

Progress and strength of response against non-communicable diseases in the US-affiliated Pacific Island jurisdictions, 2010-2021

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Objective: To determine the effectiveness of the response to the 2010 declared regional noncommunicable diseases (NCDs) emergency in nine US-affiliated Pacific Island jurisdictions.

Methods: Vital statistics and risk prevalence surveys were retrospectively reviewed using 14 standardized NCD risk, prevalence and death rate indicators to measure changes in health status over time. NCD risk and prevalence change scores were derived from subsets of these indicators, and NCD composite death rates were examined. An NCD strength-of-intervention score derived from a standardized regional monitoring tool provided measures for assessing responses aimed at curbing risk factors, prevalence and death rates. Associations between the strength-of-intervention score and changes in health status were examined.

Results: Pairs of values were available for 97 of 126 individual comparisons for 14 core indicators in nine jurisdictions. The composite mean prevalence of all risk factors across the jurisdictions between baseline and follow-up (26.7% versus 24.3%, $P=0.34$) and the composite mean diabetes and hypertension prevalence (28.3% versus 28.2%, $P=0.98$) were unchanged, while NCD death rates increased (483.0 versus 521.9 per 100 000 per year, $P<0.01$). The composite strength-of-intervention score for the region was 37.2%. Higher strength-of-intervention scores were associated with improvements in health indicators.

Discussion: Despite some improvements in selected NCD indicators at the jurisdiction level, there was no significant overall change in the prevalence of risk factors, diabetes and hypertension, and death rates have continued to increase since the NCD emergency declaration. However, the adoption of public sector NCD interventions was associated with improvements in health indicators.

Globally, the Pacific Islands are largely considered to be among the regions most severely affected by noncommunicable diseases (NCDs).¹⁻⁵ In the Pacific, NCDs are fuelled by several behavioural risk factors, including substantial rates of tobacco use and problem alcohol drinking, and (especially) patterns of diet and physical activity that result in a high prevalence of obesity.⁶⁻⁹ In 2010, the Pacific Islands Health Officers Association (PIHOA), comprising the heads of health in the US-affiliated Pacific Islands (USAPI) – American Samoa, Commonwealth of the Northern Mariana Islands, Guam, Republic of Palau, Republic of the Marshall Islands, and four states of the Federated States of Micronesia (Chuuk, Kosrae, Pohnpei and Yap) – issued a regional declaration of health emergency for NCDs. The declaration called

for an intensified response, guided by data.¹⁰ Shortly after the declaration, PIHOA convened technical working groups to develop a framework for tracking the progress of the NCD emergency, and for monitoring the response to NCDs and the impact of the declaration. With this effort, the USAPI became the first international group to recognize and organize a systematic response to NCDs. The surveillance framework includes the following indicators with standardized data definitions: youth and adult tobacco smoking and tobacco chewing; youth alcohol use and adult binge drinking; youth and adult overweight and obesity; adult diabetes and hypertension prevalence; and cause-specific death rates for cancer, cardiovascular disease, chronic lung disease and diabetes (Unpublished document: USAPI NCD Core Monitoring

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& Surveillance Framework. Honolulu, Hawaii: Pacific Islands Health Officers Association; 2012. Available on request). In contrast with infectious disease surveillance, which largely depends on tracking incident cases, NCD surveillance depends on conducting periodic, population-based surveys. These must have consistent survey questions, physical measurement methods, age groups and sampling across jurisdictions and over time. Although difficult to deploy repeatedly and consistently, population-based surveys give a much clearer picture than institution-based incidence data of the burden of NCDs in populations. The use of a predetermined, balanced set of risk, disease prevalence and death indicators across multiple jurisdictions for the past decade is a major strength of this surveillance system. The framework aligns closely with the subsequently released World Health Organization (WHO) monitoring framework, although the USAPI framework measures not just the core indicators recommended by WHO but also youth risk factors.¹¹

The USAPI framework called for monitoring the uptake of a specific suite of NCD policy measures developed by a Pacific-wide technical working group, the Pacific Monitoring Alliance for NCD Action (MANA). The MANA coordination team includes NCD policy experts from the Pacific Community (SPC), WHO, PIHOA and the Pacific Centre for Prevention of Obesity at Fiji National University. Indicator definitions and assessment criteria were developed, refined and piloted by the coordination team, and endorsed by the Pacific Heads of Health and Pacific Health Ministers groups in 2017, with the inaugural assessment report released in 2018. Progress is tracked via annual country-based assessments and reported on a MANA dashboard, which is updated every 1–3 years by each member jurisdiction, with assistance from MANA technical partners.

The MANA dashboard comprises 31 NCD interventions covering six categories including preventive policies for tobacco, policies for alcohol, policies for food environments and physical activity, health services system changes, leadership and governance structures, and surveillance and monitoring systems.^{12,13} The use of predefined measures for both health status and response across multiple jurisdictions presents an opportunity to systematically examine progress in the fight against NCDs.

In this report, we examine progress in the USAPI jurisdictions by examining the change in health status indicators in the USAPI framework in the 10 years since the emergency declaration. We also look at the strength of the response against NCDs in the USAPI (reflected as intervention scores derived from the MANA dashboards from USAPI jurisdictions) and examine the relationship between the strength of intervention and changes in population health status.

