Kahssay et al. [70] also stressed the need for dialog between CHW programs and traditional healers; “misunderstanding between the two groups ... has prevented open and creative discussions to identify common health goals and ways of cooperating in providing better health care” (p. 44–5). More recent CHW/ITH interfaces in Africa have sought to provide interventions for mental health, chronic non-communicable diseases, and HIV [82,92,133,139]. More broadly, over the last two decades around the world, traditional healers and their practices have been applied specifically to tuberculosis prevention efforts [32,96,134,138]. In Madagascar, however, Towbin [132] highlighted a move *away* from traditional healing practices. Relatedly, although Smith et al. [126] specifically recommended more communicative interface resources for health workers and the communities they would serve, the study appears to make no reference to traditional healers as one such resource, even though they exist [80].

#### *Public health messaging and tuberculosis*

While the above identifies a potential channel for communicating health messages, it does not yet illuminate *how* those messages might be conveyed. Moreover, although scholars have widely recognized effective health messaging as essential for public health interventions [6,10], how to consistently or reliably achieve this effectiveness remains elusive [76].

Lately, the previously conventional forms of print, TV, and radio media approaches for public health message delivery have been augmented (or sometimes replaced) by digital means [16,17,26,40]. For TB specifically, Haji [58] reviewed digital approaches for preventing the disease—including SMS (text) reminders to patients—and found that graphic (non-linguistic) text reminders more effectively delivered critical health reminders to patients than text-based messages, partly due to less literacy among message recipients. Bello-Bravo, Tamò, Dannon, and Pittendrigh [19], using animated videos, similarly demonstrated a greater capacity for information transfer in media after translating the audio portion of animated videos into participants’ most comfortably spoken local dialect(s). More broadly, the use of video-enabled cell-phones to acquire, share, and redistribute such translated public health animations represents one of the most scalable, culturally familiar, and cost-effective means for reaching the widest possible demographic regardless of age, sex, educational and/or technological literacy, or geographic isolation [1,83,86,120].

With respect to public health messaging about TB in Madagascar specifically, however, we identified only one study that indirectly alluded to this topic. Specifically, as part of a spatial analysis of TB distribution in Antananarivo, Rakotosami-manana et al. [109] found that the major sources of TB-related knowledge in participants were school and word of mouth (from relatives or friends with TB).

**Table 1**  
Number of articles returned by search string from Google Scholar and ScienceOpen.

Search string	Google Scholar	In-title delimited <sup>a</sup>	Science Open	In-title delimited <sup>a</sup>
"Madagascar" "tuberculosis"	17,700	72	1925	8
"Madagascar" "tuberculosis" "health messages"	208	1	14	0
"Madagascar" "tuberculosis" "health messaging"	16	0	3	0
"Madagascar" "tuberculosis" "public health"	12,003	22	1492	7
"Madagascar" "tuberculosis" "public health" "messages"	3181	1	0	0
"Madagascar" "tuberculosis" "public health" "messaging"	3247	0	23	0
"Madagascar" "tuberculosis" "community health workers"	1010	1	101	1
"Madagascar" "tuberculosis" "CHWs"	377	0	32	0
"Madagascar" "tuberculosis" "traditional healers"	1275	1	56	0
"community health workers" "traditional healers"	5206	5	719	0
"community health workers" "traditional healers" "Madagascar"	239	0	25	0

<sup>a</sup> In-title delimited searches used database search functions to limit results only to studies that included "Madagascar" and "tuberculosis" in their article title, except for the "community health workers" and "traditional healers" searches, which returned articles with those search terms in the title.

## Methodology

In this paper, we asked, "How can interactions between CHWs and ITHs be better realized in order to increase the reach and effectiveness of public health messaging for TB in Madagascar?" From 29 July to 4 August 2018, two researchers conducted searches for peer-reviewed publications in available academic databases—including Google Scholar, ScienceOpen, which aggregates PubMed, arXiv, and SciELO, the Bielefeld Academic Search Engine (BASE), and Science.gov—for the terms "Madagascar" and "tuberculosis" alone or in combination with terms and variants of "health messages," "health messaging," "traditional healers," [including "traditional health practitioners"] "community health workers," [including "lay health workers," "community care workers," "community health volunteers," "CHWs"], and "compliance." Search results were then assessed for their relevance to this study's research question, duplicates and redundant results from different databases were removed, and final counts were tabulated for the two largest databases [Google Scholar and ScienceOpen] (see Table 1).

Because the majority of search results did not address Madagascar or tuberculosis specifically, we repeated the searches using each database's "in-title" delimiter function to return studies specifically addressing those two key terms. As before, the returns were assessed for relevance, sorted for duplicates/redundancies, and tabulated. It can also be noted that, with very few (mostly French- and Spanish-language) exceptions, all in-title delimited items identified in the ScienceOpen, BASE, and Science.gov searches were redundant to searches in Google Scholar.

