

Improving services for chronic non-communicable diseases in Samoa: an implementation research study using the care cascade framework

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Samoa is a Polynesian island state in the South Pacific with two main islands (Upolu and Savai'i) and an estimated population of 196,130 people in 2018.¹ The country has recently graduated to upper-middle-income status with a gross national income (GNI) per capita of 4,190 (current US\$) in 2018.¹ Over the past decade, government health expenditure has increased as a proportion of total government spending and relative to GDP. Samoa's domestic private spending (12.8% of total health spending in 2016) is low compared to other Pacific Island Countries (PICs) and out-of-pocket spending (11.9% in 2016) is at the average level for PICs.¹

Life expectancy at birth of 73 years in 2017 in Samoa and an infant mortality rate of 13.6 per 1,000 live births in 2018 compare favourably to other PIC nations and the wider East Asia Pacific region.¹ Improvements in these key health indicators in recent decades have been driven by the decreasing burden of maternal and neonatal conditions and respiratory and enteric infections.² In contrast, 66% of premature deaths are now due to non-communicable diseases (NCDs) especially ischemic heart disease, type 2 diabetes and associated chronic kidney disease, ischemic stroke, and hypertensive heart disease, which have been rapidly increasing in prevalence over time.² These diseases are almost entirely attributable to metabolic risk factors and

Abstract

Objective: Samoa needs to intensify the response to the growing non-communicable disease burden. This study aimed to assess bottlenecks in the care continuum and identify possible solutions.

Methods: The mixed-methods study used the cascade framework as an analysis tool and hypertension as a tracer condition for chronic non-communicable diseases. Household survey data were integrated with medical record data of hypertension patients and results from focus group discussions with patients and healthcare providers.

Results: Hypertension prevalence was 38.1% but only 4.7% of hypertensive individuals had controlled blood pressure. There were large gaps in the care continuum especially at screening and referral due to multiple socio-cultural, economic and service delivery constraints.

Conclusions: In Samoa, care for chronic non-communicable diseases is not effectively addressing patient needs. This calls for better health communication, demand creation, treatment support, nutritional interventions and health service redesign, with a focus on primary healthcare and effective patient and community engagement.

Implications for public health: The proposed actions can improve the reach, accessibility, quality and effectiveness of Samoa's chronic care services. Health system redesign is necessary to ensure continuity of care and more effective primary prevention. The findings are useful for other countries in the region facing similar challenges.

Key words: Pacific Island Countries, non-communicable diseases, chronic care models, care cascade, primary healthcare

place high demands on the health system for chronic care.

In response, the Government of Samoa has made NCD control and people-centred health services a priority in its Strategy for Development and issued the National NCD Policy 2019–2023.³ In 2015, it contextualised and piloted WHO's Package of Essential Non-communicable disease (PEN) interventions

and collected implementation experiences.⁴ The PEN Fa'a Samoa ('PEN the Samoan way') is oriented toward community participation and outreach services. In line with the original WHO design, it places emphasis on early detection of NCDs, referral of high-risk groups to rural district health facilities for treatment and follow-up and enhancing population awareness of NCD risk factors;

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the Samoan adaptation uses village women's committees, which were traditionally responsible for community health, for implementation. Several villages from the islands of Upolu and Savai'i were selected for participation in a pilot phase with community-based NCD screening in early 2015 showing very high levels of NCD risk factors.⁴ A World Bank NCD cost analysis in 2017 flagged low hypertension treatment levels in Samoa as an issue of particular concern.⁵ Low treatment levels combined with insufficient prevention of metabolic risks suggested that the continuum of care for chronic NCDs is sub-optimal in Samoa.

To support the government in improving NCD care, the World Bank and the Samoan Ministry of Health (MOH) jointly conducted an implementation research study in 2018–2019 on chronic care, using hypertension as a tracer condition. The objective was to identify breakpoints and gaps in the continuum of hypertension care and recommend potential solutions for improving service delivery. This entailed: a) a detailed assessment of attainment at each cascade stage, and the barriers and facilitators of attainment at each stage of hypertension care; b) setting these results into the context of care-seeking behaviours and service provision including PEN Fa'a activities; and c) presentation of evidence-based recommendations on how to strengthen health services to improve hypertension and chronic disease management in Samoa. Given hypertension is only one of the chronic conditions requiring long-term retention in care, we explored this theme more broadly with patients and providers. To learn from previous efforts and inform future programming, the analysis reflected on the experiences of PEN Fa'a Samoa and the impact it had had on the hypertension cascade in PEN compared to non-PEN villages. The study findings can inform Samoa's national policy formulation and the World Bank's Health System Strengthening Project, which aims to improve the quality and efficiency of NCD prevention and control in Samoa.^{6,7} As the first in the Pacific Region to do an implementation cascade study, other PICs may also draw on the study results.

Methods

The study used a mixed-methods (quantitative and qualitative) approach and used the cascade framework as an analysis

tool, and hypertension as a tracer condition. The cascade framework is widely used for the assessment of disease control programs that require multiple contacts with a healthcare client to reach a desired outcome, such as HIV treatment⁸ and the long-term management of NCDs.^{9,10} The approach presents diagnosis, treatment and monitoring data in a way that intuitively makes sense to a wide range of people. It describes people's progression on the pathway of care with visuals that provide a powerful summary of where care processes stall and impact is lost. The cascade can also be used to better understand why people are dropping out of the service delivery chain and what opportunities there are to bring them back and keep them in to help them thrive. In order to bring together the most appropriate data across the entire care cascade, our analysis drew on the following diverse data sources: a household survey, medical files of registered hypertension patients, and focus group discussions with hypertension cases and healthcare providers.

Household survey

This survey was purposively conducted in two PEN villages (village 1 on Upolu Island, village 2 on Savai'i Island) and two non-PEN villages (village 3 on Upolu Island, village 4 on Savai'i Island) in November–December 2018. These villages were selected based on their relatively large number of residents and participation in the PEN pilot. Adults aged ≥ 20 were randomly selected from a household list and, after obtaining written, informed consent, were interviewed. The questionnaire covered socio-demographic characteristics, knowledge of NCDs, health service use and access to care, hypertension screening history, diagnosis and treatment, chronic treatments and treatment adherence, and – for PEN Fa'a villages – screening experiences within the program and referral patterns. Blood pressure (BP), height, body weight and waist circumference were measured in duplicate by trained study staff using standardised protocols and averaged for use in analysis.