METHODS

In this study, risk, disease prevalence and death rates were collected for each USAPI jurisdiction using historical sources dating back to 2000. Sources included surveys from the WHO STEPwise Approach to NCD Risk Factor Surveillance (STEPS); customized, PIHOA-facilitated, community-based hybrid NCD adult surveys; US Centers for Disease Control and Prevention (CDC) Behavioral Risk Factor Surveillance System surveys; CDC Youth Risk Behavior Surveillance surveys; PIHOA-facilitated, customized Rapid High School Youth Surveys; the US National Center for Health Statistics mortality databases in the three US territories (Guam, the Commonwealth of the Northern Mariana Islands and American Samoa); and jurisdiction vital statistics office databases for non-territory USAPI (the Freely Associated States of Palau, Marshall Islands and the four states of the Federated States of Micronesia). Convenience surveys were excluded. Prevalence estimates were compared from surveys that used consistent sampling, collection methods and survey questions as set forth in the USAPI NCD Core Surveillance Framework and Data Dictionary.

NCD premature mortality rates were 5-year running averages, for those aged 30–69 years, age-adjusted to the WHO 2000–2025 standard population.¹⁴ Prevalence of overweight or obesity, diabetes and hypertension were reported only from studies that included physical measurements of height, weight, blood pressure and fasting blood sugars, omitting those that relied solely on self-reported disease status.

The date of the PIHOA emergency declaration, May 2010, was considered the reference date for baseline measures. For each jurisdiction, the earliest available data point between 2010 and 2013 was used as the baseline value for each indicator, whereas the most recent avail-

able data point from 2015 to the present was considered to represent “recent status”. If no baseline data point was available between 2010 and 2013, we used data from surveys conducted before 2010.

A composite indicator (the NCD risk and disease prevalence change score) was calculated as the average change from baseline in the prevalence of all risk factors, diabetes and hypertension. In addition, category-specific change scores were produced by averaging the change in prevalence for all indicators within each of the following categories: tobacco, alcohol, nutrition and physical activity, and diabetes and hypertension. A composite NCD death rate indicator was calculated as the sum of death rates for cardiovascular disease, cancer, diabetes and chronic lung disease. These composite indicators were used to assess overall changes from baseline for each category, by jurisdiction and for the region as a whole (e.g. the average of all baseline tobacco use prevalence values for youth and adults across the region was compared with the average of values at follow-up, to assess overall tobacco trends). The scores were not adjusted for the differing population sizes of the jurisdictions; they represent the average of changes that each individual jurisdiction has managed to achieve, and do not measure the true changes in prevalence of the USAPI population as a whole. Only data points having both baseline and follow-up values were included in composite indicator calculations. Confidence intervals (CI) for NCD risk and disease prevalence change score results were calculated using t-tests at a 95% confidence level. Changes in death rates were assessed using Z-scores.

The strength of the NCD response was gauged using strength-of-intervention scores derived from the MANA dashboard. Each intervention item in the dashboard was awarded between 0 and 5 points, based on the strength of the intervention. Intervention scores were calculated as the current percentage of maximum possible points awarded for a group of response items, and were stratified by intervention category and by jurisdiction.

Intervention scores range from 0% (no actions taken) to 100% (all recommended interventions are implemented). For example, the regional tobacco intervention score is the sum of the points for all tobacco items across all nine jurisdictions, divided by the number of points possible $\times 100\%$, whereas the overall interven-

tion score is the sum of the points for all intervention items across all nine jurisdictions divided by the number of points possible $\times 100\%$.

The relation between strength-of-intervention and change in health status indicators was explored using linear regression, with the intervention score for each category of intervention (tobacco, alcohol, nutrition or physical activity, and health services) as the independent variable. The log of the relative change from baseline of the corresponding health status indicators (i.e. for tobacco, alcohol, overweight or obesity, and NCD death rates) was used as the dependent variable (with tobacco intervention items linked to tobacco indicators, alcohol items to alcohol indicators, nutrition or physical activity items linked to overweight and obesity indicators, and clinical health services linked to NCD death rates). For example, if baseline versus recent cigarette use prevalence is 50% versus 30%, the relative change is $(0.30 - 0.50) / 0.50 = -0.40$.

The relationship between average intervention scores across all intervention categories (as the independent variable) and the log of the relative change of all health status indicators (as the dependent variable) was used to provide an overall picture of how well the nine jurisdictions were doing relative to one another. Log transformation of the relative change in health status indicators was employed to address skewness of the outcome data (skewness value = 3.69 for relative change in health status indicators versus -0.41 for log transformed data).

RESULTS

Risk factors and disease prevalence, and their changes from baseline varied considerably across jurisdictions (**Tables 1, 2**). The NCD risk and disease prevalence change scores for each indicator category (95% CI) were as follows: alcohol -4.2% ($-7.7, -0.7$), tobacco -2.4% ($-5.3, 0.0$), overweight and obesity $+1.5\%$ ($-4.5, +7.4$), and diabetes and hypertension -0.4% ($-5.1, +4.3$). Negative scores indicate improvement and positive scores worsening of health status over time.

Death rates also varied substantially across jurisdictions (**Table 3**). Composite premature NCD death rates (including deaths from cardiovascular disease, cancer,

Table 1. Alcohol, tobacco and overweight and obesity prevalence data points for youth and adults for the US-affiliated Pacific Islands, 2010–2021

