# Evaluating HAMNASA's Tuberculosis Screening Services and Patient Management by District Assistants in Dili, Timor-Leste

Nuno Alberto de Jesus Ximenes

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James Pfeiffer

MaryAnne Mercer

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Abstract

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Nuno Alberto de Jesus Ximenes

Chair of the Supervisory Committee:

James Pfeiffer

Department of Global Health

**Introduction:** The primary focus of the Mother and Child Tuberculosis (TB) and Nutrition Program is on screening interventions utilizing a 'One Stop' TB mobile diagnostic van provided by the Ministry of Health (MoH) with support from The World Health Organization (WHO) and the Global Fund Timor-Leste. The program aims to achieve a rapid decline in TB incidence, mortality, and morbidity, reducing the incidence of TB by 50% by 2025 and 90% by 2035. This pilot project involves conducting community TB screening with a mobile van equipped with digital X-ray, AI analysis, and rapid molecular tests at four Community Health Centers (CHCs). The project's effectiveness will be assessed to determine if it should be implemented in other municipalities in the future.

**Methods:** The study utilizes a mixed-method approach, combining quantitative and qualitative data collection in an exploratory sequential design. The evaluation aims to identify facilitators and barriers recognized by HAMNASA in providing TB screening at four community health centers and their areas of coverage, as well as the challenges faced by district tuberculosis assistants in managing TB patients at those centers. Focus group discussions included all HAMNASA mobile team providers—a doctor, nurse, laboratory analysts, and radiographer—who are tasked with implementing the Maternal and Infant Tuberculosis and Nutrition Program. Additionally, key

informant interviews were conducted with key stakeholders, including the TB municipal coordinator from each of the four healthcare centers in Dili, HAMNASA's executive director, and the national TB manager. In addition, quantitative data were collected through routine key indicators and targets developed by the HAMNASA, which include the number of TB screenings conducted, specimens collected, and the percentage of presumptive TB cases identified and referred. The data were gathered during August- September 2023 in Dili, Timor-Leste.

**Results:** Interviews and focus group discussions revealed several key findings regarding TB management in Timor-Leste. HAMNASA is recognized as pivotal in the effort to combat TB, fostering stakeholder involvement in bolstering the treatment system. The mobile van program, praised by TB district assistants, plays a crucial role in detecting and referring TB cases within health centers. Collaborations with private and non-profit clinics extend services such as chest X-rays and sputum examinations, particularly in Dili. However, challenges persist, including transportation limitations for rural outreach, insufficient community engagement spaces in health centers, and resistance from suspected TB patients. Two among four evaluated CHCs do not consistently follow TB treatment guideline from the Ministry of Health Timor-Leste. Additionally, TB district assistants grapple with economic constraints, long commutes, and patient non-compliance, affecting TB drug adherence.

**Conclusion**: The HAMNASA mobile van has been well received by the community health centers (CHCs) in Dili. However, its impact on TB screening couldn't be measured because the CHCs already had adequate equipment TB care. The Ministry of Health is advised to reassess the national TB treatment protocol, considering if daily visits to CHCs are necessary, increasing

patient incentives to improve treatment adherence, and regularly monitoring and evaluating TB patient data management within the CHCs.

## INTRODUCTION

Timor-Leste, situated on the eastern half of the island of Timor in the Indonesian archipelago, is a small nation comprised of 13 municipalities. Its landscape varies from rugged mountainous terrain to coastal plains, with a population of 1.3 million (~70% live in rural areas) primarily engaged in subsistence agriculture, fishing, and small-scale trading[1]. Timor-Leste faces the challenge of bridging the gap between rural and urban areas, with significant disparities in access to healthcare and infrastructure. While urban centers like Dili, the capital city, have relatively better access to healthcare facilities and services, rural areas often lack adequate resources and infrastructure, posing challenges for healthcare delivery. Timor-Leste's health system with universal free health coverage is still in development and faces numerous challenges, including shortages of skilled healthcare professionals, limited healthcare facilities, and insufficient funding[1].

In Timor-Leste, the National Tuberculosis (TB) Control Program (NTP) was established in 2000 and is now fully integrated within the Ministry of Health (MoH). Despite many public health prevention efforts, which have been implemented by Government of Timor-Leste, tuberculosis remains a major problem in the country. The country has the second-highest TB incidence rate in the WHO South-East Asia Region, with a total TB incidence rate of 486 per 100,000 population.[2]

The national TB notification rate (new and relapsed TB cases notified to the national health authorities) in Timor-Leste has shown a declining trend, with only 57% of the estimated number of cases being notified in 2018[2]. The proportion of male TB cases has remained consistently higher

than female cases at the national level, with a male-to-female ratio of 1.3:1 in 2018. Child TB cases accounted for 8.4% of all notified TB cases in the country in 2018[3]. In addition, the declining trend in the national TB notification rate in Timor-Leste points to a decrease in the detection of cases and an increasing disparity between reported cases and the actual incidence of TB, indicating undetected cases and underreporting of TB cases in the country. Furthermore, high mortality rates of tuberculosis are partly attributable to low health services access, particularly in remote areas, indicating potential challenges in tuberculosis case detection in rural areas[3].

The inadequate understanding of TB including how it is spread and the presence of stigmatizing beliefs about TB can result in delays in identifying and treating the disease. Stigmatizing beliefs prevalent in Timorese communities include the fear of infection, isolation from the community, and socioeconomic consequences[4]. Having proper knowledge about TB and being aware of medical treatment are crucial factors for effectively preventing and controlling the disease. According to Pengpid and Peltzer, women based in rural areas with low social economic status said they were afraid of the tuberculosis stigma, and as a result were often admitted to the tuberculosis recuperation center with complications due to delayed treatment for tuberculosis[5].