## Results

The above searches of several available peer-reviewed knowledge repositories yielded no studies specifically addressing the potential of CHW and ITH interactions for enhancing TB public health messaging in Madagascar.

Nonetheless, we did identify a number of studies addressing various themes or sub-elements that indirectly provide a "cross-section" of evidence for informing our research question. For example, messaging challenges around *malaria* treatment compliance in Madagascar [72,117] would likely add to the picture of *tuberculosis* treatment compliance as well [33]. Similarly, issues of *urban* compliance with respect to tuberculosis messaging in Madagascar's capitol, Antananarivo [33,102] might also help to inform or contextualize *rural* messaging challenges for practitioners or community health workers in more remote areas [84,105,131].

Accordingly, we have organized our discussion below by first presenting the overall synthesis that emerged from drawing together the four major thematic strands identified in our analysis of the literature. In particular, these four strands pointed to key differences for message delivery arising from rural/urban, western/traditional, and male/female divides along with their consequent impacts on CHW/ITH interactions. It was from this analysis that a conceptually grounded framework [30] for understanding the findings overall emerged: namely, *the importance of maintaining the otherwise categorical distinctions involved in these key divides noted in the literature*, whether urban/rural, western/traditional, male/female, or even CHW/ITH. For brevity, we refer to this central finding as *not conflating or combining the terms* in the distinctions.

Our synthesis (immediately below) presents the evidence for this finding in advance of the discussion and analysis of the four thematic strands themselves, but these are (1) urban/rural differences in TB perceptions and knowledge, (2) potential conflicts between scientific (western) and traditional (ITH) knowledge, (3) specific characteristics of CHWs, traditional healers, and their interactions, and (4) themes from tuberculosis health messaging generally. Although presented second, each of these strands, as a "cross-section" of the research overall, specifically reflects back to further inform the central research question, "How can interactions between CHWs and ITHs be better realized in order to increase the reach and effectiveness of public health messaging for TB in Madagascar?"

## Discussion

### Synthesis

Drawing together the four thematic cross-sections of the literature referenced above affords an indirect picture for how to better draw upon already existing, culturally competent channels of communication between CHWs and ITHs in Madagascar to more cost-effectively enhance TB public health messaging. From the conceptually grounded framework of our analysis [30], the most recurrent theme involved how attempts to combine, conflate, or merge these two, otherwise very different social roles and knowledge/practices of CHWs and ITHs into a single social role could generate more problems than it solved. Above all, such conflation could risk decreasing the trustworthiness of the message or the one delivering the message.

Self-evidently, any aspect of public health messaging that decreases or undermines such trustworthiness is not a desirable part of any public health messaging strategy. (Whether or not any such decreases can be avoided by careful message design or social engineering must remain an issue for other, future research.) In Madagascar, however, Lyon [80] found that ombiasa and rural (“western”) doctors already co-refer cases to one another, which provides evidence for at least one already existing, trustworthy channel of communication between traditional healers and more “westernized” healthcare providers that could be further amplified and drawn upon, without additional costs, for delivering public TB health messaging to a wider demographic than currently.

If Lyon [80] suggests a means to do so, other evidence suggests a will to do so as well. In South Africa, for example, Gandugade, Nlooto, and Naidoo [53] found that a majority of ITHs (more than 75%) were willing to work with western (allopathic) medical practitioners, though they also expressed concerns about maintaining the continuity of their traditional practices in general. Traditional healers in Madagascar similarly have acknowledged that “western” medicine was sometimes more effective, and vice versa [80]. Nlooto and Ramchundur [94] found that 79.5% of South African ITHs indicated a “strong willingness” to work with (western) researchers to further develop and refine traditional ethnobotanical treatments. As such—and despite the fact that Nemetandani, Hendricks, and Mulaudzi [93] found that allopathic (western) practitioners persisted in the beliefs that “western” and “traditional” medicines were mutually incompatible and that “traditional” medicine was little more than witchcraft or superstition—to the extent that ITHs and CHWs can be (and are perceived as) *authoritative and competent within their own cultural knowledge-practice domains*, the findings from Lyon [80] demonstrate the possibility that, in Madagascar at least, “western” and “traditional” health practitioners have a demonstrated capacity of mutual respect for western/traditional differences that can negotiate the otherwise culturally charged minefield of the western/traditional divide. Consequently, this existing channel between ombiasa and rural doctors in Madagascar provides a promising, virtually no-cost means for further delivering increased TB public health messaging bi-directionally (from the general populace to message originators and vice versa).