USAPI	Alcohol consumption								
	Youth				Adult				
	Baseline % (n)	Recent % (n)	Change, %	P	Baseline % (n)	Recent % (n)	Change, %	P	
American Samoa	22.8 ^a (2577)	23.1 ^b (1940)	+0.3	0.81	27.9 ^c (843)	13.0 ^d (741)	-14.9	< 0.01	
CNMI	41.4 ^e (2291)	23.3 ^f (1621)	-18.1	< 0.01	–	23.0 ^g (1089)	–	–	
FSM	Chuuk	17.4 ^h (943)	13.1 ⁱ (1280)	-4.3	< 0.01	10.9 ^j (2034)	13.0 ^k (2046)	+2.1	0.04
	Kosrae	25.6 ^l (551)	13.2 ^m (479)	-12.4	< 0.01	18.7 ⁿ (412)	21.0 ^o (599)	+2.3	0.37
	Pohnpei	30.3 ^p (2386)	37.3 ^q (1726)	+7.0	< 0.01	26.0 ^r (2227)	26.1 ^s (1139)	+0.1	0.95
	Yap	–	45.5 ^t (699)	–	–	29.9 ^u (4271)	–	–	–
Guam	24.7 ^v (1385)	18.2 ^w (980)	-6.5	< 0.01	18.3 ^x (501)	17.9 ^y (1534)	-0.4	0.83	
RMI	40.8 ^z (1381)	–	–	–	–	15.4 ^{aa} (2693)	–	–	
Palau	43.4 ^{bb} (875)	37.4 ^{cc} (434)	-6.0	0.04	–	27.3 ^{dd} (1404)	–	–	
Alcohol change score		Percentage (95% confidence interval)							
		-4.2 (-7.7, -0.7)							
USAPI	Smoking tobacco								
	Youth				Adult				
	Baseline % (n)	Recent % (n)	Change, %	P	Baseline % (n)	Recent % (n)	Change, %	P	
American Samoa	16.4 ^a (2653)	21.7 ^b (2091)	+5.3	< 0.01	39.4 ^c (2044)	23.9 ^d (744)	-15.5	< 0.01	
CNMI	23.9 ^e (2186)	12.4 ^f (1808)	-11.5	< 0.01	28.6 ^{ee} (1429)	25.2 ^g (1089)	-3.4	0.06	
FSM	Chuuk	19.3 ^h (942)	17.4 ⁱ (1284)	-1.9	0.25	33.1 ^j (2034)	32.3 ^k (2046)	-0.8	0.59
	Kosrae	27.8 ^l (551)	25.6 ^m (480)	-2.2	0.26	20.4 ⁿ (412)	18.7 ^o (604)	-1.7	0.50
	Pohnpei	21.7 ^p (2386)	30.6 ^q (1726)	+8.9	< 0.1	29.2 ^r (2227)	21.3 ^s (1134)	-7.9	< 0.01
	Yap	–	39.0 ^t (699)	–	–	18.3 ^u (4274)	–	–	–
Guam	21.9 ^v (1460)	13.3 ^w (1079)	-8.6	< 0.01	30.5 ^x (501)	21.9 ^y (1561)	-8.6	< 0.01	
RMI	31.7 ^z (1381)	30.7 ^{ff} (2056)	-1.0	0.53	24.6 ^{gg} (2998)	23.3 ^{aa} (2677)	-1.3	0.01	
Palau	47.0 ^{bb} (869)	46.8 ^{cc} (427)	-0.2	0.95	16.7 ^{hh} (2184)	16.6 ^{dd} (1404)	-0.1	0.94	
Tobacco change score		Percentage (95% confidence interval)							
		-2.4 (-5.3, 0.0)							
USAPI	Chewing tobacco								
	Youth				Adult				
	Baseline % (n)	Recent % (n)	Change, %	P	Baseline % (n)	Recent % (n)	Change, %	P	
American Samoa	6.1 ^a (2653)	–	–	–	–	–	–	–	
CNMI	35.2 ^e (2186)	15.2 ^f (1857)	-20.0	< 0.01	21.2 ^{ee} (1429)	16.7 ^g (1089)	-4.5	< 0.01	
FSM	Chuuk	24.8 ^h (947)	19.2 ⁱ (1278)	-5.6	< 0.01	22.5 ^j (2034)	15.3 ^k (2047)	-7.2	< 0.01
	Kosrae	30.8 ^l (550)	27.6 ^m (480)	-3.2	0.26	25.7 ⁿ (412)	28.5 ^o (601)	+2.8	0.32
	Pohnpei	21.2 ^p (2386)	22.4 ^q (1726)	+1.2	0.36	26.1 ^r (2227)	48.3 ^s (1121)	+22.2	< 0.01
	Yap	–	60.7 ^t (699)	–	–	83.3 ^u (3543)	–	–	–
Guam	14.0 ^v (1460)	13.5 ^w (1181)	-0.5	0.71	8.5 ^x (501)	4.6 ^y (1562)	-3.9	< 0.01	
RMI	31.1 ^z (1381)	37.4 ^{ff} (2056)	+6.3	< 0.01	–	22.8 ^{aa} (2390)	–	–	
Palau	32.5 ^{bb} (869)	27.7 ^{cc} (560)	-4.8	0.05	48.8 ^{hh} (2184)	45.8 ^{dd} (1404)	-3.0	0.08	
Tobacco change score		Percentage (95% confidence interval)							
		-2.4 (-5.3, 0.0)							

		Overweight and obesity							
		Youth				Adult			
		Baseline % (n)	Recent % (n)	Change, %	P	Baseline % (n)	Recent % (n)	Change, %	P
American Samoa		–	–	–	–	93.1 ^c (1995)	94.7 ^d (699)	+1.6	0.14
CNMI		–	–	–	–	–	63.9 ^e (1032)	–	–
FSM	Chuuk	46.8 ^h (957)	44.6 ⁱ (1283)	–2.2	0.30	67.8 ⁱ (2034)	63.1 ^k (1332)	–4.7	< 0.01
	Kosrae	36.9 ^j (529)	36.3 ^m (479)	–0.6	0.84	–	52.6 ^o (576)	–	–
	Pohnpei	27.4 ^p (2386)	42.4 ^q (1720)	+15.0	< 0.01	59.9 ^r (2227)	80.4 ^s (1130)	+20.5	< 0.01
	Yap	29.8 ^u (610)	33.4 ^t (699)	+3.6	0.16	70.7 ^u (4191)	–	–	–
Guam		43.0 ⁱⁱ (6434)	45.0 ⁱⁱ (7706)	+2.0	0.02	–	–	–	–
RMI		–	26.5 ^{ff} (2056)	–	–	68.5 ^{gg} (1610)	72.8 ^{aa} (2570)	+4.3	< 0.01
Palau		65.0 ^{bb}	44.7 ^{cc}	–20.3	< 0.01	75.7 ^{hh} (2133)	72.5 ^{dd} (1143)	–3.2	0.04
Overweight and obesity change score		Percentage (95% confidence interval) +1.5 (–4.5, +7.4)							