*Asociasão Hamutuk Nasaun Saudável* (HAMNASA), a local non-governmental organization in Timor-Leste, received a sub-award from the Timor-Leste Ministry of Health's Global Fund Program in 2022. HAMNASA's project focuses on screening pregnant women and undernourished women and children for TB. The Mother and Child Tuberculosis and Nutrition Project aims to enhance tuberculosis screening and detection among pregnant women, mothers, and malnourished children under the age of five in Dili, Timor-Leste, and in the general population.

The project seeks to evaluate its progress and assess its challenges after one year of implementation and provide recommendations for strengthening the project.

The Mother and Child Tuberculosis and Nutrition Program's primary focus is on screening interventions utilizing a 'One Stop' TB mobile diagnostic van provided ty the MoH with support from WHO. The van is equipped with a digital X-ray machine, AI-assisted X-ray analysis and rapid molecular diagnostic tests. The mobile van visits four out of six main community health centers (CHCs) in Dili, the capital city of Timor-Leste. The total population of Dili is 324,269, making it the most populated urban center in the country[6]. The four CHCs are geographically spread out across Dili, with Becora CHC located in the east, Formosa and Vera-Cruz CHCs in the central part, and Comoro CHC in the west part of Dili.

HAMNASA aims to help the Ministry of Health of Timor-Leste to achieve a rapid decline in TB incidence, mortality, and morbidity, reducing the incidence of TB by 50% by 2025 and 90% by 2035 from the 2015 baseline figures, and improving health outcomes and equitable access to health services for the Timorese population. The impact indicators will detect at least 85% of all incident TB cases by 2023, ensuring successful treatment completion for 90% of enrolled patients, and provide MDR/RR (multidrug-resistant tuberculosis) diagnostic services for 75% of presumptive MDR TB cases by 2021 and 100% by 2022[7].

HAMNASA's mobile TB van team typically begins work at a CHC carrying out TB health promotion among community members to increase knowledge about TB and raise awareness of tuberculosis prevention. The mobile van team aims to encourage participants in educational sessions to undergo tuberculosis screening at the mobile van. The health providers working in the mobile van use a combination of approaches, such as symptom-based screening coughing and malnutrition, radiographic screening (e.g., chest X-rays), and/or other diagnostic tests (e.g., sputum

smear microscopy, molecular tests). When a diagnostic evaluation of an individual is done, and they are identified as having likely TB symptoms or abnormal screening results, they are flagged as needing further diagnostic evaluation. Those flagged receive additional tests to confirm or rule out TB disease and test for multidrug-resistant TB.

When a TB diagnosis is confirmed, the WHO conceptual framework of care emphasizes the importance of promptly linking individuals to appropriate care and TB treatment services[8]. This process ensures that individuals are referred to qualified healthcare providers or TB clinics where they can receive further evaluation, initiate treatment, and receive comprehensive care. As part of a grant agreement between HAMNASA and the MoH to strengthen TB service delivery in Dili, the HAMNASA team notifies individuals diagnosed with TB and refers them to the Municipal TB Assistant or Municipal TB Coordinator and start the TB treatment accordingly.

This study provides a preliminary evaluation of the HAMNASA TB project and seeks to identify barriers and facilitators to project implementation. The study sought to answer these three research questions:1) How is the project structured and what is the theory of action? 2) Is the project meeting the key targets for TB screening and treatment referrals based on project and health systems data? 3) What do stakeholders, program implementers and providers identify as the key facilitators and barriers to the implementation of the project?

## METHODS

Research Question:

The research questions for this evaluation study are: What facilitators and barriers are identified by HAMNASA in providing TB screening at community health centers and their areas of coverage? What challenges do district tuberculosis assistants face in managing TB patients in four community health centers?

Study Design:

The study utilizes a mixed-method approach, combining quantitative and qualitative data collection in exploratory sequential design to conduct this evaluation. As part of the program evaluation, the research used a mixed methods design that consisted of the collection and analysis of quantitative healthcare delivery data, along with qualitative interviews of providers and managers. Key quantitative indicators were used to assess measurable program outputs and impact at four sites, while qualitative interviews provided an assessment of program implementation from the perspectives of providers and managers themselves.

Sample:

Quantitative data were collected through routine key indicators and targets developed by the HAMNASA which includes the number of TB screenings conducted, specimens collected, and the percentage of presumptive TB cases identified and referred. The data were gathered during a month from August- September 2023 in Dili, Timor-Leste.

Qualitative data included focus group discussions with all HAMNASA mobile van providers, including a doctor, nurse, laboratory analysts, radiographer, and focal points. These HAMNASA staff are tasked with implementation of the Maternal and Infant's Tuberculosis and Nutrition Program. In addition, key informant interviews were conducted with the key stakeholders, including four TB municipal coordinator from each from four healthcare centers in Dili, HAMNASA's executive director, and the national TB Manager.

Data Sources and Collection Process

The HAMNASA' country director and the author collected the quantitative data at the HAMNASA main office. The quantitative data were in English, while the qualitative data gathering was conducted in the local language, Tetum. Focus group discussions and in-depth interviews were approximately 75 minutes each. The discussions and interviews were recorded after obtaining informed consent from the participants, and a code system was used to ensure confidentiality. They have been transcribed without translation.

Institutional Review Board

The Human Subjects Division of the University of Washington approved this study on May 24th 2023, determining that the proposed activity was human research that qualified for exempt status (category 2) with IRB ID: STUDY00018014.

In addition, this study was approved by *Unidade Etica Pesquiza E Desemvolvimento Do Instituto national de Saude Publica de Timor-Leste (the Research and Development Unit of the National Institute of Public Health of Timor-Leste)*, on Aug 24th 2023, with a reference number: 33/INSP-TL/UEPD/VIII/2023.

## RESULTS

Program Description

The Ministry of Health of Timor-Leste and the Global Fund strategically directed HAMNASA to park the mobile diagnostic van around four Community Health Centers (CHCs) in Becora, Comoro, Formosa, and Vera-Cruz, as well as its coverage area in Dili, to assess the effectiveness of the mobile van in detecting tuberculosis cases in the region (Table 1). Called HAMNASA Mobile, in collaboration with these four healthcare facilities the van provides

tuberculosis screening and treatment services following Timor-Leste's TB treatment guidelines, endorsed by the Ministry of Health and the World Health Organization (WHO)[8].

