

Telemedicine to Timor-Leste: implementing an international cardiac telehealth service during population dislocation, floods and COVID-19

Short title: Telehealth in Timor-Leste

Elizabeth D Paratz¹⁻³, Nicki Mock⁴, Diana Marques⁴, Will Wilson⁵, Virag Kushwaha⁶, Simon Eggleton⁶, Jess Harries⁷, Sergio da Silva⁷, Anary dos Santos da Silva⁷, Juliana Saramento⁷, Joaquina de Sousa Maurays⁷, Ricardo Flavio⁷, Ari Horton⁸, Sarah Gutman¹⁻³, Louise Creati³, Peter Barlis^{3,9}, Alan Appelbe¹⁰, Noel Bayley¹¹

1. Baker Heart and Diabetes Institute, 75 Commercial Rd Prahran 3181 VIC Australia
2. Alfred Hospital, 55 Commercial Rd Prahran 3181 VIC Australia
3. St Vincent's Hospital Melbourne, 41 Victoria Pde Fitzroy 3065 VIC Australia
4. East Timor Hearts Fund, Melbourne VIC Australia
5. Royal Melbourne Hospital, 300 Grattan St, Parkville VIC 3050
6. Eastern Heart Clinic, Prince of Wales Hospital, Randwick 2031 NSW Australia
7. Maluk Timor, Rua Aidak Nurak, Comoro, Dili Timor-Leste
8. Monash Children's Hospital, 246 Clayton Rd Clayton 3168 VIC Australia
9. Northern Hospital, 185 Cooper St Epping 3076 VIC Australia
10. University Hospital Geelong, Bellerine St Geelong 3220 VIC Australia
11. Warrnambool Base Hospital, 25 Ryot St Warrnambool 3280 VIC Australia

This article has been accepted for publication and undergone full peer review but has not been through the copyediting, typesetting, pagination and proofreading process which may lead to differences between this version and the [Version of Record](#). Please cite this article as doi: [10.1111/imj.15753](https://doi.org/10.1111/imj.15753)

This article is protected by copyright. All rights reserved.

This article is protected by copyright. All rights reserved.

Abstract

Background: The East Timor Hearts Fund (ETHF) has provided cardiac services in Timor-Leste since 2010, conducting three clinics yearly. With international border closures due to the COVID-19 pandemic, development of collaborative telehealth services was required.

Methods: Scoping discussions identified major challenges (structural, patient-related and medical system-related). At two pilot clinics, patient history, investigation and management were collated. Clinic metrics were compared to an index face-to-face clinic in February 2019. Post-clinic discussions identified areas of success and shortfall in the conduct of the telehealth clinics.

Results: 23 patients were reviewed at the online telehealth clinics held onsite at Timorese medical facilities. Compared to an index 2019 clinic, there were markedly lower numbers of new referrals (2 vs 190 patients, 8.7% vs 59.4%). Patients seen at the online clinic were predominantly female (17/23, 73.9%) and Dili-based (18/23, 78.3%) with a mean age of 25.9 ± 7.2 years old. The majority (12/23, 52.2%) had isolated rheumatic mitral valve disease. Investigations including electrocardiography, pathology, echocardiography and 6-minute walk tests were conducted in select patients. Medication advice was provided for 10 (43.5%) patients. 11 patients (47.8%) were deemed to require urgent intervention. Post-clinic discussions indicated general satisfaction with telehealth clinics, although frustration at current inability to provide interventional services was highlighted.

Conclusion: Our pilot telehealth clinics indicate that capacity-building telemedicine can be rapidly implemented in an emergency setting internationally. Clinic design benefits from careful identification and resolution of challenges to optimise flow. Cardiac patients in Timor-Leste have a significant burden of disease amenable to intervention.

Corresponding author: Dr Elizabeth D Paratz

Baker Heart and Diabetes Institute, 75 Commercial Rd Prahran VIC 3181

Email: eparatz@hotmail.com; Tel: +61 3 9231 2211; fax: +61 3 9231 3333

Conflict of Interest: No conflicts of interest are identified

Funding: No funding was provided for this project.

Abstract Word Count: 250 words

Total Word Count: 2,973 words

Keywords: Timor-Leste; cardiology; rheumatic heart disease; COVID-19

Background

The East Timor Hearts Fund (ETHF) is a non-governmental organisation operating from Australia to assist the cardiac needs of Timor-Leste. It was created in 2010, and its cardiologists have reviewed more than 2000 patients (1), with almost 100 cardiac procedures performed (2). As Timor-Leste is a low middle income country (LMIC) without in-country capacity for cardiac interventional procedures or surgery, ETHF plays an important role in the country's health infrastructure.

With the onset of COVID-19, international borders between Australia and Timor-Leste were closed by both governments in March 2020. Australian cardiologists were unable to travel to Timor-Leste to conduct clinics which usually occur three times per year. An urgent need was rapidly identified for a telehealth service to Timor-Leste, in order to enable continuity of care for the organisation's patients. Telehealth has been an important component of the response to COVID-19, with successful implementation already described in Australian outpatient cardiology clinics (3) and Timorese-Australian surgical examinations (4).