Insofar as this emphasis on not conflating “traditional” with “western” knowledge-practices in medicine illustrates the central insight of our synthesis, it also echoes a similar emphasis not to conflate a distinction between the urban and the rural as well. For instance, while schools (and educational contexts in general) are rightly championed as an ideal source and delivery venue for TB knowledge [109], school infrastructures vary dramatically in rural compared to urban settings [122]. As such, calls to increase education that do not also offset the (typically gendered, male/female) social inequalities around access to schooling (especially in rural settings) risks not only reproducing those social inequalities [28,73] but also simply failing to get messaging to people who need it, since they aren't in the schools. Put plainly, what may work in cities can often fail in the country, particularly where dialect and education significantly differ [28,73]. As such, expecting rural message reception to conform to urban norms increases the risk of failing to get the message across [41]. In contrast, that more than half (60.2%) of the rural participants in Finlay et al. [46] reported face-to-face interactions with their local (*fokotany*) village chief as the primary source of the project's public health messaging information demonstrates a second, also already existing and culturally competent low- or no-cost channel for wider public TB public health messaging in Madagascar.

A crucial part of the success of the messaging campaign in Finlay et al. [46] was the use of most comfortably spoken (rural) dialects either alone or *also* in conjunction with national (urban) dialects for delivery of public health information. This success dramatically underscores why it is not only *what* is delivered in the messaging but also *how* it is delivered that matters [17,73]. As such, the successes in Finlay et al. [46] suggest that rather than conflating the rural with the urban either culturally or linguistically, it may prove a more effective approach to instead maintain and respect the distinct autonomy of these two very different settings and the worldviews that inform them in order to bridge a space of communication across them. The long-standing recommendation to draw candidate CHWs from local populations [70] certainly helps to mitigate this rural/urban conflation; using most comfortably spoken dialects similarly increases the chances of messaging being heard, viewed as trustworthy, and acted upon [19,36,89,95].

The central insight of this synthesis—to avoid conflating or attempting to combine otherwise radically dissimilar binaries like western/traditional, urban/rural, or CHW/ITH—does not involve simply a strategic pragmatism, but also connects directly to issues of trustworthiness for effectively delivering public health messages in the first place. That is, *who* (or what) will local people listen to with respect to public health messaging? Who will message recipients *trust*? Who do they already perceive as authoritative or empowered to advocate for the behavior changes promoted in a public health message? [36,95] From the literature reviewed, not only could participants in Madagascar view the fokotany (village) chief and ombiasa as



trustworthy and authoritative sources for public health information, these figures also served as effective bi-directional conduits for public health messages between the public at large and the message originators as well [46,80].

Again self-evidently, any aspect of a public messaging campaign that erodes or undermines the (perceived) trustworthiness of the messenger or message should be avoided [113]. And while a great number of factors can affect this (perceived) trustworthiness [10,81,113], much research to date has drawn attention to the troubling power relations and negative cultural evaluations that can inhere in social milieus where binary oppositions like male/female, western/traditional, urban/rural, and even CHW/ITH prevail—binary oppositions that characteristically valorize one of the terms at the expense of the other [5,38,97]. As such, these oppositions as they play out in the world both encode and signal implicit, sometimes unconscious, social hierarchies [25,101] that can then affect (or even effect) attitudes and behaviors that negatively impact efforts to deliver public health messaging to others. Worse still, they can erode (or even preclude) trust in the messenger or message in the first place, such that any public health messaging delivered by a non-valorized source can be automatically dismissed as invalid without consideration [36,95,129].

For instance, if message recipients perceive CHWs as less trustworthy channels of public health information because they are female [127], because the CHWs are factually misinformed and/or poorly trained in medical knowledge [22], or because CHWs are less culturally competent than alternatives, like ITHs [65], then recruiting ITHs into the role of a CHW potentially weakens the capacity or effectiveness of any messaging delivered by the CHW. Among CHWs themselves, “Providers and staff with greater cultural competence and preparedness have more positive expectations of CHW interventions to reduce healthcare disparities” ([87], p. 10, emphasis added). In contrast, when CHWs (locally recruited or not) take on airs and become overly self-important or arrogant toward their patients [22,80], when urban policy developers take a “deficit” or patronizing view of their rural messaging recipients [27], when western medical practitioner-researchers denigrate traditional practices as superstition and witchcraft [93], or when rural inhabitants dismiss any urban or literate knowledge as empty book-learning [99], then this also not only self-evidently diminishes the chances of successful message delivery but erodes the effective qualities of the delivery method itself [95,129].

While one can hope that these impacts on the trustworthiness of messengers might be programmatically avoided through careful public health messaging design [6,47,81], the prevailing and often diffuse or hard-to-pin down effects from the power relations and negative social evaluations embedded in the binary oppositions of western/traditional and urban/rural can have effects on the perceptions of CHWs and ITHs despite one’s best efforts, particularly around gender [127].