**Table 1: Geographic Distribution of four community health facilities.**

| CHCs | Number of villages | Population | Area of coverage ($Km^2$) |
|---|---|---|---|
| Becora | 8 | 82,127 | 6,999,65 |
| Comoro | 9 | 170,677 | 33,12 |
| Formosa | 6 | 43,312 | 10,06 |
| Vera-Cruz | 7 | 48,279 | 25,92 |

***Source: World Health Organization, Timor-Leste***

The van is equipped with advanced diagnostic tools, including a digital X-ray machine and the TruNat TB test, a molecular test that diagnoses TB within an hour and tests for resistance to the drug rifampicin. Additionally, it features an electronic medical record system synchronized with Artificial Intelligence for reading digital X-ray films.

Before the mobile diagnostic van was introduced in Dili, health personnel of community health centers in Dili often had to go to the Guido Valadares National Hospital to access the Gene Xpert. However, all four community health care centers have resources to provide sputum smear microscopy tests, and CHC Vera-Cruz has an X-ray machine that can take chest X-ray pictures.

Table 2 provides information related to the time and distance of four community health centers, where HAMNASA has been collaborating, to access the Gene Xpert. The longest driving time noted is 30 minutes, from Comoro to the Dili national hospital.

**Table 2: Distribution of distance and time to access to Gene Xpert facility in Dili municipality.**

| CHC | Gene Xpert Facility Location | Distance (km) | Time |
|---|---|---|---|
| Becora | National Hospital Dili | 3 | 15 min |
| Comoro | National Hospital Dili | 4 | 30 min |
| Formosa | National Hospital Dili | 2 | 15 min |
| Vera-Cruz | National Hospital Dili | 2 | 20 min |

***Source: Timor-Leste Tuberculosis Control Program guideline***

The van, staffed by trained healthcare personnel and a driver, operates Monday to Friday from 08:30 am to 05:30 pm at each of the designated healthcare facilities: Becora, Comoro, Formosa, and Vera-Cruz. This initiative aims to enhance TB detection and treatment accessibility, contributing significantly to the public health efforts in Dili.

HAMNASA has four staff members called focal points; each of them remains in their assigned community healthcare center whether or not the mobile van has stopped in their locations. They are responsible to identify potential TB cases at their CHC and in the facility's geographic area of coverage. Suspected cases are encouraged to undergo screening at the mobile van.

For the mobile van diagnosis, a radiologist takes an X-ray of a suspected TB patient. A nurse provides them with a small clean container in which to collect their early morning sputum and bring it to the mobile van for the tuberculosis confirmation test. Those diagnosed with TB are referred to the District Tuberculosis Assistant (DTA) at the primary healthcare facilities for treatment initiation.

The DTA in each of the four community health centers is responsible for initiating the 6-months of tuberculosis treatment, which is divided into two phases: intensive phase, for the first two months, and continuation phase, for the last four months. Before a patient starts the continuation phase and after TB treatment completion, a district tuberculosis assistant will run

tests to ensure that patients have not developed drug resistance and are free of TB disease for the completion of TB treatment (Table 3).

During the 6 months of TB treatment, according to national TB treatment protocol, TB patients must go to a clinic to take their medicine every day during the entire 6 months of treatment. The Global Fund will provide $30 for each TB patient once they have finished their treatment.

**Table 3. Theory of Action of the Program.**

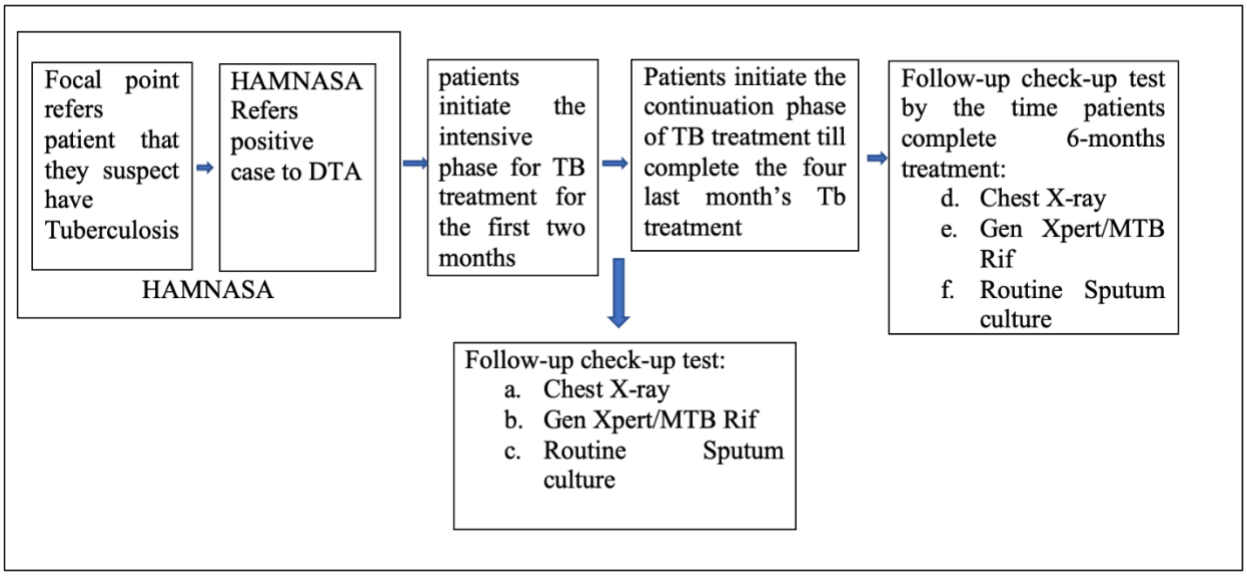



Table 4 outlines the standard treatment regimen for a TB patient according to the Timor-Leste Tuberculosis Control Program guideline. The treatment plan consists of 2 months of intensive phase (IP) followed by 4 months of continuation phase (CP), abbreviated as 2(RHZE)/4(RH).