In Timor-Leste, additional specific challenges arose in the design and conduct of telehealth clinics. These included mass population movement and evacuations, in the context of a sharp surge in the number of COVID-19 cases, widespread job losses, and severe flooding. (5), Managing an intersection of infectious and climate-related disasters, Timor-Leste upgraded its state of emergency to a state of calamity (6). In this setting, ETHF successfully conducted multiple small telehealth clinics to provide COVID-safe continuity of care for cardiac patients. This paper outlines a blueprint for the collaborative international design of speciality telehealth clinics for LMICs, including implementation challenges and subsequent patient outcomes.

Methods

Design of face-to-face clinics before COVID-19 pandemic: The conduct of ETHF's typical cardiac clinics has previously been described in detail (7). In brief, clinics are usually held three times per year in both Dili and rural districts. Approximately three hundred patients were seen at each clinic over several days, with each patient receiving an interpreter-guided history, physical examination and focussed echocardiogram performed by Australian cardiologists. The clinics comprise patients invited for review, new referrals from local healthcare facilities and walk-in patients with self-reported cardiac symptoms (1). Data from the February 2019 (face-to-face) clinic was extracted for comparison to the online clinics. Parameters included number of attendees, city/town of residence, and rates of attendance of patients invited for review.

Scoping review for planning telehealth clinic:

In preparation for transition to a telehealth clinic, key concerns were identified and addressed by clinicians, administrative staff and healthcare workers at both ETHF and Maluk Timor (Figure 1). Maluk Timor is a large non-governmental healthcare organisation based in Dili, and acted as the physical site of the telehealth clinic. Major themes identified in both countries were concerns regarding structural factors, patient factors and medical system factors.

Challenge 1. Structural factors:

a) Telecommunications: Internet service was the major concern for both Australian and Timorese clinic coordinators in anticipation of an online clinic. Internet connection in Timor-Leste is unreliable, with frequent outages. Fixed broadband is limited, with only 6% of subscriptions achieving speeds in excess of 10 megabytes/second (in comparison to 82.6% of world subscriptions) (8). Due to concerns regarding connectivity and ability to transmit any echocardiographic images in real time, patient files were reviewed in advance of the clinic. It was agreed which patients would require echocardiograms, with these scheduled to occur prior to the video appointment to facilitate file uploads and transmissions. A Zoom link was created for the clinics (Zoom Video Communications, San Jose, California, USA) with deidentified echocardiographic images shared by email or WhatsApp (WhatsApp LLC, California USA). Online systems for the real-time transfer of echocardiographic images via cloud-based systems exist and would allow for in-time image optimisation and instruction ~~but may reduce capacity and clinic efficiency.~~

b) Clinic design: Typical ETHF clinics are crowded, with patients arriving in the morning and forming a queue to be seen. In a new era of social distancing this traditional paradigm was untenable. A plan was made for patients to be given structured appointment times, and only one patient to be in the facility at a pre-set time. A pre-designed standardised questionnaire screening for COVID symptoms was utilised (9). ETHF had regularly shipped containers of personal protective equipment and hand sanitiser to Timor-Leste throughout the pandemic, enabling their availability at the clinic.

c) *Flooding*: In April 2021, Timor-Leste experienced its worst flooding in more than 50 years, affecting all 13 municipalities. Dili was worst affected, with 26,000 of 33,000 households affected (10), and over 5000 people housed in 25 evacuation centres. Multiple medical facilities were flooded, including the national hospital, national medical warehouse and local clinics. With a large proportion of Timorese temporarily homeless, it was anticipated that this could impact attendance at our telehealth clinics and resourcing.

Challenge 2. Patient factors:

a) *Absence of patients in Dili*: At the onset of the COVID-19 pandemic, large numbers of Timorese returned to rural districts due to a combination of urban job losses, fear of higher infection risk in urban settings, lower rural living costs, and increased family support in rural districts (11). One-sixth of rural households reported increasing in size (by an average of 3 people) between March-July 2020 and Dili was widely described in the media as 'deserted' (5,12,13). It was anticipated that this large-scale movement of Timorese citizens might have implications for contact of patients and clinic attendance.

b) *Difficulty contacting patients*: In previous publications we have detailed the difficulties of following up patients given Timor-Leste's minimal postal service and fixed-line phone services (0.2 fixed-line connections per 100 people) (1,8). While there are 119.2 mobile phone subscribers per 100 people, only 33.6 subscribers are active at any time, reflecting high rates of mobile service turnover and cancellation. For those who had returned to rural areas with a working mobile phone, only just over half would be anticipated to have phone coverage (8). Identification of prospective patients therefore commenced well in advance of clinics, with methods of contact including multiple phone calls, text messages, and enquiries to referring health facilities.

c) Economic barriers to patient attendance: With increasing rural re-location, travel costs to attend the telehealth clinic could be anticipated. Pre-pandemic, the majority of East Timorese already had limited funds, with a median monthly income of only US\$40 (14), but the COVID-19 pandemic substantially worsened the economic standing of the average Timor-Leste citizen. Since the onset of the pandemic, the number of Timorese households without any income has increased from 18.3% to 56.6% (5).

Rural telehealth clinics were considered but deemed infeasible. There was consensus that if a working pilot program could be established in Dili first, only then could consideration be given to replicating it in nearby rural areas with reasonably reliable internet service.