In fact, a critical point that can get lost using the gender-indistinct term “traditional healer” is the role of women, and particularly midwives, with respect to traditional methods. While traditional healers can also include “herbalists, bonesetters, [and] spiritualists” [64, p. 1], Bannermann [13] long ago acknowledged that “traditional midwives ... form the main body of primary health care workers in maternal and child care, and in some countries are responsible for over 90% of births” (p. 318). For CHWs, Frymus et al. [50] estimated that 70% worldwide were women—in some places, 100% by policy [130]. Nonetheless, gendered social inequalities around access by, and the perception of, female CHWs can complicate or inhibit service delivery [43,60,90]; that is, female CHWs can be perceived (prejudicially) as less competent, knowledgeable, or trustworthy simply by virtue of being female [43]. In Madagascar specifically, although Gilmartin and Saya [54] report on CHW incentives, they appear to provide no breakdown along demographic lines; Towbin [132] notes in passing, “The majority of CHVs [CHWs in Madagascar] are women; they are selected by their own communities” (p. 1). Given that Kaufmann and Elvin-Lewis [71] observed a three-tiered indigenous health system in parts of Madagascar—with (male) ombiasa in the highest tier, and women in the second-highest tier—it seems probable that these locally selected female CHVs would come from the second-tier of the local (indigenous) healthcare system as well.

If one can rightly regret allopathic (western) researchers’ biased denigration of traditional ethnobotanical knowledge-practices as incompatible with science and nothing more than superstition and witchcraft [93], then one can equally regret any negative perceptions or stereotypes about women that affect the capacity of female CHWs to deliver public health messaging [43,90]. Notwithstanding that these biases ought to be overcome, and efforts made to challenge the current social power and effects of their discourse, at the same time, we cannot simply ignore that these tendencies often have real, on-the-ground effects on public message delivery. For that reason, rather than conflating traditional (ITH) knowledge and practices with western (CHW) knowledge and practices for public health messaging, it may be a more effective approach to instead respect and maintain the distinct cultural categories and autonomy involved in these two very different roles and instead bridge a trustworthy space of communication across them. In Madagascar, for instance, it may be feasible to enable (or enhance any existing) linkages between female (second-tier) indigenous health system providers [71] and those “western” healthcare providers who currently exchange referrals with ombiasa [80] as one way to increase the reach of TB public health messaging. Such bridging would not require any change of social role for the messengers, would be low- to no-cost, and would be limited in reach only to the extent that the role currently experiences limitations due to prevailing social inequalities.

In closing this section, a study by Towbin [132] in USAID regions in Madagascar provides a window on these tangled ambiguities with respect to the social roles and functions of CHWs and ITHs. While reporting on project successes—including decreasing neonatal, infant, and under-five mortality, achieving full immunization in some project areas, and significantly decreasing malaria—these successes also include an apparent, negative remark in passing that unfavorably contrasts traditional (ITH) local medicine with the project’s western (CHW) efforts. From interview data, for instance, Towbin [132] notes that the “mayors of communes were very positive ... [about] the proximity of CHVs [CHWs] for people seeking care,

affordable drugs and medications, *a move away from traditional medicine*, better data on health events, better sanitation, and decreased morbidity” (p. 11, emphasis added). As seemingly the sole reference by Towbin [132] to traditional medicine in Madagascar, this points up two key ambiguities and questions around its use: (1) what traditional functions—for example, bone-setting, herbalist, spiritualist, birth attendant, midwifery, pharmacology, etc. [64]—are people moving away from, and (2) to what extent, if any, have traditionally women’s healing techniques and practices merged with CHW practices in the area, such that there may be less of *a move away from* traditional approaches than seems at first glance? In these ambiguities, Towbin [132] exemplifies the critical need for better clarification regarding the overlaps or distinctions of functions (if any) between ITHs and CHWs. Moreover, these ambiguities also remind us that an alternative to integrating CHWs and ITHs into a single role exists—namely, that one might instead build communicative bridges between socially distinct CHWs and ITHs as a way to avoid the pitfalls or problems that can arise from conflating those social roles.

#### Four themes

The above synthesis results from collating and integrating four key themes that emerged from this study’s data and data analysis: (1) urban/rural differences in TB perceptions and knowledge, (2) potential conflicts between scientific (western) and traditional (ITH) TB knowledge, (3) specific characteristics of CHWs, traditional healers, and their interactions, and (4) tuberculosis health messaging in general. Below, we discuss those four key themes in detail.

#### *Urban/rural differences in TB perceptions and knowledge*

While some health messaging challenges persist across rural and urban settings alike, other issues can be locally unique in either setting. Outside of Madagascar, for instance, rural-urban messaging differences, including gendered differences between males and females, have been noted [3,37,69,91]. In particular, disease stigma is a commonly cited aspect in rural and urban settings alike, while decreased access to education in rural areas (particularly for girls and women) tends to complicate rural public messaging efforts, especially with respect to non-literacy in print- or national languages [110,120]. In contrast, delivering public messaging in a community’s most comfortably spoken local dialect (whether rural or urban) increases that message’s appeal and likely uptake [16,88].