**TABLE 4: Standard Treatment Regimen.**

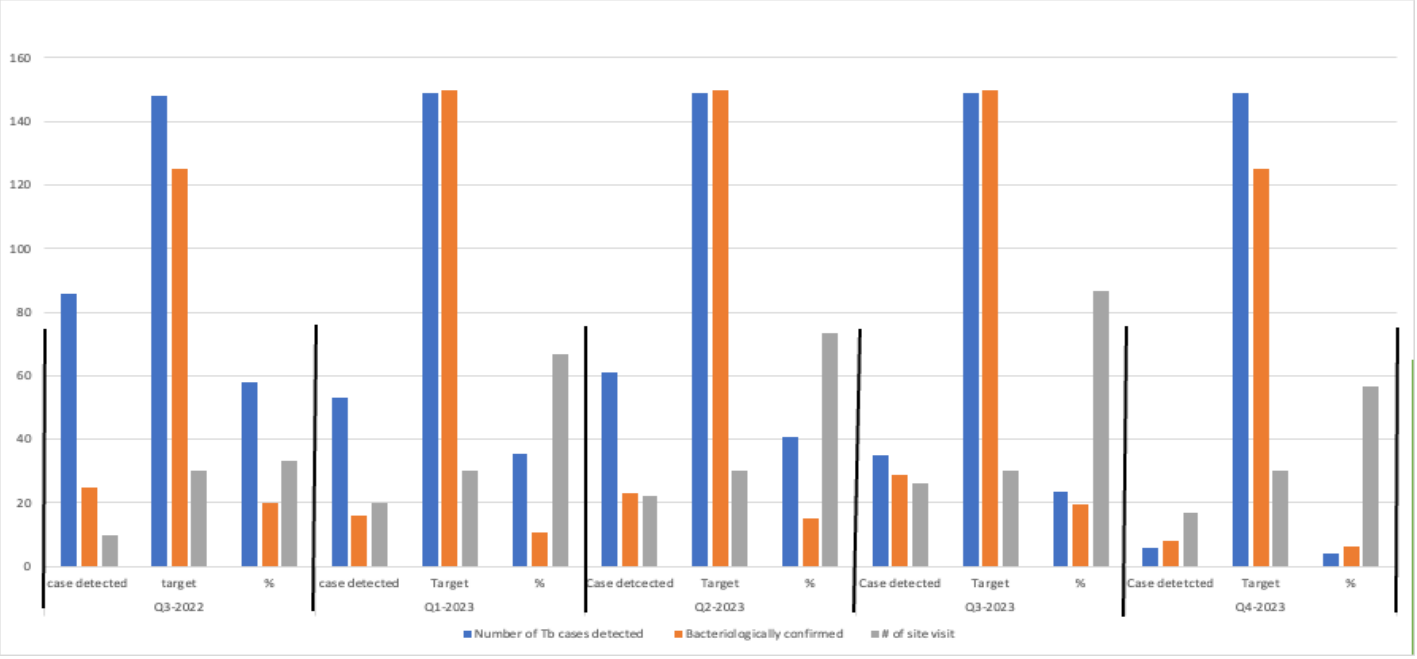
| Body weight (Kg) | Initial phase (two months) Daily number of tablets | Continuation phase (four months) Daily number of tablets |
|---|---|---|
| | 4FDC: (RHZE) (150mg + 75mg + 400mg + 275 mg) | 2FDC: (RH) (150mg + 75mg) |
| 30-39 | 2 | 2 |

| | | |
|---|---|---|
| 40-54 | 3 | 3 |
| 55-70 | 4 | 4 |
| >70 | 5 | 5 |

***Source: Timor-Leste Tuberculosis Control Program guideline***

This is the standard treatment for patients who do not have associated chronic diseases. If patients have comorbidities with other diseases, the treatment regimen will differ from the standard treatment regimen.

**Table 5. Distribution of number of TB cases detected and bacteriologically confirmed within the mobile van. October 2022- December 2023.**