Challenge 3. Medical system factors:

a) Timorese healthcare system: It was anticipated that the Timorese healthcare system might be overwhelmed by COVID-19 cases by the time of the scheduled clinics. Like all LMICs, Timor-Leste's healthcare system has minimal reserve with regards to healthcare workforce and hospital bed capacity (15,16). The (closed) land border with Indonesia, a nation with more than 3.2 million COVID-19 cases as of August 2021 (17), caused significant staff concern. As healthcare strain had already been well-documented in upper-middle-income and high-income countries such as China, Italy and America, it appeared prudent to plan for health system strain in Timor-Leste. In such an eventuality, it would be likely that Timorese clinic staff would be redeployed to direct COVID-19 care, Timorese citizens would be under stay-at-home orders, and the online clinic could not proceed.

b) Upskilling of local practitioners in hand-held echocardiography: At a typical face-to-face ETHF clinic, focussed echocardiograms are performed on all patients by Australian cardiologists. ETHF staff

Accepted Article

routinely transport echocardiography machines from Australia for each clinic. Fortuitously, prior to the onset of COVID-19, a clinical research study had commenced investigating the utility of handheld echocardiography performed by non-specialist staff (18). Consequently, a Phillips Lumify S4-1 phased-array transducer (Phillips Healthcare, USA) was already present at the clinic and local healthcare workers competent in its use to obtain parasternal long-axis views (19). Additional online training workshops were organized by ETHF staff with local healthcare workers prior to the telehealth clinic, demonstrating how to obtain parasternal short-axis and apical views. With these limited views and colour Doppler imaging, it was anticipated that clinically useful images might be obtainable.

c) Medical indemnity status: The potential legal vulnerability of Australian cardiologists participating in the telehealth clinics was raised. Although overseas volunteer work has previously been indemnified for cardiologists practising within their Australian area of expertise, the indemnity status of volunteer telehealth had not been explicitly defined. Several major indemnity companies had explicitly stated that they did not cover overseas telehealth in their policies (20), raising concerns amongst the organisation's cardiologists. Following further discussions with multiple large medical indemnity organisations, it was agreed that ETHF cardiologists would be indemnified on the basis that their work would be of a volunteer nature only, that full documentation would be maintained for all encounters, and that a licensed Timorese medical professional and an interpreter would be present in all consultations in Timor-Leste.

Conduct of clinics: Following the scoping review and proactive mitigation of issues raised, a protocol was designed for clinic flow (Figure 2). At the online clinic, data was collected on all adult patients (>16 years old) seen. We recorded basic demographics such as age, gender, cardiac condition, number of echocardiograms performed, and number with medications prescribed or investigations arranged as a result of the telehealth consultation. Patients were interviewed regarding their New

York Heart Association (NYHA) score with consensus on scoring by two consultant cardiologists, any definite COVID-19 infections, and any episodes of hospitalisation. Comparison was made with an index face-to-face clinic conducted in February 2019.

Following each clinic, a debriefing session was held by phone conference with clinicians in both countries. Participants were asked to identify factors in the clinic design which had worked at or above expectations, and areas that required further intervention.

Ethical approval: Approval for this project was granted from the St Vincent's Hospital Research Ethics Committee (QA 21038).

Results

2019 clinic baseline figures: At the February 2019 clinic (acting as a typical index clinic), 306 patients were seen. These comprised 116 patients who were scheduled for review (224 patients scheduled, callback success rate of 51.8%) and 190 new patients.

Online telehealth clinics: Two telehealth clinics were held, one in October 2020 and one in March 2021. Originally, 167 adult patients were scheduled for review in either 2020 or 2021 in the ETHF clinics prior to the pandemic. Given the small nature of the telehealth clinics, we attempted to contact 45 high-priority patients to schedule an appointment. Ultimately 23 patients were seen at the telehealth clinics (Figure 3), of whom 21 were scheduled patients and 2 were new referrals. Non-contactable patients typically had disconnected phone numbers, and at least four patients have subsequently been identified to be deceased from sudden death of probable cardiac cause. The

Accepted Article

patients' mean age was 25.9 ± 7.2 years, with approximately three-quarters of the patients female (17 patients, 73.9%). 18 of the 23 patients (78.3%) were Dili residents. The most common cardiac pathology reviewed in the clinics was rheumatic heart disease with isolated mitral valve involvement (Table 1).

Of 23 patients reviewed, all had vital signs recorded and history taken. No patients reported having had confirmed COVID-19 infection, although 3 (13.0%) reported common cold symptoms within the last year. One pregnancy and successful delivery had occurred amongst the cohort. Six patients (26.1%) had had at least one hospitalisation, five for heart failure symptoms and one for childbirth. The median NYHA score was II [IQR I-III], indicating cardiac symptoms on exertion.

In terms of investigations, one patient (4.3%) had a six-minute walk test performed and 12 (52.2%) had an echocardiogram performed at the clinic. Future investigations were scheduled for 4 patients (17.4%), with 3 (13.0%) electrocardiograms and 3 (13.0%) pathology tests arranged.

Ultimately, it was agreed that 11 patients (47.8%) would require early cardiac intervention within 3-6 months or once transfer to interventional centres became a logistic possibility. 10 patients (43.5%) had medical therapy adjusted. One patient who had been scheduled for review was identified to have experienced sudden death the day prior to the clinic.