Change scores represent the average per jurisdiction change from baseline of risk factors for alcohol, tobacco and overweight and obesity. They are not adjusted for differing population sizes and are not an estimate of prevalence changes in the USAPI population as a whole. Average values do not include missing values and their pairs (e.g. Yap baseline and recent youth drinking, American Samoa baseline and recent youth chewing tobacco, and Marshall Islands baseline and recent overweight and obesity).

CNMI: Commonwealth of the Northern Mariana Islands; FSM: Federated States of Micronesia; RMI: Republic of the Marshall Islands; USAPI: US-affiliated Pacific Islands. See additional notes following Table 3.

Table 2. Diabetes and hypertension prevalence data points for adults for the US-affiliated Pacific Islands, 2010–2021

USAPI	Adult diabetes prevalence				
	Baseline % (n)	Recent % (n)	Change, %	P	
American Samoa	47.3 ^{kk} (342)	45.4 (746)	–1.9	0.55	
CNMI	–	–	–	–	
FSM	Chuuk	35.4 ^l (2034)	–	–	
	Kosrae	–	29.4 ^o (603)	–	
	Pohnpei	24.7 ^r (2227)	23.5 ^s (1146)	–1.2	0.44
	Yap	–	–	–	–
Guam	–	–	–	–	
RMI	20.7 ^{gg} (878)	25.3 ^{aa} (2559)	+4.6	< 0.01	
Palau	20.6 ^{hh} (1895)	22.2 ^{dd} (1335)	+1.6	0.27	
Adult hypertension prevalence					
	Baseline % (n)	Recent % (n)	Change, %	P	
American Samoa	34.2 ^c (2050)	39.7 ^d (725)	+5.5	0.01	
CNMI	–	56.0 ^q (1063)	–	–	
FSM	Chuuk	11.9 ^j (2034)	12.4 ^k (1357)	+0.5	0.66
	Kosrae	–	27.0 ^o (610)	–	–
	Pohnpei	22.9 ^r (2227)	21.6 ^s (1143)	–1.3	0.39
	Yap	30.9 ^u (4285)	–	–	–
Guam	–	–	–	–	
RMI	11.6 ^{gg} (1670)	19.2 ^{aa} (2657)	+7.6	< 0.01	
Palau	51.6 ^{hh} (2173)	33.0 ^{dd} (1377)	–18.6	< 0.01	
Diabetes and hypertension change score	Percentage (95% confidence interval) –0.4 (–5.1, +4.3)				

Change scores represent the average per jurisdiction change from baseline of diabetes and hypertension prevalence. They are not adjusted for differing population sizes and are not an estimate of prevalence changes in the USAPI population as a whole. Average values do not include missing values and their pairs.

CNMI: Commonwealth of the Northern Mariana Islands; FSM: Federated States of Micronesia; RMI: Republic of the Marshall Islands; USAPI: US-affiliated Pacific Islands. See additional notes following Table 3.

Table 3. Noncommunicable disease premature death rates for the US-affiliated Pacific Islands, 2010–2021^{mm}

	Diabetes			Cardiovascular disease			Cancer			Chronic lung disease			Total		
	Baseline	Recent	P	Baseline	Recent	P	Baseline	Recent	P	Baseline	Recent	P	Baseline	Recent	P
American Samoa	107.4 ⁿⁿ	100.4 ^{oo}	0.64	243.4 ⁿⁿ	237.0 ^{oo}	0.76	110.7 ⁿⁿ	118.6 ^{oo}	0.59	22.8 ⁿⁿ	20.6 ^{oo}	0.73	484.3 ⁿⁿ	476.6 ^{oo}	0.68
CNMI	48.8 ⁿⁿ	41.4 ^{oo}	0.35	164.1 ⁿⁿ	146.8 ^{oo}	0.24	93.3 ⁿⁿ	101.3 ^{oo}	0.49	33.4 ⁿⁿ	7.0 ^{oo}	0.69	339.6 ⁿⁿ	296.5 ^{oo}	<0.01
Chuuk	162.0 ^{pp}	193.2 ^{oo}	0.14	216.6 ^{pp}	252.6 ^{oo}	0.14	78.6 ^{pp}	198.2 ^{oo}	<0.01	23.8 ^{pp}	18.2 ^{oo}	0.45	481.0 ^{pp}	662.2 ^{oo}	<0.01
Kosrae	364.1 ^{pp}	327.6 ^{oo}	0.64	292.0 ^{pp}	335.4 ^{oo}	0.56	170.8 ^{pp}	153.7 ^{oo}	0.75	32.0 ^{pp}	45.1 ^{oo}	0.62	858.9 ^{pp}	861.8 ^{oo}	0.97
Pohnpei	172.0 ^{pp}	186.0 ^{oo}	0.55	251.0 ^{pp}	338.0 ^{oo}	<0.01	127.0 ^{pp}	135.2 ^{oo}	0.68	72.0 ^{pp}	65.7 ^{oo}	0.66	622.0 ^{pp}	724.9 ^{oo}	<0.01
Yap	76.0 ^{pp}	82.2 ^{qq}	0.81	140.2 ^{pp}	159.2 ^{qq}	0.59	306.5 ^{pp}	283.0 ^{qq}	0.64	60.4 ^{pp}	15.0 ^{qq}	0.01	583.1 ^{pp}	539.4 ^{qq}	0.32
Guam	39.9 ⁿⁿ	36.0 ^{oo}	0.39	223.1 ⁿⁿ	243.3 ^{oo}	0.07	111.1 ⁿⁿ	134.3 ^{oo}	<0.01	15.7 ⁿⁿ	9.7 ^{oo}	0.02	389.8 ⁿⁿ	423.3 ^{oo}	<0.01
RMI	428.0 ^{rr}	404.0 ^{qq}	0.42	139.0 ^{rr}	211.0 ^{qq}	<0.01	121.0 ^{rr}	129.9 ^{qq}	0.59	11.0 ^{rr}	17.0 ^{qq}	0.27	699.0 ^{rr}	761.0 ^{qq}	<0.01
Palau	94.0 ^{ss}	65.2 ^{oo}	0.13	266.0 ^{ss}	274.5 ^{oo}	0.80	233.0 ^{ss}	204.7 ^{oo}	0.36	29.0 ^{ss}	32.8 ^{oo}	0.85	622.0 ^{ss}	577.2 ^{oo}	0.23
All USAPI	381.6	368.4	0.42	717.3	791.4	<0.01	406.8	476.3	<0.01	86.7	59.9	<0.01	483.0	521.9	<0.01