Medical files of registered hypertension patients

Existing routine data was extracted by study team members at the three health facilities serving the survey villages in November 2018 (the records system was paper-based and not centralised, prohibiting complete examination of receipt of care). Only patients

who had been registered as hypertension cases for at least one year were eligible, as the study aimed to determine treatment monitoring and BP control. The aim was to randomly select 100 patient files at each of three health facilities serving the survey villages. The medical record review extracted patient data from the day of registration (date, BP result, bodyweight), the date of treatment start, prescribed medications, diabetes information (diagnosis date, treatments), BP results from the last two visits, the most recent bodyweight and laboratory results (HbA1C, cholesterol, glucose) and any hospital admission data.

Individuals selected from the hypertension registers were independent of the household survey sample and represented a different population (although some random overlap may have existed). The cascade approach links these two groups at the cascade stage of treatment, so the entire cascade of hypertension care can be constructed using the most accurate data for each stage, including clinical data on guideline-compatible BP monitoring and BP control levels while in hypertension care. The survey and medical record data were used without weighting or adjustments across villages and health facilities, respectively.

Focus group discussions with hypertension cases and healthcare providers

Three focus group discussions (FGDs) were conducted in February 2019, with separate discussions for females and males who had been diagnosed with hypertension and with nurses from Upolu and Savai'i health facilities. FGDs were only conducted in the Upolu village that had participated in the PEN program (village 1), due to travel restrictions after a cyclone that prohibited ferry travel to Savai'i. Participants were eligible for the focus groups based on survey response indicating: 1) a failure to seek further evaluation at the health centre following their positive (hypertensive) BP screen; 2) having sought evaluation at the health centre but not currently taking hypertension medication; and/or 3) had started taking hypertension medication. Focus group members were randomly selected from eligible participants in each of these categories for an invitation to take part; group members were representative of the eligible participants in each category in terms of age, education and income.

We defined the cascade stages for the hypertension cascade as shown in Table 1.

In terms of severity of hypertension, three stages were distinguished (all mmHg): Stage 1 (systolic BP 140-159 or diastolic BP 90-99); stage 2 (systolic BP 160-179 or diastolic BP 100-109); and stage 3 (systolic BP 180+ or diastolic BP 110+).

Quantitative data were analysed descriptively with simple proportions calculated. Survey populations were evaluated for comparability across socioeconomic variables using statistical testing. Discrete variables were compared using the chi-square test or Fisher's exact test when appropriate (e.g. proportion ever screened, proportion with successful referral) and two-sided t-tests were used for continuous variables (e.g. waist circumference measurement). No adjustments were made for facility-level clustering of the patient data. Although it was sometimes necessary to recruit more than one participant per household to increase the survey sample, no adjustment for household-level (or village-level) clustering was made in the analysis of the survey data.

Qualitative data from audio files recorded during the FGDs were transcribed verbatim in Samoan; transcripts were reviewed by a second Samoan-speaking researcher for accuracy before translation into English. Codes for the analysis were developed by two of the authors (NLH and MSR) from an initial reading of the transcripts and were based on the main interview questions as well as emergent themes. Transcripts were reviewed by at least two coders who met to compare and agree on final codes. Since the qualitative analysis was designed to support the quantitative findings, rather than generate new theory, a thematic analysis was conducted in which individual codes relevant to understanding the quantitative findings were read in aggregate and summarised. Quotes presented here were selected to illustrate the results and participants' colloquial language is retained.

The household survey and FGDs were conducted by research partners Lutia I Puava Ae Mapu I Fagalele in collaboration with Yale School of Public Health; patient data were extracted from health records by personnel from the Samoa MOH. The study protocol, data collection instruments and informed consent forms for research participants were reviewed and approved by the Human Research Committee of the Samoa MOH.

Table 1: Cascade stages, definitions and data sources.

Stage/Cascade column	Definition and cascade calculations	Data source
Hypertension	Survey participants who had: Systolic BP ≥ 140 mmHg, or Diastolic BP ≥ 90 mmHg, or Reported use of oral medication for high BP (the value used in the analysis was the average of two BP measurements taken at least 5 minutes apart during the survey). The survey participants classified as hypertensive formed the denominator of the hypertension cascade (=100%)	BP measurements during household survey
Ever screened	Numerator: Number of individuals reporting that they had ever had their BP measured Denominator: All individuals classified as hypertensive in survey	Interview and BP measurement during household survey
Screened last 12 months	Numerator: Number of individuals reporting that they had had their BP measured in the last 12 months Denominator: All individuals classified as hypertensive in survey	Interview during household survey
Diagnosed	Numerator: Number of individuals reporting to have been diagnosed with high BP or hypertension by a health worker Denominator: All individuals classified as hypertensive in survey	Interview during household survey
On treatment	Numerator: Number of individuals reporting to be taking medicine for high BP or hypertension Denominator: All individuals classified as hypertensive in survey	Interview during household survey
Monitoring BP last 90 days	Among the sampled patients in hypertension care, the proportion with evidence of BP measurement recorded by the health facility staff in their file, during the 90 days prior to the patient file review. This proportion was then applied to the previous cascade stage of 'on treatment'.	Medical files of clinic-registered hypertension patients sampled for file review
BP control	Among the sampled patients in hypertension care, the proportion with the last recorded BP result meeting the BP target of $<140/90$ mmHg ($<130/80$ mmHg for co-morbid patients with diabetes). This proportion was then applied to the cascade stage of 'on treatment'.	Medical files of clinic-registered hypertension patients sampled for file review

Note:
BP = Blood pressure

Results

The household survey provided data on BP levels from 554 men, 555 non-pregnant women and 98 women with current or recent (past 12 months) pregnancy (see Supplementary Table S1 for samples in each village). There were no differences in the age composition and the average number of years of education of participants from PEN and non-PEN villages. A greater proportion of participants in PEN villages were married; non-pregnant women were responsible for this difference (81.9% of women in PEN villages were married vs. 73.4% in non-PEN villages). A greater proportion of participants in PEN villages had a college/university education compared to non-PEN villages (41.8% vs. 35.3%), this was borderline statistically significant ($p=0.05$; driven by the non-pregnant women). Furthermore, there were significant differences in employment status between PEN and non-PEN villages, but the differences driving the association were in the less common categories (self-employed, retired, other), not unemployed vs. employed. The medical file review provided data on a total of 300 patients in hypertension care in Faleolo and Lufilufi Health Centres (both Upolu) and Sataua Rural District

Hospital (Savai'i), see Supplementary Table S2. There were 115 male and 185 female patients included, their median age was virtually the same (67.8 vs. 68.0 years).