Stakeholder feedback post clinics:

Correspondence between clinicians following the clinics identified several consistent themes (Table 2). There was consensus that telecommunications had performed better than expected. The use of handheld echocardiography by local healthcare workers was highly clinically valuable. Although precise measurements such as valvular gradients could not be made, the images obtained were adequately diagnostic to guide management (Figure 4). This was a function of both excellent

technique by local clinicians obtaining images, and also surprisingly good image fidelity when transmitted electronically in a deidentified format using free internet platforms.

Frustration was expressed by all clinicians involved regarding the endpoint of the clinic and the current inability to provide intervention for clearly symptomatic patients.

Discussion

We present a pragmatic model for rapidly constructing an international telehealth service to an LMIC. Although in numerical terms we reviewed only a subset of our usual patient base, we describe successful maintenance of continuity of care internationally to a country with minimal internal specialty cardiac resources and experiencing a state of calamity due to geographic disasters and pandemic influenza.

Success and shortfall in a time of major disruption

Timor-Leste has experienced even more disruption than most LMICs during its COVID-19 experience. It shares a land border with Indonesia, which has reported more than 3.2 million confirmed COVID-19 cases to date (17). In addition to carefully managing their border and infection risk, Timorese citizens have experienced large-scale population dislocations and calamitous floods. This occurred in the context of an already strained health system.

At the onset of the pandemic there was high concern amongst ETHF staff that our patient base would be at uniquely high risk given their pre-existing cardiac pathology. Additionally, delays in their progression to interventions could increase mortality even if they did not contract COVID: the typical Timorese patient with cardiac disease warranting intervention experienced a median wait time of 5 months pre-pandemic (2).

To date there have been areas of success. Timor-Leste has managed their COVID-19 protection very effectively with only 10,000 cases as of August 2021 (17). The health system has maintained relatively normal function, and cardiac patient deaths from COVID-19 have not been reported in large numbers (although data collection is incomplete). A vaccination program has now been implemented, with 7% of the population already fully vaccinated as of August 2021 (17).

However, there are areas of shortfall in our telehealth clinics. One of the most important was the recognition that new referrals were markedly reduced. Pre-pandemic, new referrals would typically comprise more than half of a clinic (and in excess of 1000 patients over a two-year period) but we reviewed only two new patients at the new telehealth clinics. This marked reduction in new referrals is likely to be multi-factorial: with priority placed on seeing established ETHF patients with known diagnosis, large-scale population movement, and also the death of one of Timor-Leste's busiest doctors who referred a large number of patients to ETHF (21).

Is a telehealth clinic useful if intervention is not possible?

The major frustration consistently reported by clinicians involved in the telehealth clinics is the lack of definitive intervention for young patients with symptomatic severe cardiac disease amenable to cardiac intervention or surgery. The experience of talking to young patients without capacity to arrange emergent cardiac intervention is asymmetric with the usual ETHF clinic experience, where over 100 cardiac procedures and surgeries have previously been arranged for patients in Australia (2). With the ongoing closure of international borders and requirement for quarantine in both countries, it is not possible to bring patients to Australia.

However, clinicians agreed on reflection that the clinics were still very valuable in allowing ongoing assessment of patients, with optimisation of medications and arrangement of investigation.

Confirming and arranging ongoing supplies of medication remains a highly useful intervention in an

Accepted Article

environment where 72% of patients reported difficulties accessing medication pre-pandemic (10). The large number of echocardiograms performed were also considered very clinically useful, and hopefully echocardiographic transmission will shift to being real-time at future clinics for patient convenience and image optimisation. Staff at Maluk Timor reported that the slower clinic pace and pre-clinic echocardiography training sessions were clinically valuable for professional development. Perhaps most crucially, the telehealth clinics facilitated ongoing communication between colleagues internationally, patients to feel supported and surgical lists were updated in anticipation of intervention once this is logistically possible.

Looking to a post-pandemic future

Following the resolution of the COVID-19 pandemic, ETHF staff anticipate long-term change in the conduct of clinic operations. Stemming from our small numbers of new referrals, there is concern that we may see a wave of patients with cardiac conditions undiagnosed in 2020 and 2021, and that patients presenting to ETHF will likely be at a more advanced stage of their cardiac disease than at prior clinics. Given that one in five new patients at a typical pre-pandemic clinic already had disease too advanced for intervention, this is a concerning prospect (7).

In addition to resuming in-country services and international cardiac procedures as soon as possible, there is a consensus amongst staff that it is highly likely that telehealth will continue to be optimised and remain an integral part of clinic operations. Our pilot online telehealth clinic provides a blueprint for providing international care to an LMIC, with reference to both general and specific challenges.

Conclusion

Online cardiac telehealth clinic services were successfully implemented to Timor-Leste during the COVID-19 pandemic. Major challenges included, but were not limited to, telecommunications issues,

patient contactability, catastrophic flooding, health system strain and medical indemnity concerns.

23 patients were reviewed, with appropriate history, examination and investigations. Almost half of patients reviewed will require urgent cardiac intervention when borders reopen.