CNMI: Commonwealth of the Northern Mariana Islands; FSM: Federated States of Micronesia; RMI: Republic of the Marshall Islands; USAPI: US-affiliated Pacific Islands.

Notes for Tables 1–3:

^a 2011 American Samoa Youth Risk Behavior Survey (high school, grades 9–12)

^b 2015 American Samoa Youth Risk Behavior Survey (high school, grades 9–12)

^c 2004 American Samoa NCD STEPs Survey (25–64 years)

^d 2018 American Samoa Hybrid NCD Survey (25–64 years)

^e 2011 CNMI Youth Risk Behavior Survey (high school, grades 9–12)

^f 2017 CNMI Youth Risk Behavior Survey (high school, grades 9–12)

^g 2016 CNMI Hybrid NCD Survey (≥18 years)

^h 2017 Chuuk Rapid Youth Survey (high school, grades 9–12)

ⁱ 2019 Chuuk Rapid Youth Survey (high school, grades 9–12)

^j 2006 Chuuk Behavioral Risk Factor Surveillance System Survey (18–64 years)

^k 2016 Chuuk NCD STEPs Survey (18–64 years)

^l 2015 Kosrae Rapid Youth Survey (high school, grades 9–12)

^m 2019 Kosrae Rapid Youth Survey (high school, grades 9–12)

ⁿ 2012 Kosrae Behavioral Risk Factor Surveillance Survey (≥18 years)

^o 2019 Kosrae Hybrid NCD Survey (≥18 years)

^p 2015 Pohnpei Rapid Youth Survey (high school, grades 9–12)

^q 2017 Pohnpei Rapid Youth Survey (high school, grades 9–12)

^r 2008 Pohnpei NCD STEPs Survey, as reported in Pohnpei State Department of Health Year 2015 NCD Profile (25–64 years)

^s 2019 Pohnpei Hybrid NCD Survey (≥18 years, but values in table were for adults 25–64 years only)

^t 2016 Yap Rapid Youth Survey (high school, grades 9–12)

^u 2013 Yap Community Health Assessment Survey (youth items 15–18 years; adult items ≥18 years)

^v 2011 Guam Youth Risk Behavior Survey (high school, grades 9–12)

^w 2017 Guam Youth Risk Behavior Survey (high school, grades 9–12)

^x 2011 Guam Behavioral Risk Factor Surveillance Survey (≥18 years)

^y 2017 Guam Behavioral Risk Factor Surveillance Survey (≥18 years)

^z 2011 RMI Youth Risk Behavior Survey (high school, grades 9–12)

^{aa} 2018 RMI Hybrid NCD Survey (18–64 years)

^{bb} 2011 Palau Youth Risk Behavior Survey (high school, grades 9–12)

^{cc} 2015 Palau Youth Risk Behavior Survey (high school, grades 9–12)

^{dd} 2017 Palau Hybrid NCD Survey (25–64 years)

^{ee} 2011 CNMI Behavioral Health Survey (≥18 years)

^{ff} 2016 RMI Joint Global Youth Tobacco & Rapid Youth Survey (high school, grades 9–12)

^{gg} 2002 RMI NCD STEPs Survey (18–64 years)

^{hh} 2012 Palau NCD STEPs Survey (25–64 years)

ⁱⁱ 2015 Guam School BMI Survey (results from grades 9–12 presented)

^{jj} 2019 Guam School BMI Survey (results from grades 9–12 presented)

^{kk} 2004 American Samoa NCD STEPs Survey (25–64 years; cut off for diabetes set at ≥110 mg/dL)

^{ll} 2018 American Samoa Hybrid NCD Survey (25–64 years; cut off for diabetes set at ≥110 mg/dL)

^{mm} Death rates – per 100 000 residents per year – are for those aged 30–69 years, age-adjusted (to the WHO 2000–2025 standard population) five-year running averages. USAPI totals are weighted by the population size of those aged 30–69 years for each jurisdiction

ⁿⁿ Running average, 2006–2010

^{oo} Running average, 2013–2017

^{pp} Running average, 2007–2011

^{qq} Running average, 2014–2018

^{rr} Running average, 2011–2015

^{ss} Running average, 2008–2012

diabetes and chronic lung disease) for the region as a whole increased from a baseline of 483.0 to 521.9 per 100 000 residents aged 30–69 years ($P < 0.01$).