***Source: HAMNASA's Database Report***

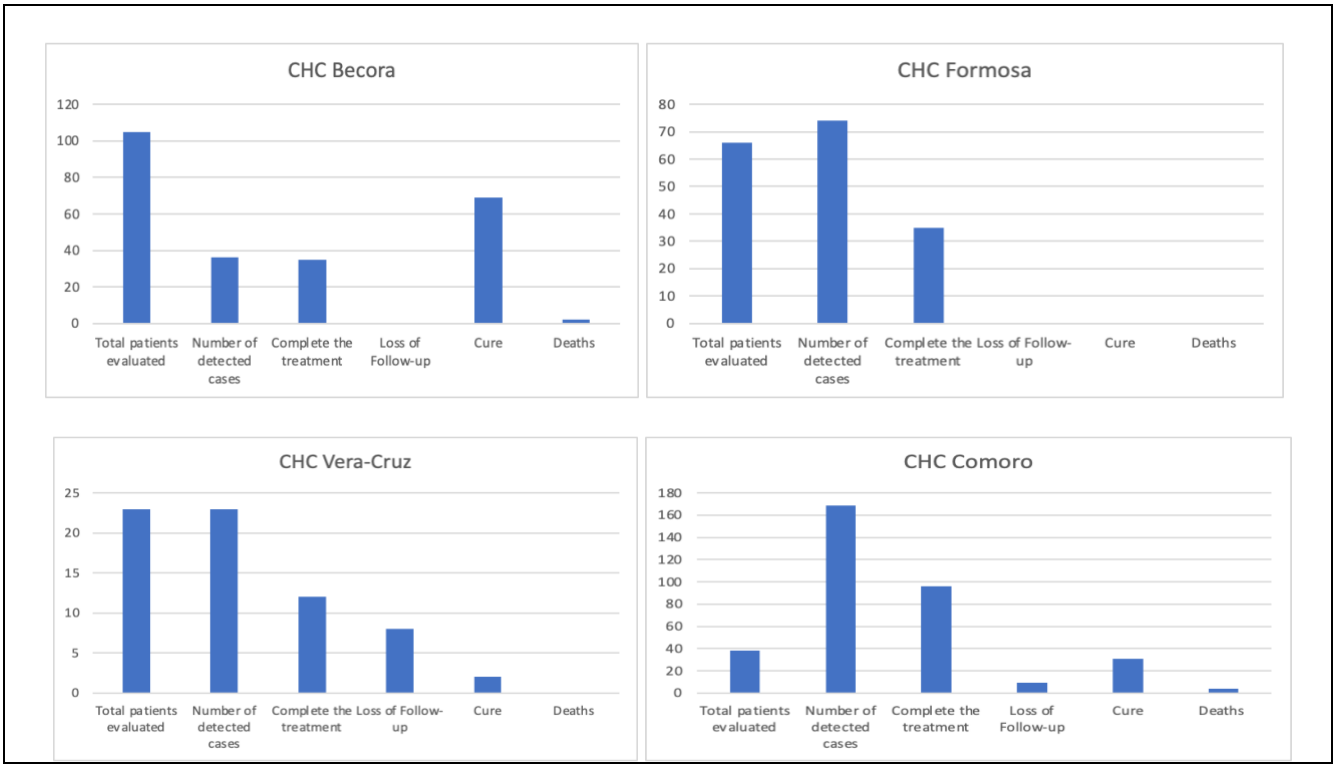
Quantitative data results

To align with the key indicators for TB district assistants in managing TB patients, this study included three quantitative indicators of the mobile van activities: the number of tuberculosis cases detected, the number of bacteriologically confirmed cases, and the number of site visits.

Table 5 shows that from October 2022 to December 2023, the mobile van diagnosed 241 cases of TB, including 101 bacteriologically confirmed cases, across 78 sites in Dili. The overall detection rate for TB cases in each quarter was well below 60% of program targets set by the TB program and HAMNASA.

In the municipality of Dili during this period, there was a total of 1,901 tuberculosis cases identified, with 764 of them bacteriologically confirmed. Thus, according to Dili Health Provision, in 2023 HAMNASA's mobile van diagnosed 12.6 % TB cases in Dili and 13.2% of cases that were bacteriologically confirmed.

**Table 6: Distribution of Tuberculosis patients among four Community Health Centers.**




***Source: Dili Health Provision Department***

The data summarized in Table 6 shows the performance of four Community Health Centers in terms of patient care and treatment outcomes. It includes reports of total patients evaluated,

cases detected, and patients who completed the treatment, as well as those lost to follow-up, cured, and who died.

Based on the TB guidelines for national tuberculosis control program, “cured” refers to treatment completed without evidence of failure, with three or more consecutive cultures taken at least 30 days apart being negative after the intensive phase, while “treatment completed” indicates no evidence of failure but lacking records of three or more consecutive negative cultures taken at least 30 days apart after the intensive phase. Deaths denotes a patient who passes away for any reason during treatment, while lost to follow-up signifies a patient whose treatment was interrupted for two consecutive months or more.

The data in Table 6 from the community health care facilities reveals significant variations in patient outcomes and reporting practices. CHC Vera-Cruz evaluated 23 patients and detected an equal number of cases, with a moderate treatment completion rate and some follow-up losses, resulting in a few cures and no deaths. CHC Formosa evaluated 66 patients but reported more detected cases than evaluated and it showed a solid treatment completion rate with no follow-up losses, cures, or deaths. CHC Becora, which evaluated the most patients (105), had a lower detection rate but reported a high number of cures (69) and some deaths, suggesting effective treatment outcomes despite the fatalities. CHC Comoro had a notably high number of detected cases (169) compared to the few patients reported as evaluated, with the highest treatment completion rate but also the highest number of follow-up losses and deaths, indicating challenges in patient management and reporting accuracy.

The data in Table 6 suggest several data quality issues, making accurate analysis challenging. The inconsistencies include discrepancies in the total number of patients evaluated and the number of detected cases for various facilities. For example, at CHC Formosa, the

number of detected cases exceeds the total patients evaluated, indicating potential data entry errors. Additionally, missing data for some columns, such as deaths and cures, further complicates the analysis. Inconsistencies in treatment completion are also noted, with illogical discrepancies between the number of cures and detected cases at CHC Becora. These data suggest that much of the quantitative data collected at the CHCs are of doubtful accuracy, indicating that the project requires improved data quality monitoring.

Themes and findings from interviews and a focus group discussion

Through the qualitative data collected from personnel involved in the program, the research identified key facilitators and barriers to effective programming.

*Participants reported a generally positive view of the mobile van program*

Interviews showed that HAMNASA is considered to be one of the key local organizations in the strategic plan to end TB in Timor-Leste. HAMNASA is seen to increase the participation of stakeholders in strengthening health system in TB treatment. In a one of the key informant interviews, a TB district assistant pointed out, “The mobile van program is considered a valuable resource in strengthening the health system within the four health centers for TB detection and its referral.”

In addition, in the focus group discussion a participant explained, “Supporting these community health centers, the mobile van team has also collaborated with private and non-profit clinics such as Ordem da Malta and Motael Clinic, which are essential for providing chest X-ray services and sputum examinations. Furthermore, HAMNASA visits some sites in Dili alongside the health personnel from Motael Clinic. While Motael Clinic’s health personnel provide medical consultations and treatment, HAMNASA offers TB-related tests to the community.”

While this study only focused on TB screening, the author found that HAMNASA also has a nutrition program primarily for pregnant women alongside to TB screening program. They provide nutritional sessions once in a month and offer $20 incentives for participants, who are exclusively pregnant women.