References

1. Paratz ED, Mock N, Gutman SJ et al. Taking the pulse of Timor-Leste's cardiac needs: a 10-year descriptive time-trend analysis. *Intern Med J* 2020;50:838-845.
2. Paratz ED, Mock N, Cochrane A et al. Adult and Paediatric Cardiac Intervention in Timor-Leste: Disease Burden, Demographics and Clinical Outcomes. *Heart Lung Circ* 2020;29:1112-1121.
3. Rowe SJ, Paratz ED, Fahy L, Prior DL, Maclsaac AI. Telehealth in Australian cardiology: Insight into factors predicting the use of telephone versus video during the COVID-19 pandemic. *Intern Med J* 2021.
4. Salendo J, Soares A, de Sousa Saldanha Soares SB et al. Conducting clinical surgical examinations in Timor-Leste during the COVID-19 global pandemic. *ANZ J Surg* 2020;90:2399-2401.
5. Aldar D PN, Santos R, Eelens F, Peraccini G, Boender C, McTurk N, Caminha S, Whoolery S, Altangerel M, Lindstrom R. Socioeconomic impact assessment of COVID-19 in Timor-Leste. Dili, Timor-Leste: United Nations Timor-Leste, 2020.
6. Timor-Leste U. Timor-Leste April Flood Response Situation Report 7 Dili, Timor: United Nations, 2021:1-11.
7. Paratz ED, Bayley N. Heart disease in East Timor: cross-sectional analysis of 474 patients attending Timor-Leste's first cardiology service. *Intern Med J* 2017;47:423-428.
8. Union IT. Measuring the Information Society Report (Country Profile: Timor-Leste). Geneva, Switzerland, 2018:179.
9. Howitt R, de Jesus GA, Araujo F et al. Screening and triage at health-care facilities in Timor-Leste during the COVID-19 pandemic. *Lancet Respir Med* 2020;8:e43.

10. General Directorate of Statistics MoPaFaMoH. Timor-Leste: 2016 Demographic and Health Survey Key Findings. Dili, Timor-Leste, 2018.
11. Research ACfIA. COVID-19 and food systems in Timor-Leste. Canberra, Australia: Australian Government, 2020.
12. M L. A political impasse in Timor-Leste as coronavirus looms. Sydney, Australia: Lowy Institute, 2020.
13. Dili almost at a standstill, even without movement restrictions in the state of emergency. LUSA. Dili, Timor-Leste, 2020.
14. Directorate NS. Timor-Leste Household Income and Expenditure Survey 2011 2011.
15. Cabral J, Dussault G, Buchan J, Ferrinho P. Scaling-up the medical workforce in Timor-Leste: challenges of a great leap forward. *Soc Sci Med* 2013;96:285-9.
16. Martins N, Trevena LJ. Implementing what works: a case study of integrated primary health care revitalisation in Timor-Leste. *Asia Pac Fam Med* 2014;13:5.
17. Center CR. COVID-19 Dashboard. Johns Hopkins University, 2021.
18. Francis JR, Fairhurst H, Whalley G et al. The RECARDINA Study protocol: diagnostic utility of ultra-abbreviated echocardiographic protocol for handheld machines used by non-experts to detect rheumatic heart disease. *BMJ Open* 2020;10:e037609.
19. Remenyi B, Davis K, Draper A et al. Single Parasternal-Long-Axis-View-Sweep Screening Echocardiographic Protocol to Detect Rheumatic Heart Disease: A Prospective Study of Diagnostic Accuracy. *Heart Lung Circ* 2020;29:859-866.
20. Mutual A. Practitioner Indemnity Insurance Policy: Cover Outside Australia. 2021:10.
21. Ximenes F BR. Respected Family Doctor Dan Murphy Dies, Aged 75. *Tatoli*. Dili, Timor-Leste, 2020.