In urban areas of Madagascar specifically, Raheerinandrasana et al. [102] reported on qualitative TB knowledge and perceptions in an urbanized district in the capitol. Participants in that study showed good information about the cause and transmission of tuberculosis, but poor knowledge for symptoms and prevention. The researchers specifically called for better health messaging to close this knowledge gap and to combat misconceptions about TB. In an earlier, also urban, study, Comolet et al. [33] found that treatment non-adherence did not vary significantly for those who supplemented treatment with traditional approaches; that is, “defaulters did not have a more ‘old-fashioned’ view than the controls [regarding] traditional and supernatural explanations for the disease, nor did they consult traditional healers more often” (p. 896). This, again, shows a compatibility between “western” and “traditional” frameworks, in Madagascar at least, that contradicts attitudes that these two approaches are mutually exclusive [93]. Another urban study, also in Antananarivo, found better symptom knowledge but poor prevention knowledge [109]. Importantly, participants reported school as one source of TB health knowledge. Like Raheerinandrasana et al. [102], however, participants also reported that shame about having the disease kept them from doing more or learning more about the disease.

For rural Madagascar, two important differences are (1) fewer to no resources available for surveillance on rural tuberculosis and (2) increased risk of bovine-to-human transmission of bovine tuberculosis [35, 115]. As noted above, that the most comfortably spoken local dialect may not coincide with national languages in Madagascar further complicates public messaging in rural areas. For instance, that urban participants in Rakotosamimanana et al. [109] could report school as a source of TB knowledge would seem less likely in rural settings, where decreased availability of schooling is prevalent; this hypothesis would require testing. Relatedly, Towbin [132] emphasized the knowledge gains about tuberculosis among rural CHWs but not the patients. It is also not clear to what extent rural participants might have what Comolet et al. [33] referred to as an “‘old-fashioned’ view” of TB’s causes or treatment and/or whether they would consult with ITHs more often either out of those old-fashioned beliefs or because ITHs are more accessible and less expensive than CHWs (if there are any in the area in the first place).

Notwithstanding the resources-straitened situation in Madagascar that makes implementing public TB messaging in rural areas difficult (or, in more remote places, impossible), more research could begin to characterize what differences of TB perception and knowledge, if any, obtain across the urban/rural divide on the island. Such studies might also establish how disruptive it is (or would be) to combine CHWs and ITHs into a single role. If “old-fashioned” views prevail in rural settings, then it may be strategically more effective to allow CHWs to hand off the task of “translating” any needed public health messaging into culturally competent forms by ITHs. More research is needed to explore this.

In summary, with respect to this study’s research question specifically, drawing upon existing networks of ITH/CHW interactions between ombiasa and rural doctors [80] affords one already existing, low- or no-cost channel for deploying wider public health messaging. To the extent that “second-tier” (female) ITHs are also available in rural areas [71], they too may be able to afford similar channels for getting TB public health messaging to a wider demographic than is currently possible. Information and communication technology (ICT) techniques as well have shown a demonstrated capacity for this kind of successful messaging in rural, remote, and even isolated areas [14,17] and would be readily available, low-cost alternatives for increasing CHW/ITH interactions in these areas for increased TB public health messaging.

### Potential conflicts between scientific (western) and traditional (ITH) TB knowledge

Because public health messaging is a form of knowledge, the frameworks through which it is transmitted to people can affect its reception [25,28,73]. One of the most basic illustrations of this notion is public health messaging delivered to people using a less comfortably spoken dialect than they use on a daily basis; in contrast, research demonstrates that messaging delivered in recipient's most comfortably spoken (daily) dialect is generally more favorably received and thus more likely to be taken up and acted upon [17,129]. A more controversial illustration of this notion pits proponents of scientific (western) forms of knowledge against proponents of traditional (indigenous) knowledge forms. Because differences in these framings can have a decisive, if yet still diffuse and nearly invisible, impact on the effectiveness or ineffectiveness of public health messaging, the use of information and communication technology (ICT) media more readily perceived as "neutral" may afford one way to bypass the effects of this western/traditional divide [19]. More research to investigate this possibility is needed.

However, it is well beyond the scope of this review to adequately discuss the issues and tangles that inhere in the debate between "indigenous" or traditional and "western" or scientific forms of knowledge. While important, for the purpose of this paper, our criterion is simply whether a given knowledge (indigenous, western, or otherwise) would or would not more effectively deliver public health messaging to the widest demographic possible. Because it remains an open question whether "western" and "indigenous" knowledge are even commensurable in the first place (c.f., [4, p. 287]), we must underscore that any call to re-cast one in terms of the other may risk a distortion (if not a falsification) of both. And while such distortions may be useful in certain contexts [7,34], within public health messaging contexts, any distortions or falsifications of knowledge can risk decreasing the trustworthiness of the message, the messenger, or both, with negatively impacting consequences and poorer public health [10,113]. On pragmatic grounds, then, both the World Health Organization [135] and other medicine-based evidence advocates (c.f., [67,74]) have argued for the use of *any* healing knowledge-practice that *works*, regardless of whether the mechanism for it working can be (or has been) scientifically validated or otherwise still remains unclear, puzzling, or unknown.