*HAMNASA is a valued organization addressing tuberculosis in Timor-Leste*

In a key informant interview, a participant explained, "HAMNASA is a key organization in the strategic plan to end tuberculosis over a five-year period, from 2020 to 2024, playing an essential role in detecting tuberculosis cases. We are concerned about the limited medical resources at community health centers in Dili, which hinder community access to an X-ray machine."

The mobile van is exclusively operated by trained health professionals, in addition to the driver. In focus group discussions, one participant stated, "A week before HAMNASA got the mobile van, we were trained for three days by the WHO Timor-Leste to operate the mobile van and its components. That was the only training program we have ever received regarding the mobile van program. Additionally, the World Health Organization has been actively monitoring our performance in detecting TB cases, and they always come to check the condition of the mobile van."

The participant continued to describe that while there is a Gene-Expert and Chest-Xray machine available at the National Hospital Guido Valadares, complaints have been received from the community about long wait times for chest X-ray photographs and extended waits to see a doctor. These circumstances might be contributing to increased loss of follow-up and low detection

rates at that level. The informant believed that the mobile van operated by the HAMNASA organization is helping to increase the number of TB detections in the Dili municipality.

Additionally, during the focus groups discussion, one of the HAMNASA focal points explained “I usually start my workday by standing next to an entrance of a community health center and trying to identify if a person presents any visible symptoms of tuberculosis, such as a thin body. Additionally, if I notice that person starting to cough, I approach them and begin asking questions: 'How long have you been coughing? Has anyone in your household taken tuberculosis drugs?' If they have, I refer them to the mobile van for diagnosis.”

Furthermore, respondents stated that HAMNASA’s presence has also increased collaboration among doctors, village chiefs, and the HAMNASA mobile van. In a focus group discussion, a participant shared a success story of the mobile van: “One day, a village chief reached out to us because a person in the community had been coughing for several weeks. He had visited a doctor in the community health center, and the doctor suggested that he might have tuberculosis. All we needed was for him to undergo a chest X-ray and sputum test. We visited that village to perform the tests and discovered that the person and others were positive for TB.”

*Barriers and facilitators for program implementation*

Several barriers were identified during the qualitative data collection, such as a lack of transportation to support initiating collaboration between HAMNASA and rural communities and a scarcity of public spaces in CHC to initiate conversations that would encourage community members to visit the mobile van for TB-related tests. The lack of collaboration from suspected TB patients was seen as barrier for program implementation.

In addition, barriers were identified in ensuring adherence to TB treatment in four CHCs, including low household economic status, the time and distance required to commute to a CHC, and non-compliance by TB staff with TB treatment recommendations from the Ministry of Health.

Regarding facilitators for the provision of TB screening services at the community level, during the focus group discussion with mobile van health personnel, a participant explained, “We often communicate with the village chief before the van goes to provide TB screening services. We have their contact information, so it is easy to reach out to them. However, for a new community where we have not provided TB screening services before, we must go about a week in advance. We need to have an official letter for the village chief, explaining who HAMNASA is and what we are going to do. So far, collaboration with the village chiefs has been good”.

However, one of the participants of FDG pointed out, “initiating collaboration with the villages can be challenging due to a lack of transportation. Sometimes, we rely on our own transportation, and some areas are difficult to reach out.”

*The scarcity of private spaces in the CHC to initiate conversations discourages some community members from visiting the mobile van for TB-related tests*

“Conducting screening around a community health center might be challenging," said a participant in the focus group discussion. She described an incident: "One day, I attempted to approach a pregnant lady who had come to the clinic with her husband. I had noticed her coughing since their arrival, so I asked her, 'Since you've been coughing, are you aware of the TB screening?' Immediately, her husband interjected, 'You shouldn't have asked for screening in a public space like this. You should have invited us to a private or quiet space to discuss with my pregnant wife.

Unfortunately, the situation was a little tense, and we were unable to conduct the screening with her."

Further, a participant of the focus group discussed one of the challenges in which suspected persons with TB sometimes did not bring their sputum for the bacteriological confirmation test. They said, “We try to reach out to them through the phone number that they provide in the registration session, most of the time, they pick up the call. However, they say, ‘I have dry coughing. Therefore, I cannot produce sputum, so I don’t go back to you bring the sputum.’ In addition, there was another suspected patient who answered my phone call, and they told us: *I am on my way to the mobile clinic*. Unfortunately, they never arrived.”

*The mobile van itself has limitations due to breakdowns*

The TB screening services are immensely dependent on the condition of the mobile van's software system. If the system is interrupted or there is a related mechanical issue, they cannot provide the screening.

The van has to stop TB screening services for any mechanical problems. Typically, it takes about one week to repair the van since its system is software-based. Whenever the van encounters a mechanical issue, HAMNASA notifies the Global Fund, which then informs the World Health Organization Timor-Leste, since the WHO is responsible for the mobile van’s maintenance. The WHO subsequently contacts technicians in India to address the van's related software-based issues.

In an in-depth interview, a participant explained, “While the mobile van is under repair, the four focal points will continuously work at four community healthcare facilities to find suspected TB individuals and refer them to HAMNASA’s mobile van once it has been fixed.

Meanwhile, the health personnel will stay in HAMNASA's main office and perform administrative tasks."

According to the mobile van's personnel, some community health centers have reached out to the for-chest X-rays on patients suspected to have tuberculosis. Unfortunately, they had to say, "Sorry, currently we cannot provide service as we are experiencing a shortage of electricity to support the X-ray machine."

In addition, the large size of the vans was mentioned during the focus group discussion, which makes the vans difficult to use in rural areas around Dili. One participant explained, "Roads in rural areas are too narrow for the vans, and sometimes the electricity lines are too short around the streets, which makes it challenging for the vans to reach certain areas in Dili."

*Some patients are abandoning TB treatment despite receiving $30 incentives*

The key-informant interviews with the District Tuberculosis Assistants (DTAs) revealed that many patients abandon treatment despite receiving $30 incentives.

