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## **U.S. Associated Pacific Islands Health Care Teams Chart a Course for Improved Health Systems: Implementation and Evaluation of a Non-communicable Disease Collaborative Model**

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## Summary

The burden of non-communicable disease (NCD) is increasing in the U.S. Associated Pacific Islands (USAPI). We describe the implementation and evaluation of a NCD Collaborative pilot, using local trainers, as an evidence-based strategy to systematically strengthen NCD health care quality and outcomes, focusing on diabetes preventive care across five health systems in the region.

## Keywords

Micronesia; U.S. Associated Pacific Islands; chronic disease; chronic care model; diabetes; cardiovascular disease; system change; consolidated framework for implementation research; quality improvement; indigenous knowledge

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The United States Associated Pacific Islands (USAPI) jurisdictions are facing an increased burden of non-communicable diseases (NCDs), particularly diabetes and cardiovascular disease (CVD).<sup>1</sup> Changing sociodemographic factors, including population aging, economic growth, and upward trends in high-risk lifestyle behaviors (e.g., tobacco use, physical inactivity, and unhealthy diets), are associated with the increase in NCDs.<sup>2,3</sup> Combatting NCDs involves multisectoral partnerships to implement policies that target population-level risk factors and ensure that essential, cost-effective health services are available to individuals at risk of and with NCDs.<sup>2,4</sup> Most USAPI health systems have been designed to handle communicable disease threats, acute illness, and maternal-child health. As the burden of NCDs increases within the USAPI, transforming health systems, especially at the primary-care level, to respond efficiently and effectively to the challenges of chronic disease is becoming a priority.<sup>5-7</sup>

Since 2009, the Pacific Chronic Disease Council (PCDC), a council of the National Association of Chronic Disease Directors, has provided leadership in the development of a NCD Collaborative model that proactively targets health system change and expands population outreach efforts. In 2010, the Pacific Island Health Officers Association declared a state of emergency due to the epidemic of NCDs.<sup>8</sup> The resolution encouraged the collaborative work necessary to combat the burden of NCDs in the region. We describe the development and mixed-methods evaluation of the PCDC NCD Collaborative model.

## Context

Six USAPI jurisdictions have formal relationships with the U.S.: the flag territories of American Samoa, Guam, and the Commonwealth of the Northern Mariana Islands (CNMI); and the freely associated jurisdictions of the Federated States of Micronesia (FSM; includes Chuuk, Kosrae, Pohnpei, and Yap), the Republic of Palau (Palau), and the Republic of the Marshall Islands (RMI: includes Majuro and Ebeye) (Figure 1). Although the availability of USAPI population and institution-based health data is limited, a recent quality assessment of hospital-based care found that, compared with hospitals in the U.S. states, hospitals in the U.S. territories (e.g., CNMI, Guam, American Samoa, Commonwealth of Puerto Rico, and U.S. Virgin Islands) have significantly higher 30-day mortality rates and lower performance

on core process measures for three NCD-related conditions (e.g., acute myocardial infarction, heart failure, and pneumonia).<sup>9</sup> Another review of USAPI mortality data (between 2003 and 2010) showed that the five leading causes of death, in each jurisdiction, included at least two NCD-related conditions (i.e., CVD, hypertension, renal disease, or diabetes).<sup>10</sup> Additionally, the prevalence of diabetes within the USAPI is among the highest in the world.<sup>11</sup> For example, the 2008 estimated diabetes prevalence for FSM was 15.6% and for the RMI was 26.5% (adults 25 years or older, fasting blood glucose (FBG) 126 mg/dL).<sup>12</sup> The 2010 estimated prevalence of diabetes for the U.S. population (adults 20 years and older; diagnosed and undiagnosed) was 08.3%.<sup>13</sup>