Implementation cascade for hypertension

The prevalence of hypertension in the 1,207 adults aged ≥ 20 years assessed in the survey was 38.1% (see Table S1 for participants' characteristics). This population, classified as having hypertension by either having elevated BP (35.6%) upon measurement or normal blood pressure upon measurement but reporting use of anti-hypertensive medication (2.5%), formed the denominator for the implementation cascade. Hypertension prevalence and mean resting BP levels by sample characteristic are shown in Supplementary Figure S1 and Table S3). As expected, hypertension levels were higher among older persons (reaching 65% hypertension prevalence in persons aged 70 and older) and persons with high body mass index (BMI), reaching 43% in persons with BMI ≥ 30 ; the effect of BMI was stronger in men, with the proportion of participants with hypertension twice as high in men with obesity versus those with healthy weight.

In line with the pathology of diabetes, hypertension was much more frequent in the 78 survey participants reporting a diagnosis of diabetes (63% hypertension prevalence). As education level increased, prevalence of hypertension decreased. There were no significant differences in hypertension prevalence between PEN and non-PEN villages.

The implementation cascade for hypertension is shown in Figure 1, with the 221 men and 201 women classified as having hypertension representing the 100% column and proportions calculated from the medical patient files then applied to the previous cascade stage (see Table 1 definitions and data sources for each cascade stage). There were large gaps at every cascade stage along the service continuum. The insufficient screening coverage and incomplete referral accrued, resulting in only one-quarter of all individuals with hypertension having been diagnosed. These drop-offs, combined with gaps in effective treatment coverage among diagnosed cases and sub-optimal patient monitoring, led to fewer than 5% of those with hypertension having control of their condition, in our estimation, using the cascade framework for analysis.

Figure 1 also summarises the barriers and facilitators across the stages of service delivery identified during FGDs and survey interviews with participants with hypertension and healthcare providers. Dominant underlying factors impacting care-seeking behaviours were low-risk perception among younger adults and a view, primarily among older people, that hypertension is a normal condition to have.

At his age, if his blood pressure is normal, he could be someone from another planet. (Male FGD participant)

The ability to pay for treatment and transport to the health facility were also important factors reducing service uptake across the continuum. The availability of hypertension drugs, the paucity of prescribing clinicians, and waiting times in the rural health facilities were identified as additional major barriers to treatment adherence. Furthermore, the asymptomatic nature of hypertension was poorly understood, both as a precursor to disease and as a silent, chronic condition necessitating life-long treatment.

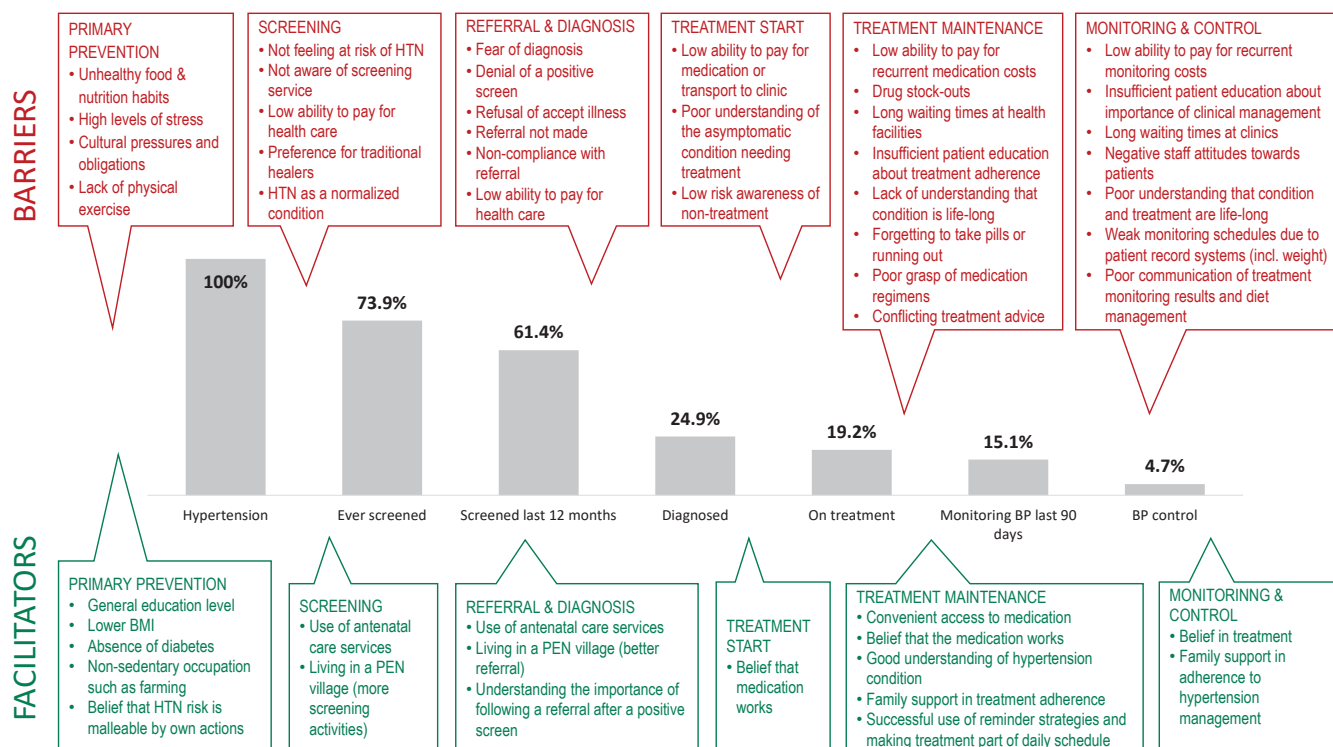
Having obtained an overview of gaps and challenges in the continuity of care, the study further explored issues affecting each

stage of the chronic care continuum, using hypertension as a tracer.