Viewing tuberculosis in Madagascar through a western/medical lens, the disease as old as its original inhabitants [45] and is well-attested as a long-standing problem in older medical literature as well [2,55]. Consequently, the majority of tuberculosis studies in Madagascar have sought to identify and contextualize local TB strains, including its specific drug-resistances, spatially identify its distribution, test drug regimens to treat it, and investigate problems of compliance [29,111,114]. As one of the most biodiverse regions on Earth [12], the inhabitants of Madagascar also have long-traditionally drawn on the island's ethnobotanical biodiversity to develop and provide medical treatments, including for tuberculosis [118].

Viewing tuberculosis in Madagascar through a contrasting traditional/medical lens, then, the technique of *tambavy* (a form of medicinal decoction) comprises a basic and ubiquitous traditional healing practice across the island [100]. Much of the ethnobotanical knowledge basic to *tambavy* specifically involves women's knowledge, particularly for assisting during and after child delivery [31,98]. This again points to Madagascar's "second-tier" (predominantly female) ITHs [71] as a potential channel for increased TB messaging particularly in rural, remote, and isolated areas, and as a complement to Madagascar's "third-tier" (predominantly male) *ombiasa* [71].

Lyon [80] provides not only considerable detail about such medicinal plant treatments in Madagascar but also the most extensive evidence of existing CHW/ITH channels through interviews with these third-tier health practitioners. She presents a complex picture of western and indigenous knowledge in a process of interacting, particularly in *ombiasa* practices and amongst middle-class mothers who will use western medicines for child-care but traditional medicines for other conditions. With respect to communications between traditional healers and CHWs, data from Lyon's [80] interviews indicate that traditional healers would refer patients to western doctors for cases of malaria or acute illness; "*Ombiasa* explained that for many illnesses western medicines are much more effective than medicinal plants" (p. 58). Referrals in the opposite direction occurred as well; *ombiasa* also explained that "rural doctors at local clinics will refer patients to *ombiasa* if they feel unsure of their patient's diagnosis. Doctors also stated that rural people will have more faith in their treatment if the *ombiasa* has first diagnosed the illness" (pp. 58–59, italics in original). Importantly, Gracely, Dubner, Deeter, and Wolskee [57] long ago demonstrated that *clinician* faith in a given treatment plays a role in the effectiveness of treatment generally, even for placebos—a finding that echoes the question of *who* can be perceived in a community as speaking authoritatively or trustworthily about public health messaging.

Importantly, among the various ethnobotanical *tambavy* for ailments, Lyon [80] also notes two remedies for spirit possession. If one might debate whether ITHs or CHWs represent an appropriate resource for addressing various *physically* symptomatic conditions, if one is instead suffering from spirit possession, then it becomes clear why patients might not seek out CHWs for a cure (unless the CHW is also a trusted traditional healer). In general, we can leave it as a matter for further qualitative research to determine to what extent the transformation of an ITH into a CHW in Madagascar involves, *contra* WHO [135], a *replacement* rather than an *augmentation* of traditional methods. Nonetheless, *ombiasa* and non-traditional healers can, and do, communicate and co-refer patients to one another (see also [78] for further present-day social negotiations by *ombiasa*). This evidence points to the existence of already-existing social channels for linking (but not conflating) the social roles of ITHs and CHWs in order to potentially increase the reach and effectiveness of public health messaging in Madagascar. Kahssay et al. [70] long ago noted the importance of a national-level commitment to such channels of dialog; WHO [137] recently reiterated its similar position from 1991.

While these channels exist, there still remains a need to characterize "traditional" knowledge and perceptions about tuberculosis (and its cure or treatment) in order to understand how to develop culturally competent public messaging for



TB that message recipients will trust and act on. While it may be that a strictly “western” medical framework can suffice for eliciting the needed behavior change vis-à-vis tuberculosis, this does not demonstrate that such a framework cannot benefit from augmentation using a traditional framework as well. More research is needed to assess this. Meanwhile, just as linguistic translation into locally most comfortably spoken dialects better enables message transmission and reception, “translating” the desired public health behavior changes into locally most comfortable (culturally familiar) practices similarly enhances message reception and actionability [75,89].

With regard to this study’s research question, then, to determine if *ombiasa* or other local ITHs have a greater capacity for this act of “cultural” translation could benefit from more research; more generally, identifying and deploying people and/or ICT media using animated videos that can effect that translation would help immensely for further facilitating CHW/ITH interactions for increased TB public health messaging [17], especially in rural, remote, and/or isolated regions in Madagascar.