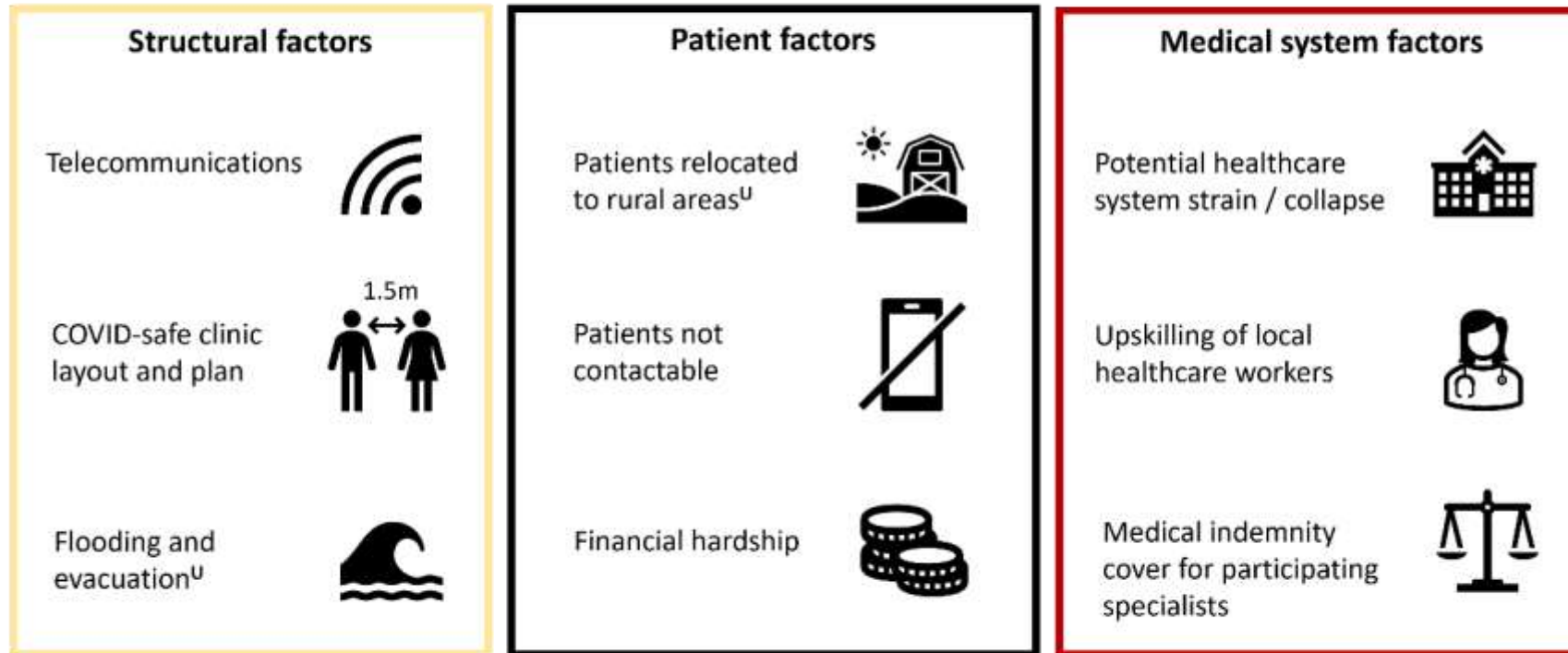
Table 1. Characteristics of patients seen at clinics

Number	23
Mean age (years)	25.9 ± 7.2
Male gender (%)	6 (26.1%)
Live in Dili (%)	18 (78.3%)
Description of cardiac disease	12 rheumatic mitral valve disease 4 unrepaired congenital cardiac disease 3 post-procedural review 2 multivalvular rheumatic heart disease 1 rheumatic aortic valve disease 1 uncertain – further investigations required

Table 2. Themes of success and shortfall in the online telehealth clinic

	Functioned well	Could be improved
Structural factors	<ul style="list-style-type: none"> Internet and live videoconferencing functioned better than expected Multi-room clinic experience to expedite patient flow in a COVID-safe manner 	
Patient factors	<ul style="list-style-type: none"> Patients comfortable with online clinic experience Relative punctuality 	<ul style="list-style-type: none"> See larger number of patients at future clinics Low recall rate of schedule patients Very low number of new referrals
Medical system factors	<ul style="list-style-type: none"> Medical system not under excessive strain: able to conduct clinics Excellent quality of echocardiographic images even after online transmission 	

CONSTRUCTING AN INTERNATIONAL CARDIAC TELEHEALTH SERVICE AMIDST THE COVID-19 PANDEMIC : THEMES IDENTIFIED IN CLINIC PLANNING



^U = challenge unique to Timor-Leste in terms of clinic planning

Figure 1. Multiple concerns were raised and addressed by clinicians and administrative staff in Australia and Timor-Leste prior to conducting online telehealth clinics.