Primary prevention of hypertension

The PEN assessments in 2015 had identified high alcohol use and smoking in men and low levels of physical activity among adults as chief contributors to hypertension.¹¹ The STEPS survey conducted in 2013 reported high levels of obesity as a major contributor to the NCD epidemic.¹² During our FGDs, unhealthy food and stress were by far the most commonly mentioned causes of hypertension by male and female community members. Reported access to fruit and vegetables was relatively high among survey participants with 61% consuming fruit and vegetables several times a day. However, 26% consumed fruit or vegetables less than once a day. Stress and unhealthy food, sometimes linked to the food-oriented culture in Samoa's home and church life, were seen as contributors to the NCD epidemic by community members, patients and care providers. A minority of comments concerned exercising, genetic predisposition and changes in the physical environment. Many providers talked about the past when they could offer more prevention services; they

Figure 1: Samoa hypertension implementation cascade with barriers and facilitators in hypertension control identified by patients and healthcare providers.



Note:

Cascade based on individuals classified as hypertensive in the household survey: 221 hypertensive men (of 554 surveyed) and 201 hypertensive non-pregnant women (of 555 surveyed).

Sources: 2018 World Bank Samoa Hypertension Cascade Study household survey and focus group discussions.

found the pressure on health services now too great. Some providers felt that patients needed education to ensure they used the correct preventative health services.

While the FGDs indicated awareness of various NCD risk factors including nutritional habits, obesity was nevertheless highly prevalent. Nine out of ten survey participants were classified as having overweight or obesity based on BMI. Women had especially high rates of severe obesity: one in four women had a BMI ≥ 40 putting them at very high risk of hypertension, diabetes and other conditions. Women in all age groups and men in all groups aged above 40 years had an average waist circumference measurement indicative of increased risk for developing metabolic complications (Supplementary Figure S2).

In the two PEN villages, significantly fewer men had obesity compared to men in the non-PEN villages, and the average waist circumference was about 3 cm smaller in PEN men compared to non-PEN men ($p=0.02$). In the PEN villages, 91% of survey respondents recalled learning about causes of hypertension, especially foods high in sugar, fat and salt, but it was not possible to attribute these anthropometric differences directly to the public education activities during the PEN pilot. One primary prevention program that was widely discussed during the FGDs was the METI nutrition program that promoted a whole-food, plant-based diet. METI (Matuaileoo Environment Trust, Inc.) is a local organisation that does village outreach visits, organises seminars, and publishes testimonies of patients who have reversed their hypertension or diabetes through dietary changes; however, FGD discussants noted that participation in this program sometimes led to discontinuation of hypertension or diabetes medication without clinical supervision.

Screening for hypertension

Screening coverage was higher among women compared to men: 70% of women had ever been screened for hypertension, and 57% in the last 12 months, compared to 62% and 47% of men, respectively. Higher screening rates in the additional, small group of women with current or recent pregnancy (76% ever, 58% recent) suggested that some of the sex differences arise through antenatal care-based BP measurements.

Significantly more PEN village residents had ever been screened for hypertension

compared to non-PEN residents (70.0% vs. 62.4%, $p=0.021$), and this difference was driven by higher BP testing in PEN village men (66.3%) compared to non-PEN village men (56.2%). In the PEN screening campaign itself, only 23.5% of interviewed PEN residents recalled having participated. The main reasons for non-participation were not knowing about the activity or being away from the village at the time of program implementation (Supplementary Figure S3). Although the peak of PEN Fa'a Samoa pilot implementation was in 2015, more BP screening seemed to still take place among PEN village residents. In particular, there was a significant difference between PEN and non-PEN villages in the frequency of BP checks during the past 12 months: 37.9% of PEN village residents had had their BP checked three times or more compared to 29.9% of non-PEN villagers ($p<0.001$), indicating that the women's committee representatives continued the screening in the PEN villages according to the pilot plan. PEN village residents were more likely to have received a BP check at their nearest government facility, while those in non-PEN villages were more frequently receiving BP checks outside of the health system (e.g. by their local women's committee, at screening days). This may also have reflected proximity to local health centres, since the two PEN villages were geographically closer to a health facility.

Many statements from FGD participants illustrated the concerns around checking BP for identifying disease. Despite statements about the 'normalcy' of the condition, there was a pervasive belief that a diagnosis with high BP meant that someone would die; participants often believed that hypertension was 'inevitable' with age, but also something to be feared.

I suppose if for the first time you are being told that you have high blood pressure, you would be devastated, and very worried, thinking that you will die soon. (Male FGD participant)

Referral and diagnosis of positive screens

We explored referral as a breakpoint in the continuum of care between screening and diagnosis. According to survey responses, seven out of 10 positive screens received a referral to a health facility while three did not get referred for diagnosis. The local health facilities reported as the location for referral were, with one exception, always the closest facility to the survey village (Lufilufi for village

3; Faleolo for village 1; Sataua for villages 2 and 4); therefore, cases were not being referred to district hospitals other than their own. Overall, PEN villagers had significantly better follow-up with a healthcare provider after being referred (69% followed the referral successfully, $p=0.033$) compared to non-PEN (50% followed referral), and while 5% of PEN villagers did not follow their referral, 18% in non-PEN villages failed to follow it ($p=0.016$), suggesting that PEN villagers may have a better understanding of the importance of seeking hypertension care once screened as with a high risk of having hypertension.

In the FGDs, there were many examples given of participants having positive BP screens but not following the referral advice, or refusing to acknowledge the screening result. This lack of taking the test result stood in contrast with the anxiety the participants themselves expressed about hypertension. Disbelief about the positive BP test may have prevented some from following the referral, and/or fears of getting a confirmed hypertension diagnosis.

Care providers agreed that successful referral is very important as many new cases were identified through community outreach rather than patients attending the clinics for screening. However, healthcare provider follow-up for those who were identified to have hypertension during village outreach was lacking. While providers did acknowledge the challenges patients might experience in accessing health services because of cost or distance, their conversation centred on 'denial' or alternative treatment-seeking behaviour.

Most of the work we conduct is our programs in the villages and we find new cases and patients with long-term high blood pressure and they stay home because they don't want to come to the hospital. (Nurse, Provider FG)

There are very many people that have the mentality of denial or refuse to accept their illness. (Nurse, Provider FG)

Treatment initiation and maintenance

The first BP measurements recorded in the medical files of the 300 hypertension patients reviewed in this study (Supplementary Table S2) reinforce the impression that diagnosis and onset of clinical management were often late, with 36% having stage 2 and 35% having stage 3 hypertension at registration (7% of patients had normal BP levels at registration and might therefore not have been newly diagnosed cases but patients transferring from another health facility).