Baseline versus recent death rates

Table 4 shows MANA intervention scores for tobacco, alcohol, overweight or obesity, and health services intervention categories by jurisdiction. The average overall NCD strength-of-intervention score for the region was

37.2%. There was considerable variation in the strength of intervention by category, from 24.9% for nutrition or physical activity to 48.1% for tobacco. The average composite strength-of-intervention score across intervention categories by jurisdiction also varied considerably, from 25.0% for the Republic of the Marshall Islands to 54.8% in Guam.

Log linear regression showed an overall negative relationship between response scores and the log

Table 4. **Strength of noncommunicable disease interventions in the USAPI, 2020**

Response category	Interventions	American Samoa	CNMI	Chuuk (FSM)	Kosrae (FSM)	Pohnpei (FSM)	Yap (FSM)	Guam	RMI	Palau	Total points	Points possible	Intervention score by category (%)
Tobacco	Tobacco excise taxes	4	4	3	3	3	3	3	1	5	29	45	48.1
	Smoke-free environments	5	4	1	4	5	1	5	4	4	33	45	
	Tobacco health warnings	0	2	1	1	1	1	3	2	0	11	45	
	Tobacco advertising, promotion and sponsorship	2	1	1	4	5	1	2	4	5	25	45	
	Tobacco sales and licensing	5	5	0	3	1	0	4	0	5	23	45	
	Tobacco industry interference	0	0	1	1	1	1	0	0	0	4	45	
	Enforcement of laws and regulations related to tobacco	1	3	2	2	2	2	3	0	1	18	27	
Alcohol	Alcohol licensing to restrict sales	5	5	3	3	4	3	5	4	5	37	45	46.4
	Restrict alcohol advertising	0	0	0	0	5	0	2	0	0	7	45	
	Alcohol taxation	2	2	2	2	2	2	2	1	2	17	45	
	Drinking and driving penalties	3	3	2	2	2	2	4	3	4	25	45	
	Enforcement of laws and regulations related to alcohol	1	3	0	0	0	0	3	0	1	10	27	
Nutrition & physical activity	Reducing salt consumption	0	1	5	0	1	5	4	0	3	19	45	24.9
	Eliminating trans-fats	1	1	0	0	0	0	1	1	1	5	45	
	Restricting unhealthy food marketing to children	1	0	0	0	1	0	1	0	1	4	45	
	Food fiscal policies	0	0	3	2	3	3	0	3	0	14	45	
	Healthy food policies in schools	4	2	0	1	1	0	5	1	1	15	45	
	Food-based dietary guidelines	1	1	2	2	2	2	4	3	1	18	45	
	Restrict marketing of breast milk substitutes	0	0	0	0	0	0	0	0	5	5	45	
	Baby-friendly hospitals	2	1	2	0	3	2	0	1	1	12	45	
	Maternity leave and breastfeeding	0	1	1	1	0	1	1	0	1	6	45	
	Compulsory physical education in school curriculum	5	1	1	0	1	1	3	0	1	13	45	
Enforcement of laws and regulations related to nutrition & physical activity	1	3	0	0	0	0	3	0	1	8	27		
Health services	National guidelines for care of main NCDs	4	1	2	1	1	2	4	2	0	17	45	47.4
	Essential drugs	2	5	2	4	4	2	2	1	0	22	45	
	Smoking cessation availability	3	4	3	2	3	3	4	0	3	25	45	
Total points		50	53	37	38	51	37	68	31	51	422	1116	
Points possible		124	124	124	124	124	124	124	124	124	1116		
Intervention score by jurisdiction (%)		40.3	42.7	29.8	30.6	41.1	29.8	54.8	25.0	41.1	Average intervention score = 37.2%		

CNMI: Commonwealth of the Northern Mariana Islands; FSM: Federated States of Micronesia; NCD: noncommunicable disease; RMI: Republic of the Marshall Islands; USAPI: US-affiliated Pacific Islands.

Strength of intervention: Not present = 0 points; under development = 1 point; present but low strength = 2 points; present with medium strength = 3 points; present with higher strength = 4 points; present with highest strength = 5 points. Response scores are calculated as number of points awarded in the category, divided by the total points possible × 100%.

Notes: The original MANA dashboard has 31 indicators grouped into categories for governance, monitoring systems, health service systems, tobacco, alcohol, nutrition and physical activity. For this report, we omitted indicators for governance and monitoring systems, and used the remaining 26 that corresponded directly to intervention categories that match groups of health status indicators in the USAPI NCD Monitoring & Surveillance Framework (i.e. MANA tobacco items for tobacco indicators; alcohol items for alcohol indicators; physical activity and nutrition items for overweight and obesity indicators; and health service items for death rates – since health services are deemed to have the greatest potential impact on NCD death rates in the short-to-medium term). Responses for the NCD interventions in the MANA dashboard are graded using a “traffic light” rating scheme: red denotes that no policy or action has been taken; amber denotes that policy or action is under development; and green denotes that policy or action is in place. When a policy or action is in place, the strength of the actions is assessed using a star system (0–3 stars).¹² For the purposes of this report, the traffic light codes for each intervention were assigned a numerical point score ranging from 0 to 5, with 5 points indicating the strongest response for that intervention. In the MANA dashboard, enforcement of laws and policies related to nutrition, alcohol and tobacco are included as a single item (with higher scores awarded for enforcement of more than one substance). In the present report, enforcement was split into three items: tobacco, alcohol, and nutrition law and policies enforcement. These items were graded on a scale of 0–3: 0 = no enforcement provisions; 1 = enforcement regime under development; 2 = compliance monitoring in place with annual summary reports issued; and 3 = compliance monitoring in place with annual summary reports and evidence of fines or other sanctions given to violators.