#### *Specific characteristics of CHWs, traditional healers, and their interactions*

Situationally, CHWs often suffer the brunt of patient dissatisfaction (sometimes with cause). Medicines from government clinics that are often prohibitively costly and geographically distant for patients, especially in rural areas [80], can seem to patients simply *withheld* by CHWs. Moreover, despite (sometimes too limited) efforts to properly train CHWs, variability in skill, a lack of availability and/or accessibility to needed resources, misunderstandings, unreasonable (and sometimes reasonable) expectations by patients, and simply bad luck (including the weather) all can serve at times to land blame on a CHW for a patient’s ongoing or unaddressed distress [79]. For supposedly authorized and competent public figures, these unfortunate events (justly or not) can erode a CHWs authority or trustworthiness and thus their capacity to deliver public health messaging to the people who need it.

Moreover, once things go awry, the scramble to ascribe blame (fairly or not) can go in any direction: from the CHW to the patient as ignorant or stubborn [22], from CHW employers to practitioners as lazy or incompetent [49], from CHWs to their employers as poor planners or provisioners of resources in the first place [48,85], or from patients (or local chiefs) to CHWs as untrustworthy or simply unhelpful [70,126]. While Smith et al. [126] recently recommended in Madagascar that “linkages with ... communities should be strengthened” (p. v), the report appears to have no reference to traditional healers or *ombiasa*. Instead, it advocates the establishment of social development committees (SDCs) tasked “to be champions in the community and broker relationships between CHVs and the community” [126, p. 25]. As a channel designed to advocate for CHWs, particularly in the face of resistance by local chiefs [126], this may be reinventing the wheel if channels already otherwise exist between *ombiasa* and other health personnel.

One key difference between *ombiasa* and CHWs is that the former are not paid if the condition is not cured [80], whereas CHWs are paid regardless of the outcome. As such, the pay structure incentives for CHWs can lead to real and/or perceived bureaucratic inertia, sinecures, and/or nepotism [48]. Moreover, while some of the research above indicates a move away from traditional medicine, the president of an association of traditional healers in Ranomafa, Madagascar explained the Association’s intention that all members have access to a botanical garden, where they could plant and harvest medicinal plants for treating disease, supply access to traditional healing, and also educate local populations about the conservation of plants and botanical biodiversity (personal communication, 2018).

This gives further evidence of a (sociopolitical) tension between “western” and “traditional” approaches in Madagascar that also informs perceptions of CHWs and ITHs. To the extent that CHWs are perceived (especially in rural settings) as agents, representatives, or proxies of “western” or “urban” (national) entities, then the kind of laziness, incompetence, or helplessness noted by the research above on the part of CHWs (whether fairly or unfairly imputed) can erode the capacity of CHWs to deliver public health messaging. That is, while laziness, incompetence, or helplessness can be a (real or perceived) defect for any healthcare practitioner, if a CHW exhibits (or is perceived as exhibiting) these qualities, then those defects can be perceived as a consequence of the (western) CHW role itself, such that “western” medicine itself is then framed as ineffective or useless—thus, again, diminishing any authority that CHW public messaging has. To be sure, while negotiating these several challenges must necessarily hinge entirely on the local, specific dynamics of each place in question, nonetheless one way to ameliorate any loss of public messaging effectiveness due to negative perceptions of CHWs (or ITHs recruited as CHWs)—especially where cultural biases view female CHWs less favorably [43,90]—would be to find other authoritative or trustworthy proxies to coordinate message delivery through.

With respect to our research question, the above evidence suggests not only that *ombiasa* and second-tier (female) healthcare providers (who are otherwise viewed by their *female* clients as authoritative and competent within their domain of practice) could afford this function as a proxy apart from CHWs but also that locally translated ICT media that CHWs or others could share and distribute would do so as well [83], especially in isolated, rural, or remote areas of Madagascar.

#### *Tuberculosis health messaging generally*

Public health messaging tends to utilize any available and affordable media for delivery, whether this involves print, radio and television, or more recently digital means [21]. However, in multi-lingual settings where fluency in national or administrative dialects is not universal, public health messaging benefits from, even requires, translation into local dialects [17]. While media such as radio and television, and more recently Internet content, have been able to reach more remote and hitherto inaccessible locations, this reach is limited both by infrastructure and broadcast capacities as well as financial or personnel constraints involved in translating any public messaging into locally most comfortably spoken dialects [14,113].

Whatever media public health officials have used for messaging in the past in Madagascar, a number of studies have explored the use and effectiveness of electronic messaging, especially texting [9,23,58]. Although cell-phones, like elsewhere in Africa, are plentiful in Madagascar [44], texting shows better support for inter-institutional or inter-provider communications, particularly around disease surveillance and health data collection [56,103] than for provider-patient communications. However, as Andriandrambo, David-Benz, and Rahelizatoivo [8] caution, even with cell-phone access in Madagascar, challenges involving phone quality (including the inability to receive texts) as well as technological and print literacy issues can impact the feasibility of texting via-cellphone. The solution proposed by Haji [58]—to use images rather than texts to convey information—partially and ingeniously solves this problem. Delivering ICT animated content on video-enabled cell-phones represents another possible solution [17], especially given that Scientific Animations Without Borders (SAWBO) has already produced cellphone-deliverable animated videos in fourteen languages, including Malagasy, for TB prevention [125], drug-resistance in tuberculosis, and topics relating to TB-HIV coinfection [123,124].