Treatment initiation had been accompanied by counselling for 76% of patients; counselling covered a range of topics but did not appear to focus on real-life challenges and practical tips to master these, how to prevent treatment interruptions, or metabolic risk factors. Some hypertension patients thought that dietary changes could be effective as a cure for high BP (e.g. consuming more vegetables, soups and green tea). Men, in particular, believed that exercise could play a role in managing the condition or even replacing medication. The FGD with nurses related how they evaluate suspect cases using their history and BP result and a decision is made between immediate referral, local follow-up appointment or lifestyle education.

Once diagnosed with hypertension, the majority of cases initiated treatment swiftly with household survey responses and patient file data providing a similar picture. Treatment rates within one month were at 86% among diagnosed cases in the survey and at 93% among patients on the hypertension registers (which likely contained some patients already on treatment when registering). Some participants said they were offered treatment but did not accept it (6%), but not being offered treatment was rare (3%). Our analysis of medicine prescription patterns distinguished four types of hypertension drugs and three types of supportive medication (aspirin, statins, beta-blockers). Only 14% were prescribed a combination of four or more of the seven types of drugs, and even among patients aged ≥ 65 , hypertension polypharmacy (5+ drugs) was very low at 2%. At the time of the patient record review, 44% of hypertension cases were also known to have type 2 diabetes. Among these 132 co-morbid patients, 82% were on oral glucose-lowering drugs and 11% on insulin alone or in combination with oral drugs, while 7% did not have any diabetes medication recorded in their file.

Treatment monitoring

According to Samoan guidelines, hypertension patients should have their BP checked at least every 90 days and be tested for glucose and cholesterol (LDL) at least every 12 months. We looked for evidence in the patient files to establish whether these monitoring checks were being carried out and where the gaps were (we could not include checks that had not been recorded in the patient file). Overall, 61% of the

hypertension patients included in the medical file review had evidence of a BP check within 90 days, and 61% had glucose and cholesterol checked within 12 months; differences between male and female patients were very small.

Well me, I never try other way to cure my blood pressure, only pills. I'm happy for that way. My blood pressure always hundred forty that's tell me it is not high. (Female FGD participant)

Among patients with co-morbid diabetes, only 51% had a monitoring BP within 90 days recorded (63% among hypertension-only patients). Coverage of annual cholesterol and glucose and/or HbA1C tests was 68% in co-morbid and 56% in hypertension-only patients. It is possible that some diabetes cases were receiving additional care elsewhere, which was not noted in their medical files.

Counselling and education about a healthy diet, physical activity and weight control are part of the clinical management of hypertension and diabetes care. To assess whether patients successfully implement the advice, a patient's body weight (or BMI) needs to be monitored and evaluated as part of the treatment plan. Only 13% of the reviewed patients had their weight recorded at registration, and body weight was poorly monitored with 93% of patients having no bodyweight record in their file for the past 12 months. Furthermore, only 38% of patients had their height recorded in addition to their weight, suggesting that BMI was rarely systematically monitored.

Patient advice primarily focused on medication, whereas advice on nutrition or weight-loss was less common. Counselling was for many patients a one-off service despite the chronicity of hypertension and the majority of patients failing to meet BP targets. Considering all hypertension education obtained by patients in the clinic settings, information about medication schedules, managing missing doses, side effects, switching regimens, and sustained adherence even when feeling fine were poorly covered based on survey responses.

Blood pressure control: attainments and shortfalls

We used the last recorded BP result in the patient files to determine if patients achieved BP control by meeting the treatment target level. Overall, only 19% of the reviewed patients in hypertension care achieved

their BP target, and the proportion of male and female patients was identical. Among co-morbid patients, only 9% achieved the BP target of $<130/80$ mmHg, but among those without diabetes, 34% achieved the target of $<140/90$ mmHg. If all hypertension was considered including undiagnosed cases, as per our implementation cascade (Figure 1), hypertension control at the population level was below 5%. However, significantly better screening coverage in women translated into higher linkage to care and clinical management levels. Consequently, at population level, women with hypertension were three times more likely to start treatment and three times more likely to attain BP control (7.2%) compared to men with hypertension (2.5%, $p=0.023$).

There were many reasons for patients to lack treatment success, and many of them were rooted in their perceptions of the limitations within the health services to address hypertension. Table 2 summarises the main themes and perspectives shared by FGD participants. Dominant themes were the lack of human resources in primary care facilities leading to sub-optimal service provision and patients forced to seek care at a higher level. According to the participants, access to anti-hypertension medication was hampered by insufficient supply and inconvenient refill systems. Other major emerging themes related to poor communication between healthcare users and providers, missed opportunities to educate and counsel patients, and inadequate equipment to provide quality care.

After having assessed the cascade using hypertension as a tracer for chronic conditions, the study addressed two final issues relevant to future NCD strategy: People's perspectives on Samoa's significant PEN Fa'a implementation experiences, and the wider picture of chronic care provision and health-seeking behaviours.

Reflections about the PEN Fa'a experiences

The PEN Fa'a program had made a significant difference to screening coverage in the pilot villages, which translated to slightly better diagnosis and treatment levels in PEN areas, but no benefit to BP control levels according to this assessment.

Most female FGD participants appeared familiar with the PEN program and expressed appreciation about the training of facilitators

and getting care closer to home. But many felt PEN had been under-resourced and hinged on unpaid community-based work. They also expressed concern about the poor level of feedback about PEN results by the MOH. Men were less familiar with PEN but expressed a desire to see the program return to their village. In case of PEN continuation, women suggested that PEN could be combined with METI programming and that the PEN intervention should also address hypertension treatment, monitoring and staying in care, and not only screening.

Care providers expressed appreciation for the underlying goals of the PEN, believing that if implemented correctly it could help the healthcare system to support community outreach. They questioned PEN's sustainability and attributed the failure to fully launch PEN to insufficient investment in training, human resources, equipment and data recording systems, resulting in a relatively small reach of PEN. Providers expressed enthusiasm for re-starting or expanding the program but highlighted the need for PEN to better align and coordinate with health facilities.