of relative changes in health status indicators, with an R^2 of 0.063 and regression line slope of -0.0024 ($P = 0.01$) (Fig. 1). This suggests an average improvement in related health status indicators of 2.7% for every 10% increase in the corresponding response index. Log linear regression also showed a negative relationship between average response scores by jurisdiction and the log of relative changes in health status indicators by jurisdiction (regression line slope = -0.0044 ; $P = 0.02$) (Fig. 2).

DISCUSSION

Through collective action, USAPI countries and territories have defined a consensus set of core NCD response measures and health status indicators, permitting a concerted approach to addressing the NCD crisis and to monitoring progress in the region.

This study shows that, since the NCD emergency declaration in 2010, there was no change in the composite mean prevalence of all risk factors across the USAPI jurisdictions between baseline and follow-up and the composite mean diabetes and hypertension prevalence, whereas NCD death rates significantly increased. There were some improvements in the prevalence of alcohol and tobacco use, and increases in obesity prevalence and NCD death rates. Given these results, it will be difficult to meet the United Nations Sustainable Development Goal 3.4: “By 2030, reduce by one third premature mortality from non-communicable diseases”.¹⁵ NCD prevalence and death rates are largely the result of long-standing behaviours and they change relatively slowly in response to policy measures (although improvements in health services can improve death rates more rapidly). In contrast, risk factor prevalence changes more rapidly in response to effective policy measures; thus, the decline in some risk factors could presage future improvements in disease prevalence and mortality as their benefits accrue over time. The only jurisdiction to show a decrease in NCD death rates, the Northern Mariana Islands, has one of the highest intervention scores.

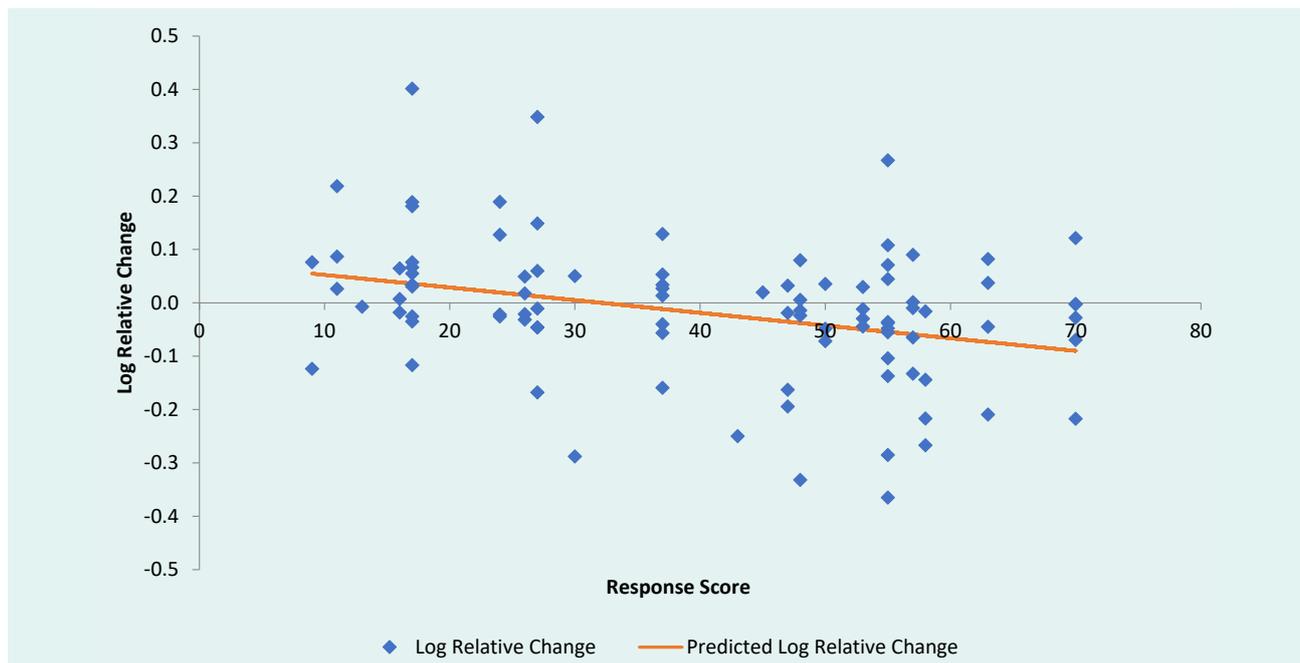
Across all jurisdictions, the strength of response score was 43%, indicating that many evidence-based interventions have not yet been implemented; most of these interventions are the province of policy-makers outside the health sector. As noted by others, strengthened multisectoral commitment is therefore a key to success.¹⁶

Our conclusions are subject to several limitations. First, various data points for either baseline or recent core health status indicators were not available for some jurisdictions. Timely, routine surveillance activities (youth school-based surveys, adult community-based surveys and analysis of vital statistics data) based on jurisdiction-level NCD monitoring and surveillance plans are needed to fill these gaps and provide a more complete picture of the ongoing NCD emergency. Second, although we would have liked to use 2010 baseline values and recent data points for each indicator, the collection years and time span between the baseline and recent data points vary among indicators and jurisdictions, introducing some uncertainty in assessing progress.