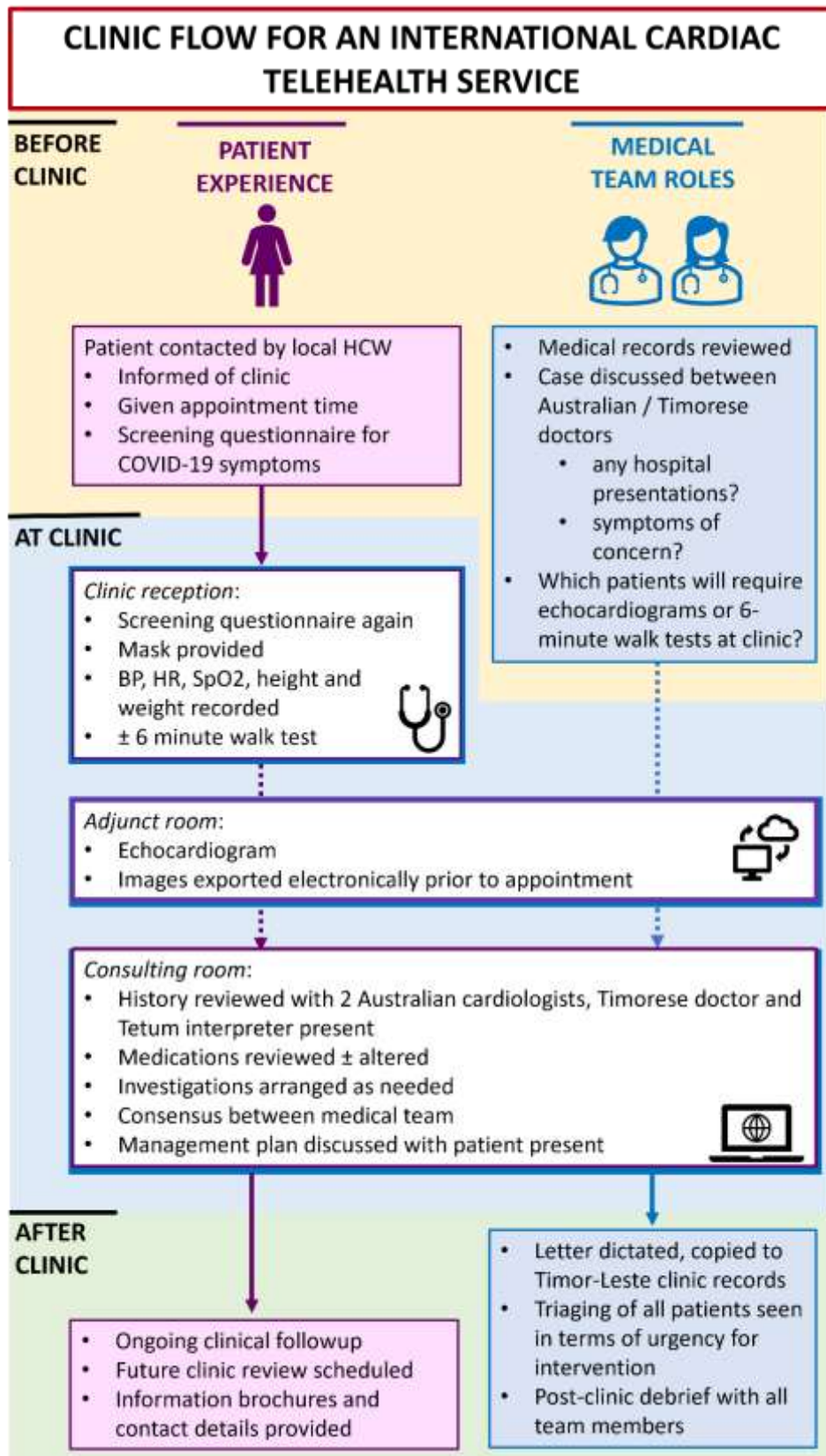


Figure 2. Following a scoping review identifying concerns with challenges relating to an online telehealth clinic, a protocol for clinic conduct was designed. HCW = healthcare worker.