... most of the time if there's not enough strips to measure the sugar then we keep waiting for them. Or else they will just do their job but no treatments... But they do not just measure the sugar, measure the blood and then just leave it there and gone, without nothing given to them for treatments. (Female FGD participant)

I remember vividly it was my participation in the PEN that first revealed I have high blood pressure. I was given a referral, and I saw a doctor and it was the start of my treatment. (Male FGD participant)

Chronic conditions and care-seeking behaviours

In the household survey, 29% of women and 16% of men said that they had at least one chronic disease or condition, which was most often high BP or diabetes, especially in women, who have higher diagnosis rates. Some of the other conditions the respondents had, such as heart disease, eye problems and kidney disease, may be complications of undiagnosed, untreated or uncontrolled hypertension and diabetes. Another nutrition-related disease reported by 2.3% of men was gout.

Almost three-quarters of patients with chronic conditions were looked after by doctors primarily, and about one in 10

Table 2: Perspectives of patients and health care providers about key factors affecting the clinical management of hypertension.

Theme	Perspectives from FGD participants
Weak primary health care services with no doctors stationed in the primary health care facilities and poor triage to higher level care	<p>"In Savai'i we have four interns working here to cover all of Savai'i, they cover Savai'i and are based in Tuasivi. So it's impossible for four interns, three and the doctor who is a registrar to come once a week." (Nurse)</p> <p>"... there is a Doctor however they are not able to bring a lot of medication, therefore when it leaves the people no choice but to go to Apia to received their medications." (Nurse)</p> <p>"... by the time we come to visit them the medication was finished that's what happen" (Female patient)</p> <p>"In the morning, in the hospital it's many of them - they are coming for treatment, but not all the time we've got anti-hypertensive drugs, because only the central ones in the hospital. And the doctor comes in only once a week, so we advise them to come when the doctors visit..." (Nurse)</p> <p>"I got there at 9.30am but I went out at 3.30pm... I can't wait in the hospital for 7 hours." (Male patient)</p> <p>"We keep waiting a long time for the doctors or the people working at the medical records those who passing the papers to us to see the doctors." (Female patient)</p>
Anti-hypertensive drugs: Inconvenient drug refill system, and drug shortages and stock-outs in public health facilities	<p>"The bad thing we can't take it [prescriptions] at any pharmacy, only at the hospital, but the pharmacy they can't, just the hospital" (Female patient)</p> <p>"But I went all the way to Apia it's a long trip and far away more money to spend to get the medication from Apia but this is not a right thing to do." (Female patient)</p> <p>"... there are a lot of medications here for anti-hypertension medicine that is not available in our clinic... so they have to wait for the outreach clinic to come out and deliver. They go, and at the time they come the next week there is no Doctor." (Nurse)</p>
Poor patient-provider communication	<p>"I consulted the doctor, she prescribed blood pressure medication for me. I took my medication for a while when I started coughing regularly, I consulted a private doctor and she advise me to stop taking my hypertension medication. Still worried and confused about my blood pressure, I started taking herbal medicine." (Male patient)</p> <p>"I went to see him [my Family Doctor] as part of my monthly check up. He said your blood pressure is kind of high but not really high. So I did not really know what he meant... He went on and prescribed some medication with the advice to take every day. By doing this, I'm more confused." (Male patient)</p> <p>"... he measure my blood well and he said ohhh it too high, and I told her can you try another machine, and she do it. The result say it's normal, so on that time I'm so confusing..." (Female patient)</p>
Insufficient patient education and counselling, leading to sub-optimal patient treatment behaviors	<p>"Sometimes my checks came out high and some are low... I ask the doctor if my high blood can be cure completely by the medication I'm taking. He happily informed me that medication can certainly cure high blood pressure. Since there is no change for the better in my case, I'm giving up on my medication" (Male patient)</p> <p>"We had a program, on Mondays, Wednesdays and Fridays. We have a PA system that the Nurse use to talk from the mic, in explaining NCDs in every way in-front of the waiting area... like how you feel when you have hypertension? What food you need to eat? What things you need to do? How to protect you from NCDs? The days that the pharmacy open, their appointments and everything for their information... but at the moment, the short of our midwives, stop that program from continuing." (Nurse)</p>
Negative attitudes of health staff	<p>"... and the way they look to people they argue and show their long faces to people, those faces they show to the people make them [the patients] shy to share with others they already had those diseases." (Female patient)</p> <p>"I don't want to see the doctors at the health center because of the attitude of the doctor." (Male patient)</p>
Challenges with equipment due to insufficient maintenance and difficulty getting quality replacements	<p>"So I know one of the big challenges of the role of nurse manager in terms of diagnostics and management is the small amount of resources and technology and other things, to help us to do our jobs" (Nurse)</p> <p>"We need the quality. The best quality, not the quantity. We order and the pharmacy provide us the sphygs [sphygmomanometers] but the problem with the sphyg when you pump it high - like about 200 - it's broken." (Nurse)</p> <p>"... we leave it... because there are no resources for cholesterol. Also the blood pressure monitor, we told them it was broken, we need another one but there is no respond, and suddenly stopped." (Nurse)</p>

Source: Patient and provider focus group discussions, 2018

received care mainly from nurses. Only 6% had a dietician involved in their care, and few said they received care from counsellors or traditional healers. Patients spent on average 50 Samoan tālā (US\$20) per month on chronic care, just over 5% of an average monthly income. Similar to hypertension treatment, patients with chronic conditions stopped medical treatment due to problems

accessing medications and getting timely medication refills, feeling better or having normal test results, not prioritising health and wellbeing, and opting for alternative treatment approaches.

Patients identified possible solutions to improve continuity of care for chronic conditions including hypertension by responding to questionnaire options about

improvements that might be made (Figure 2). Health facility capacity to provide efficient, flexible and friendly NCD services received a lot of support. Better patient information was also welcomed by many individuals, including more counselling at the start of treatment. Several strategies for supporting patients to maintain treatment and navigate challenges were also favoured, among them phone reminders and community support groups, as well as convenient drug refill options. Participants from PEN villages were consistently more likely than those from non-PEN villages to welcome ideas on adherence support and were more familiar with the use of community health workers. This may be due to the better NCD awareness in PEN villages as the intervention had sensitised the community to the issues around NCD care.

Discussion

Despite sustained efforts and local recognition of many of the issues raised here (as reflected in the National NCD Policy), Samoa's health service delivery system is still not sufficiently equipped to tackle the rising NCD epidemic. It is hospital-centric, with patients bypassing the under-resourced

primary health care (PHC) level and doctors concentrated in Apia's referral hospital. The PHC facilities lack the capacity to diagnose and manage chronic NCDs⁷ and the village women's committees, historically a key part of the PHC system, had lost their importance until PEN Fa'a Samoa provided a new entry point.