The Global Fund provides $30 for each patient once they have completed 6 months of treatment and confirmed that they no longer have TB through chest X-rays and routine sputum tests. However, the incentives are not aligned with cost to the patient of their tuberculosis care. In a key informant interview with a DTA, he said that "With only $30 for a patient to commute to the CHC every day, even though we inform patients that we will reimburse their transportation money, most of the time, they do not show up." Another DTA stated, "Patients not only spend their money but also their time. We assume that patients only make a direct trip to the clinic and back. However, sometimes a patient needs to take 2 or 3 forms of transportation to get to the clinic and back home. Therefore, the incentive is not sufficient."

Additionally, a DTA explained, "We will submit to SSM *(Servisu Saúde Municipiu)* Dili a document that includes a list of patients who have completed the 6-month treatment. Then, they will send it to the National Tuberculosis Program (NTP). Once the NTP revises the document, they will disburse the funds according to the number of patients. Afterward, we will contact the patients to get their reimbursement. This process usually takes about one to two months. Therefore, a patient often must wait more than a month to get their incentives."

*Two out of four CHCs are not consistently able to follow TB treatment guidelines.*

At the Comoro and Vera-Cruz community healthcare facilities, the district tuberculosis assistants acknowledge that they have not been able to consistently follow the guidelines of the TB treatment protocol. One elaborated, "Sometimes I encounter strong resistance from patients when I instruct them to come to the clinic daily for medicine, because they feel ashamed." In a focus group discussion with HAMNASA mobile van health personnel, one participant pointed out that "I have encountered many patients that feel ashamed to come to the clinic every day or every month. That patient said, 'I feel so ashamed to come to the clinic to take my medicine. Every time I go to this room [the DTA's room] I think people will know my disease.' With this circumstance I always explain 'this is a curable disease, it only takes 6 months, please don't feel ashamed and let us know when you need supports, we are here to help.'

Furthermore, many live far from the clinic, lack transportation, or lack the money for daily commuting and do not or cannot come to the clinic daily for their medication. Therefore, some staff adjust the TB treatment according to the patient's condition to ensure adherence. "I must administer TB drugs to a patient every one to two weeks and have them return to the clinic once they have completed all the drugs," explained a DTA in a key informant interview.

## DISCUSSION

The mobile van program is considered a valuable resource for facilitating TB screening at the four community health centers and their respective coverage areas. HAMNASA. The TB district assistants have worked closely together and have not encountered any issues in providing TB screening and treatment to the community around Dili. This is in contrast to a study conducted in Lima, Peru, where physicians in community health centers were not accepting TB diagnoses based on X-ray and Xpert, which eventually delayed initiation of TB treatment.[9]

HAMNASA did not meet the relatively high targets set by the TB program and HAMNASA for their two indicators: the number of TB cases detected and bacteriologically confirmed from the beginning of the mobile van program implementation to the last quarter of 2023. They did, however, contribute around 12-13% to TB case detection and bacteriologically confirmed cases in Dili municipality, complementing services of other screening facilities in the same area, The four community health centers where HAMNASA provides TB screening all have resources to conduct sputum smear microscopy tests. Additionally, CHC Vera-Cruz has an X-ray machine that can take chest X-rays. These capabilities might explain why HAMNASA did not meet their indicators, as the four CHCs can provide TB tests without HAMNASA's presence in their areas.

TB-related stigmatization was identified as a contributing factor to delays in initiating and maintaining TB treatment. This is a common problem found by TB treatment programs. According to a study by Appiah et al., “A patient indicated that none of his family members wanted to come near him because of the infectious nature of the disease, to the extent that his family did not share the same drinking cup with him.”[10] Similarly, a study conducted by Maibvise et, al. toward

tuberculosis and perception about tuberculosis in Eswatini, reported that "At-risk individuals indicate that fear of TB stigma and the social and economic impact of stigma affect their willingness to undergo TB screening and to seek medical care after the onset of symptoms associated with TB[11]." These findings show that TB-related stigmatization can have a significant influence on the initiation of TB treatment.

In addition, low economic status was found to be a factor influencing patient adherence to TB treatment. A study conducted by Murno et al reported that, "Some patients prioritized work over treatment, and for many, there appeared to be a "choice" between work and adherence[12]." Comparably to study in North-eastern Uganda which concluded low socio-economic status is associated with poor TB treatment outcomes[13]. Thus, it is evident that low economic status significantly impacts patient adherence to TB treatment, as both the study by Murno et al. and the research in North-eastern Uganda underscore the struggle between economic survival and health priorities, leading to poor treatment outcomes.

The distance from the community residence to the community health center was one of the challenges in retaining TB treatment within four CHCs. However, the absence of a clear correlation between distance to healthcare facilities and TB treatment outcomes, as evidenced by studies in both the Alamata district of northeast Ethiopia and Uganda, has been shown to challenge conventional assumptions[1415].

These findings emphasize the intricate interplay of factors shaping treatment success, particularly in urban settings where access barriers may extend beyond mere physical distance. Tailored interventions are imperative to address the nuanced challenges faced by urban populations in adhering to TB treatment. Moreover, further research is essential to unravel the

multifaceted determinants of treatment outcomes, paving the way for more nuanced and effective strategies in global TB control and management efforts.

Many TB patients have shown hesitancy in following the national tuberculosis protocol treatment guidelines requiring daily trips to the CHC, despite receiving a $30 incentive for transportation to commute there. These guidelines require them to visit a community health center every day for six months to take their TB medication. To commute to a community health center in Dili, the cost of the most basic public transportation is $0.25 for a one-way trip. For a round trip, it costs a patient $0.50. Over a 6-month period of treatment, the total cost amounts to $90. This commute cost discourages patients from coming to the CHC daily, as the cumulative expense can be a significant burden, potentially hindering their ability to receive consistent treatment and achieve better health outcomes.