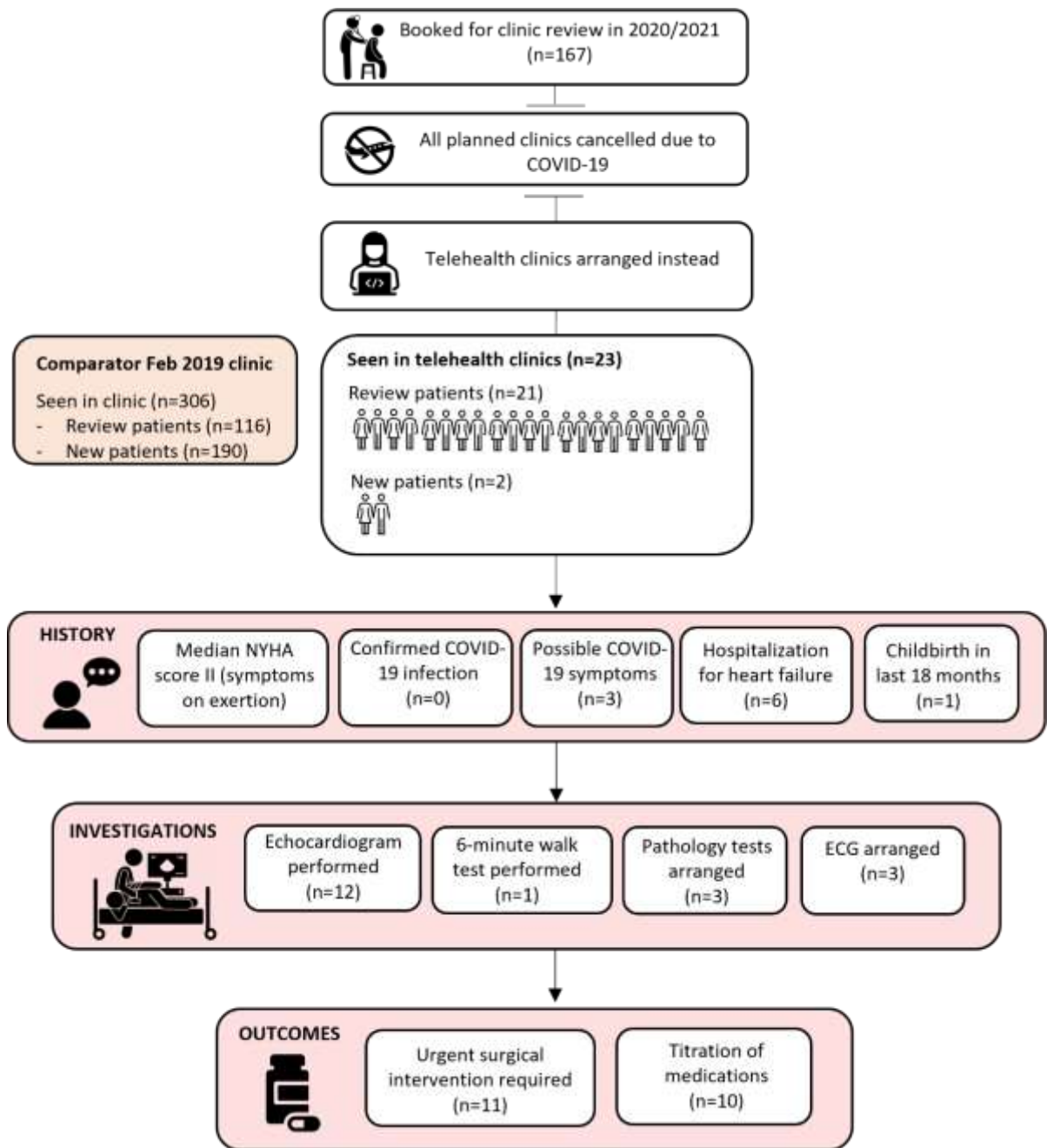


Figure 3. Flow-chart of patients seen at online telehealth clinics and their outcomes. ECG = electrocardiogram; NYHA = New York Heart Association.

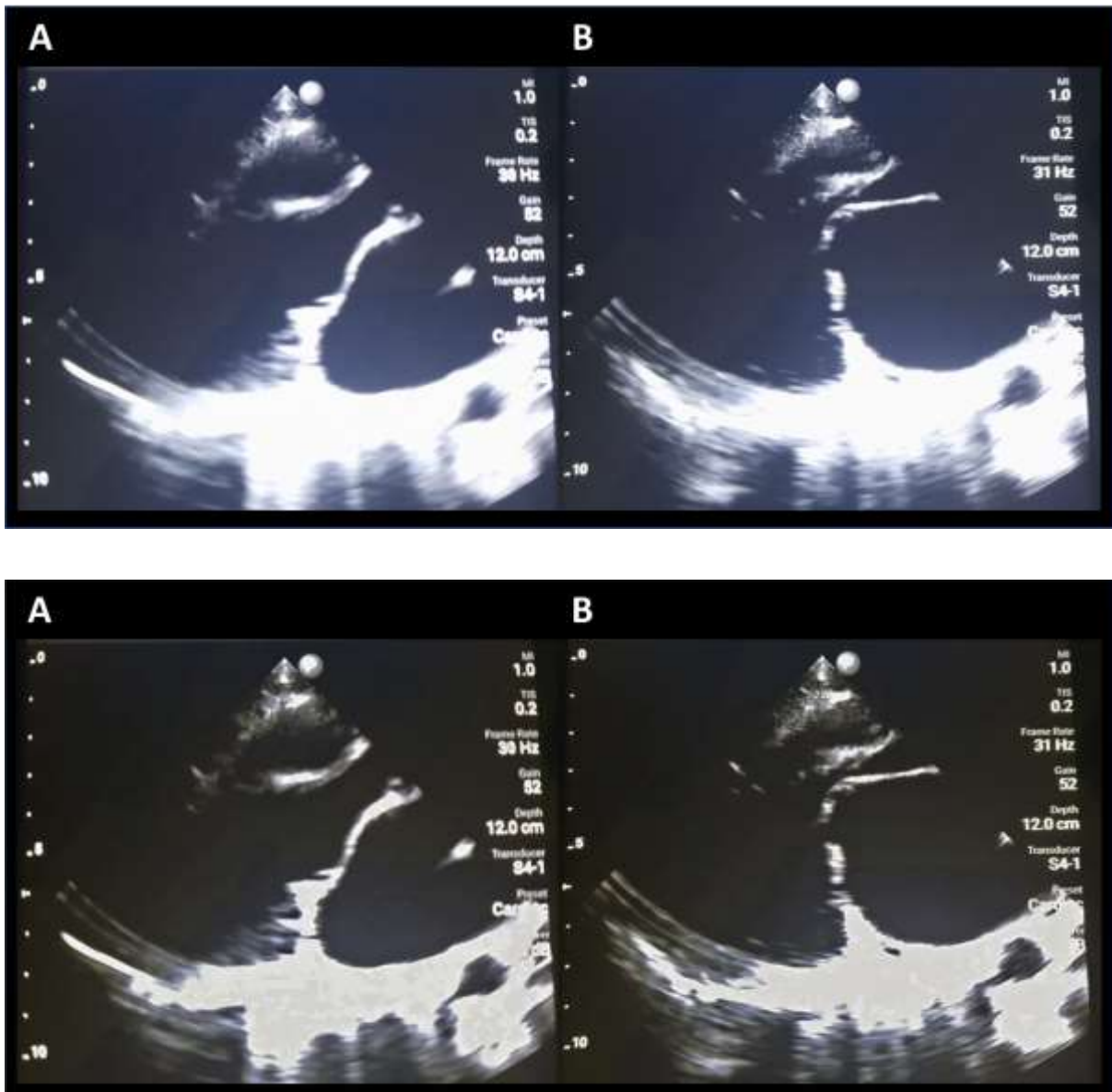


Figure 4. Echocardiographic images were obtained by local healthcare workers using handheld ultrasound machines and transmitted in a de-identified form using free cross-platform messaging services. This is a parasternal long-axis view, demonstrating A. Thickened rheumatic mitral valve in systole with left atrial enlargement e B. Mitral stenosis (diastole) with posterior leaflet restriction and diastolic doming of the anterior mitral valve leaflet, creating the classic 'hockey-stick' sign of rheumatic mitral valve disease.