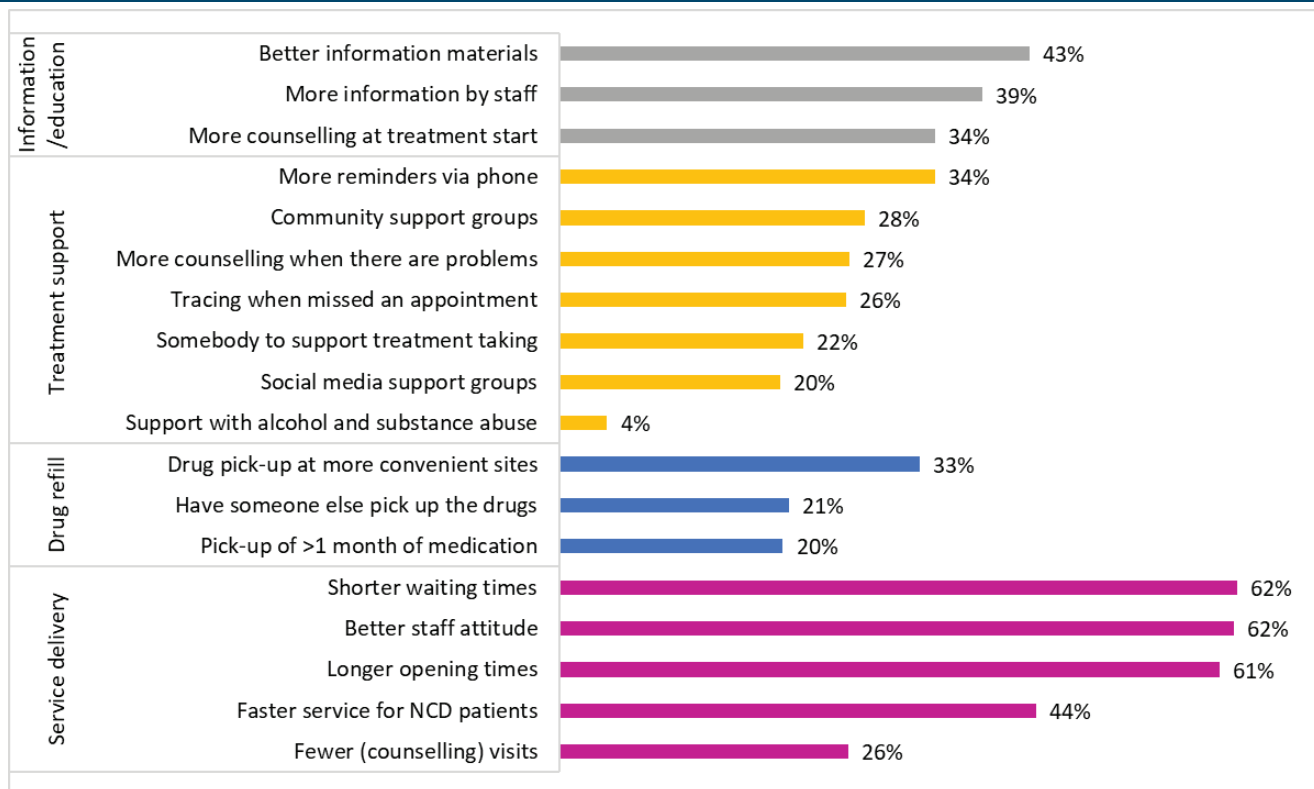
This implementation research demonstrated how access barriers and service delivery bottlenecks affect the continuity of hypertension care in Samoa, leading to very few cases having treatment success. It confirmed that hypertension is under-treated⁵ and that current NCD service provision has serious gaps at all stages of engagement in hypertension care, thereby precipitating a high incidence of cardiovascular diseases.

The 33.1% prevalence of *elevated BP* (140+ or 90+ mmHg, excluding survey participants who were normotensive but treated, to be able to compare to the PEN Fa'a Samoa data) was close to the 32.7% reported from the PEN Fa'a Samoa assessment in 2015 of adults aged ≥18 years.⁴ The prevalence of *hypertension* in this survey (38.1%) was, however, higher than the hypertension prevalence in the 2013 STEPS survey (28.9%). High BP, together with

high fasting plasma glucose and high BMI, is driving premature mortality in Samoan adults.¹³ While this study did not focus on type 2 diabetes, it found comparatively lower BP monitoring and control in those with co-morbid hypertension and diabetes, and high hypertension prevalence. The study also showed the excess hypertension risk due to high BMI and the poor tracking of patient weight as a risk factor and indicator of lifestyle change. Comparison with the 2013 STEPS suggested recent increases in obesity of about nine percentage points among men and eight percentage points in women over the five years (2013 obesity rates M: 44.8%, F: 68.8% (ages 18–64 years) versus M: 53.4%, F: 76.6% (ages 20+ years) in 2018).¹²

The study participants were generally familiar with the importance of healthy eating, but weight control was not prominent in any of the discussions or interviews. Given the strong links between hypertension, obesity and diabetes, the nutrition-related advice seemed too infrequent or not well recalled by patients. Despite a general reliance on imported convenience foods, many people are still involved in subsistence farming or fruit production and this represents an opportunity for improving nutritional habits

Figure 2: Patients' proposed strategies to improve treatment adherence and outcomes.



Source: Hypertension household survey, World Bank 2018.

within a larger effort of primary prevention of NCDs.

The study confirmed a basic level of awareness about NCDs in the population, however, concerns about being diagnosed with hypertension negatively affect demand for services. Many people seem to associate the condition with cardiovascular emergencies and death. Also, the burden on patients to get their mostly asymptomatic hypertension treated and monitored seems large and connected to considerable costs, inconveniences and anxieties due to drug stock-outs, contradicting advice or confusing test results. Therefore, people often ignore a positive screening result or the referral advice to obtain a full diagnosis or default treatment. In line with other reports,¹⁴ this study found that staff limitations create bottlenecks in service delivery, limiting the reach and scale of NCD care with low screening and sub-optimal referral preventing entry into hypertension care. Furthermore, the study provided information on chronic conditions, which can further inform Samoa's health system re-design. Almost one in four people reported having a chronic condition and considerable recurrent spending for transport to the clinic, drugs and consultations.