In terms of messaging content, public health efforts can also face the challenge of overcoming resistance to the message itself [10,81]. For public TB health messaging, this involves complications due to drug-resistant tuberculosis (DRTB), co-impacts on HIV treatment or HIV-TB coinfection, and therefore stigma associated with the disease. Treatment adherence to avoid DRTB is a critical TB messaging theme in general [33,51,52]. However, given HIV-TB coinfection and treatment, this medically complex scenario requires highly specialized CHW knowledge, if not fully trained medical expertise [24]. Ironically, the comparatively low rate of HIV infection in Madagascar also generates a very high degree of misinformation and stigma about the condition and therefore requires even greater efforts to adequately transmit public messaging around it, HIV-TB coinfection, and/or TB itself [61,119]. The complexities of these issues make crafting simple, straightforward, or unambiguous public messaging difficult, if not currently impossible. Even the simplest directive like “see your doctor regularly for treatment” can quickly run into prohibitive costs to patients in terms of time, money, and possibly transportation as well, increasing the risk of program default or simply not seeking treatment in the first place. Here again as well, stigma associated with TB complicates getting people into treatment.

With regard to tuberculosis messaging specifically in Madagascar, Rakotonirina, Ravaoarisoa, et al. [106] found that urban males and younger people in (urban) Antananarivo were more likely to default or have gaps in their treatment, suggesting a need for more messaging to this demographic. Raheinandrasana et al. [102] reported good participant knowledge about the transmission and causes of TB but a need for improved health messaging around symptoms and prevention. And although no studies were identified specifically pertaining to approaches used in TB public messaging, one study that describes a public messaging campaign to distribute bed-nets to combat malaria in Madagascar provides an indirect illustration.

Conducted along the eastern coast of Madagascar, and with more than 75% of participants having no more than a primary school education, Finlay et al. [46] found that 93.1% of participants reported face-to-face message delivery as their primary source of project information. While the authors do not identify what dialects the campaign messaging was delivered in, given this face-to-face format, it seems likely that most comfortably spoken local dialects were used. Such linguistically localized mobilization resembles SAWBO's video animated approach as well [18], which can effectively deliver scientifically grounded best-practices interventions for health-related messaging to a wide diversity of people regardless of their socio-economic, educational, or technological background [15,20]. More importantly, this approach can also reach even the most remote and isolated areas.

With respect to the research question, then, SAWBO's and/or other already locally translated animated TB videos can be utilized by CHWs and ITHs in Madagascar as cost-effective resources for increasing the reach and effectiveness of public health messaging to combat a major health issue in the country.

## Conclusions and recommendations

Barring any dramatic reduction to the current public health resource constraints in Madagascar, any increase in public health messaging for tuberculosis will have to rely on existing cultural infrastructures and low- or no-cost message channels for delivery. Presently, the cultural amity and habit of co-referral of cases between traditional “third-tier” medical practitioners (*ombiasa*) and non-traditional medical practitioners (rural doctors) in Madagascar highlights one such already existing channel, which can then be further drawn upon at minimal cost to deliver authoritative public health messaging on TB prevention, management, and TB/HIV co-incidence to wider a demographic than is currently being reached, especially outside of urban areas. This existing linkage may also open a channel for “second-tier” traditional (female) ITHs in Madagascar for even further messaging reach, with a potential to reach people less likely to receive TB public health information in schools (the current national source for such messaging).

While future research may identify still more existing channels for disseminating nationally vital TB public health information, these channels already afford the delivery of trustworthy and authoritative information that recipients across the widest demographic may then elect to act on. In particular, the use of already existing TB health animated videos would help to amplify existing CHW/ITH interactions to more widely disseminate that messaging. The main potential cost of this approach would involve no more than translating those existing materials into the full range of recipients' locally most comfortably spoken dialects. It may be possible to further defray these costs where *ombiasa*, second-tier ITHs, or other local people also with fluency in national dialects can translate the TB messaging into local dialects themselves, or otherwise by soliciting volunteer translators.

Notwithstanding the domestic lack of resources in Madagascar, future research is needed to investigate the advantages or disadvantages of combining the social role and function of traditional (ITH) and non-traditional (CHW) healthcare practitioners into a single role. Similarly, more research would help to identify and characterize how rural/urban, western/traditional, and male/female differences around perceptions and knowledge of TB can amplify, diminish, or have no effect on the effectiveness of public messaging efforts across those divides in Madagascar. Here again, the use of locally translated, low-cost information and communication technology media has shown a demonstrated capacity for increasing the reach of public health messaging in general to participants on both sides of these divides.

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