Deficiencies in the completeness and accuracy of mortality reporting that have been observed in the region may also have affected our findings, while out-migration from several of the jurisdictions since censuses were last conducted (between 2010 and 2015) may also have affected mortality rate estimates.¹⁷ In addition, it would be useful to track the exact dates of initiation of interventions. However, some interventions (e.g. tobacco and alcohol tax increases) are introduced in phases and implementation times for others are unclear. Finally, the numerical scoring of ordinal values used in the NCD intervention scores may compromise precision in these measures (since the expected impact from each additional point within an intervention and the expected impact of each point from one intervention to the next may not be constant).

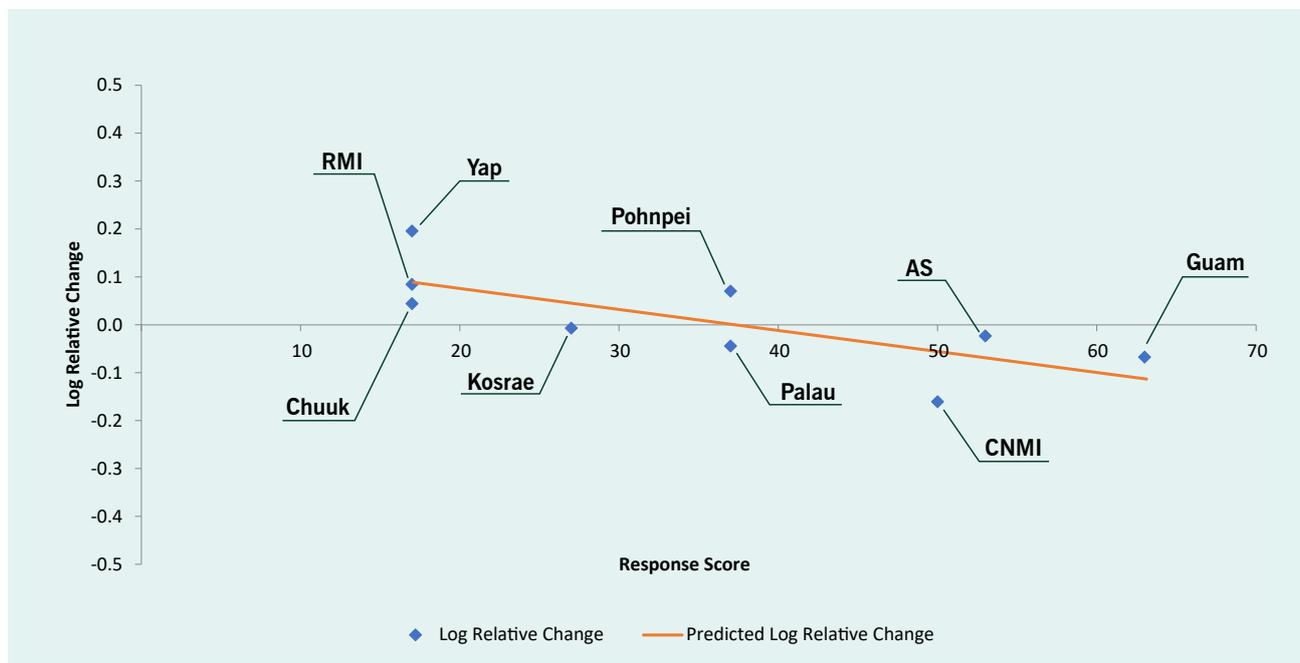
In summary, declaring a regional emergency for NCDs in USAPI has stimulated the development of standardized frameworks for NCD surveillance and response. Although surveillance for NCDs is challenging and additional investments are needed to address gaps and assure rigorous conduct of surveys, existing data do yield a detailed picture of progress over the past 10 years. Some progress has been made towards better control of alcohol and tobacco, but there is little change in other measures of health. The evidence supports the effectiveness of policy and health system interventions in the context of the Pacific Islands; however, many of the recommended NCD interventions have not been adopted, especially in the most affected areas (geographical and risk factors). A renewed commitment to adopt these measures is needed to decisively turn the tide of NCDs in the region.

Fig. 1. Noncommunicable disease intervention scores versus change in corresponding health indicators, US-affiliated Pacific Islands, 2010–2020



Data points are the log of the relative changes in health indicators versus corresponding composite intervention indicators at the jurisdiction level (i.e. each tobacco indicator versus the jurisdiction's tobacco intervention score, alcohol indicators versus the jurisdiction's alcohol intervention score, etc.).

Fig. 2. Composite jurisdiction noncommunicable disease intervention scores versus relative change in health indicators, US-affiliated Pacific Islands, 2010–2020



Data points are the overall intervention indicator for each jurisdiction versus the log of the average of relative changes for all measured health indicators. AS: American Samoa; CNMI: Commonwealth of the Northern Mariana Islands; RMI: Republic of the Marshall Islands.

Public health implications

Agreement across countries and territories on a core set of predefined NCD-related response measures and health status indicators enables a systematic approach to monitoring the response to the NCD crisis and resulting changes in population health status. The provision of such high-quality feedback is useful for strategic planning and evaluation for public health practitioners, technical assistance agencies and policy-makers. The discrete groupings and modest population sizes within multiple jurisdictions and the ability to track the impact of interventions make the USAPI an attractive setting for testing innovative approaches to the NCD crisis.

Conflicts of interest

None of the authors has a conflict of interest wherein any author, our institutions or WPSAR reviewers or editors have financial or personal relationships that might influence (bias) their actions.

Ethics statement

The work and results reported in this paper were a product of routine surveillance activities. No information identifiable to specific people is included. Ethics committee approval was not necessary.

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