While the study was not designed to evaluate the legacy of the PEN pilot, it served to collect some service coverage data and stakeholder perspectives about it. According to this study, the PEN pilot might have positively influenced the coverage of BP screening, especially among men, and referral of suspected cases. Recall of unhealthy food items as causes of hypertension was strong and the significantly lower prevalence of obesity in PEN village men and their lower waist circumference are worth mentioning (although without longitudinal data this cannot be directly attributed to the PEN project). Stakeholders shared the view that PEN should be expanded to cover nutrition education and NCD care and treatment. Going forward, the actions identified through this implementation research, in addition to the valuable lessons learnt in the PEN Fa'a Samoa pilot, can inform work plans and innovation under the National NCD Policy 2019-2023.

Taking into account the body of collected opinions and the facilitators of chronic care (Figure 1), the study identified six key areas for action to improve the continuity of chronic care in Samoa and address the NCD epidemic (Table 3).

Table 3. Identified key areas for action to strengthen care of chronic NCDs.

Area	Actions
Health service redesign and repurposing of PHC	Improve PHC-level chronic care provision by redesigning how services are delivered, making better use of outreach, triage, decentralisation (deploying doctors to rural health facilities), and task shifting, so that chronic care, including prevention, screening, referral and case management, is coordinated and delivered by PHC workers and through training and facility-level optimisations gains efficiency, attractiveness, quality and impact.
Community empowerment and multisectoral response	Engage and empower village-based groups to improve the effectiveness of NCD screening, referral, diagnosis, and treatment adherence, by expanding the community aspects of PEN Fa'a Samoa that worked well, broadening the response with non-health actors especially agriculture and education sectors, and directing effort to closing the gaps in the continuum of hypertension care. Scale up PEN Fa'a Samoa screening to more villages.
Step-up public education campaign against risk factors	Scale-up public awareness communications on nutrition, hypertension, and diabetes, using multiple media and channels and harmonized, evidence-informed messages and branding strategies, and by linking demand creation for screening to screening provision.
Patient-centred care-treatment adherence and retention in care	Improve provider understandings of the reasons for non-adherence to hypertension treatment at the individual patient level, and provide targeted adherence support to patients, by building better knowledge among health personnel on continuity of and barriers to NCD care, and how to advise patients on practical issues helping with treatment adherence, while also trialing new approaches.
Nutrition behaviors to reduce metabolic risk factors	Ensure body weight monitoring and the management of overweight and obesity is an integral part of hypertension and diabetes care, by systematizing weight measurements, patient feedback, and clinical action, and increasing the number and capacity of dietitians and nutrition workers.
Fit-for-purpose management information systems	Building country's health information system including digital patient tracking system, ensure the patient-level medical record system is more effectively used to support frontline staff in providing chronic care to patients, by maximising the patient interaction through joint treatment planning and phone-based communication, and by using data dashboards, lists, exception reports, and other functionalities for proactive data use in patient management.
Supply, availability and refill of NCD medicines at the PHC level	Update the national essential drug list according to WHO recommendations and ensure the stable procurement of the essential drugs. Improve the planning and projection of medication usage for each of the PHC facilities through better patient tracking and better patient registration.

The strength of this study was to triangulate data from multiple sources using a 'convergent mixed-methods design' with parallel quantitative and qualitative data strands.¹⁵ This approach has, for instance, been used in a service delivery study on NCD care in Bangladesh¹⁶ and in an implementation research study on a mental health intervention in India.¹⁷ However, the study had a number of limitations: First, it only sampled survey participants from four of Samoa's 265 villages, and hypertension patients from the registers of three of Samoa's 11 health facilities at the district hospital/health centre level, and is therefore not a representative sample of the population. However, every attempt was made to minimise participation bias and there were no refusals among survey respondents. The quality of BP and anthropometric measurements were closely controlled and all but one of the interviewed participants had two valid BP measurements for analysis. Second, no adjustments were made to account for household-level or village-level clustering in the survey data, and for facility-level clustering in the patient data, which increases the risk of type II errors. Third, key information such as history of BP screening and medication adherence was recalled by participants, as is typical for this type of

assessment, so there may have been recall bias. Fourth, our methodological approach associated household survey data on people reporting hypertension treatment with medical record data on hypertension patients in treatment. While this approach was purposefully chosen, it can bias the cascade estimates on BP monitoring and control as it doesn't involve the same individuals or sample composition. In fact, in the household survey, 73% of all persons reporting to be on hypertension treatment were female, and in the health facility sample, 62% were female. Fifth, participants for the FGDs were randomly selected, an approach that cannot ensure maximum diversity in the sample. Sixth, reporting of chronic conditions was lower than expected, possibly due to desirability bias, underdiagnosis, or normalising of conditions (e.g. joint pain, headaches, mental health conditions, gastric ulcers). Given the aim of this study and the comparison with other data, we feel confident that the quality of findings is valid for use in decision support by the Samoan Government.

Conclusions

The Government of Samoa recognises NCDs as an increasing problem and has taken important actions to address the challenge.

The pilot phase of PEN Fa'a Samoa has demonstrated the importance of adapting the PEN approach to Samoa's social and cultural context.⁴ Strengthening service delivery along the care cascade for chronic NCDs will complement other important measures such as the increased taxation on imported food with high fat, sugar and salt content, and on alcohol and tobacco. This study outlines possible actions, drawing from solutions identified by stakeholders. A repurposing of the PHC facilities and revitalised health promotion with increased community and patient engagement will help to tackle the NCD epidemic in Samoa. Being the first in the region to conduct an implementation cascade study, the results from this study in Samoa can be used to inform the design of NCD control interventions in other Pacific Island Countries.

Key message

Using hypertension as a tracer condition for chronic NCDs, this mixed-methods study shows that the primary healthcare system in Samoa needs to be redesigned and health promotion revitalised. Practical and feasible solutions include making better use of outreach, triage, decentralisation (deploying doctors to rural health facilities), task shifting, and expanding the community aspects of PEN Fa'a Samoa that are proven to work.

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Supporting Information

Additional supporting information may be found in the online version of this article:

Supplementary Table S1. Characteristics of participants in the household survey.

Supplementary Table S2. Characteristics of hypertension patients included in the medical file review.

Supplementary Table S3. Resting blood pressure by population and village.

Supplementary Figure S1. Hypertension prevalence in Samoa for men and women by characteristics.

Supplementary Figure S2. Average waist circumference by age group and gender.

Supplementary Figure S3. Coverage by PEN Fa'a Samoa screening and reasons for non-coverage.