While staff reported that patients for two of the studied community health centers usually follow the daily guideline, the other two clinics should consider exploring with the MoH the use of an adjusted treatment regimen, based on the patient's access and other factors to ensure adherence. The MoH should also consider adjusting the timing and amount of the financial incentive given for completed treatment. A study from Uganda, for example, found that incentives correlated with higher TB cure rates and lower loss-to-follow-up rates among people with TB in rural areas. However, the Uganda program provided a one-dollar incentive for each visit rather than giving a single incentive upon the completion of TB treatment. This approach suggests that consistent, small incentives could effectively encourage regular visits and adherence to treatment protocols, leading to improved health outcomes for TB patients[16].

A study from Ting et al describes that "Patients commonly found travelling to the chest clinic for DOT inconvenient and time-consuming. A quarter of participants found their return trip

stressful due to medication side effects. For some, daily travel to the TB clinic was very cumbersome because they lived far away[17]." Similarly, a study in Ethiopia found that "The primary reason for delayed treatment initiation was patients' limited access to financial resources. Patients required money for transportation, registration, diagnosis, medication, costly referrals to nearby hospitals, and other basic needs. These financial constraints caused significant delays in obtaining a diagnosis and receiving appropriate treatment." These findings indicate that logistical and financial barriers can significantly hinder timely treatment initiation and adherence to TB treatment, underscoring the need for improved access to healthcare services and financial support for patients[18].

Accurate data related to TB services are important measures to assure the tracking of outcomes of care. However, routine data were inadequately collected in the four community health centers (CHCs) in this study. These errors make the interpretation of the data difficult and unreliable, necessitating a re-evaluation of data sources and consistency across all entries. HAMNASA has a strong data management system that is computer-based, facilitating easier analysis and interpretation. However, the four CHCs rely on hand-based data collection, which contributes to these issues.

Additionally, the large size of the vans may be a factor contributing to the program's inability to meet its goals. As reported by the Ministry of Health for a similar program in Tanzania, "The size of the van has also been consistently mentioned as a barrier to reaching some of the targeted areas. This is due to challenges such as narrow or rough roads, bridges, and electricity lines; hence some planned mobile clinics could not be accomplished[19].

Moreover, when the power generator breaks down, it impacts the TB screening services of the van for days at a time. This problem was also reported in India, as illustrated in a study

conducted by Giridharan et al. The research in India described that "X-ray machines and generators often overheated despite having an air conditioner in the X-ray van. Backup machines were available when breakdowns occurred. Having a comprehensive maintenance contract with the supplier, including regular maintenance, reduced the downtime of equipment[20]."

## STRENGTHS OF THE STUDY

This study evaluated the performance of HAMNASA's mobile unit in detecting tuberculosis for the first time in Dili. Conducted by Timorese staff entirely in Tetum, the local language, the study opted not to use a translator for the qualitative data analysis of the transcripts. HAMNASA demonstrated exceptional data management capabilities, facilitating the analysis and interpretation of quantitative data. In addition, this evaluation identifies a large number of factors that will help the TB program understand how to improve its performance, as HAMANSA, alongside the Ministry of Health and the Global Fund of Timor-Leste, plans to extend mobile van services throughout the country.

## LIMITATIONS OF THE STUDY

The study was limited to TB care providers, so data collection from TB patients within these centers was not employed in this study. Patients diagnosed with TB by HAMNASA's mobile van or from the community health centers were not included in the research design. Thus, the qualitative data collected focused solely on the program's implementation perspectives not on TB patients' perspectives of services.

The WHO Timor-Leste and the Global Fund Timor-Leste were initially invited to participate in the study but did not respond to the invitation.

Additionally, the research did not utilize data analysis software to analyze the qualitative data. Consequently, data collection and analysis proved to be a significantly time-consuming task.

## RECOMMENDATIONS

1. Encouraging HAMNASA to expand their TB screening services in rural areas would allow an assessment of the true effectiveness of the mobile van's impact. All four CHCs have resources to provide TB related tests and staff can reach the GeneXpert at the National Hospital of Guido Valadares in Dili, which is 2-4 km away, in less than 30 minutes. The mobile van may be more useful in a primarily rural area, without such access.
2. The HAMNASA team should reassess their target indicators using demographic and TB-related report data and increase the targets by 10% each year. .
3. Scheduled regular maintenance for the mobile van is needed, incorporating automobile maintenance and repair services into the program to ensure that the mechanical components of the van are always functioning whenever they are needed.
4. To address the challenges presented by the current mobile van size, the TB program should consider an alternative proposed by the Ministry of Health of The United Republic of Tanzania in their TB program assessment, which suggests focusing on two key aspects[19]. Firstly, advocating for a more compact van design that can easily navigate narrow roads while accommodating essential equipment and personnel. Secondly, enhancing the vans' off-road capabilities, including reinforced suspension, all-terrain tires, and increased ground clearance, to facilitate smooth traversal of rough terrain.
5. The Ministry of Health is highly encouraged to reassess the national tuberculosis treatment protocol, particularly deciding whether TB patients should be required to come to a CHC to take their medicine or if alternative approaches can be tested. One option would be for

patients to take their medication at home after the first two months of intensive treatment, then for the remaining four months. getting a weekly or monthly prescription for TB treatment to be taken daily at home. Community-based supervision of therapy has also been used in some areas.

6. Regular monitoring and evaluation of data management for TB patients within the CHCs is badly needed. High-quality data management will benefit health policymakers in assessing and strengthening weak links in TB detection and treatment.
7. The national TB program should consider enhanced patient incentives for treatment, providing them on the day patients begin TB treatment, as implemented in other settings, to improve adherence among TB patients.

## CONCLUSION

The HAMNASA mobile van has been well accepted within the CHCs in Dili. However, this evaluation study could not measure the extent of the reach of the van services in providing TB screening for the community. This was because the four community health centers already possessed sufficient medical equipment and staff to conduct TB-related care.

The Ministry of Health is highly encouraged to reassess the national tuberculosis treatment protocol, including whether TB patients should be required to visit CHCs daily for medication, increase patients' incentives for treatment to improve adherence, and implement regular monitoring and evaluation of data management for TB patients within the CHC.

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