## PCDC Background and NCD Collaborative Rationale

The PCDC, constituted of representatives appointed by the Ministers of Health within each jurisdiction, provides an avenue to act collectively with federal, non-federal, and community-based partners on issues that affect the successful implementation of NCD prevention programs. Figure 2 shows a timeline (1986–2015) of diabetes prevention efforts and the PCDC development. In 2009, the PCDCs provided prioritized recommendations to a U.S. Health and Human Services Steering Committee to address the reduction of NCDs within the region. From 2009–2012, the PCDC coordinated a broad-based assessment of the USAPI health systems focusing on NCD related services. A key finding of the assessment showed that the approach to NCD prevention and management within the region was often unstructured with fragmentation of services, inadequate continuity of care, and limited morbidity/mortality data.<sup>10</sup> Although two sites (Palau and Ebeye) reported ongoing integration of lessons learned from participation in the Health Resources and Services Administration's (HRSA) Health Disparities Collaboratives.<sup>14,15</sup> Using a collaborative approach, the teams maintained evidence of: 1) partnerships between clinical systems and public health programs, 2) use of clinical data for patient follow-up and monitoring, and 3) availability of aggregated data to inform health planning and evaluation.<sup>10</sup>

## NCD Collaborative Overview

In 2011, based on the PCDC's 2009 recommendations and the preliminary recommendations from the assessment of NCD health services in the region, the PCDC initiated a NCD Collaborative pilot. The goal of the pilot program was to determine the feasibility of adopting the HRSA Health Disparities Collaborative model as a strategy to systematically strengthen the quality of NCD prevention and management in the region. The evidence-based CCM, known to improve health outcomes and enhance community linkages,<sup>14–16</sup> served as the pilot's framework. The CCM targets proactive, population-based health care through enhanced health system organization and design incorporating evidence-based disease management; use of patient registries and other information technology; and self-management support strengthened by more effective use of community resources.<sup>17</sup> These elements synergistically serve to support and demonstrate evidence-based system change to improve health outcomes for both the individual and the population within the local health care environment.<sup>14–18</sup>

Although the CCM has been widely adopted and evaluated,<sup>18</sup> there are limited data about implementation experiences across various health systems and the factors that influence its successful uptake.<sup>19</sup> In order to gain a better understanding of the NCD Collaborative teams' implementation experiences and to inform program scale-up and sustainability within the region, we also incorporated the Consolidated Framework for Implementation Research (CFIR). The CFIR provides a meta-theoretical framework, which can be used to identify and understand factors that may influence successful implementation of complex health care interventions,<sup>20</sup> including evaluation of CCM interventions.<sup>19</sup> The CFIR includes multiple constructs organized across five interactive domains and, as applied to our evaluation, include: characteristics of the NCD Collaborative Model (e.g., evidence strength and quality, adaptability), outer setting (e.g., patient needs and resources, influence of federal partners), inner setting (e.g., team organization and recognition of cultural norms and values), characteristics of team members involved (e.g., knowledge and beliefs about the NCD Collaborative), and the process of implementation (e.g., planning and executing health system change within teams; senior leader engagement). Box 1 provides summary descriptions of each CFIR domains.

In 2012, a NCD Collaborative team comprising three-five members (i.e., physician, nurse, data staff, and senior administrator) was established in health systems (e.g., Community Health Centers and hospital-based systems) within each of the four states of FSM and Majuro, RMI. Grounded in the principles of community-based partnerships, each of the five NCD Collaborative teams participated in a cycle of interactive three-day learning sessions followed by action periods (across four-six months) using a continuous quality improvement process (e.g., plan, do, study, act) to target health system improvements (see <https://www.deming.org/theman/theories/pdsacycle>)\*. Each learning session focused on training and coaching teams, encouraging peers, reviewing progress, solving problems, and planning for diffusion of improvements. Learning sessions were coordinated through the PCDC and relied significantly on the skills and expertise of local health professional trainers familiar with the HRSA Health Disparities Collaborative approach. Box 2 provides examples of PCDC leadership and local health care professional roles.

Initially, each Collaborative team selected a population of focus of 50 patients, aged 18 years or older, with diabetes (the Majuro team selected 100) to provide a baseline for measuring outcomes achieved. The teams selected core (all sites) and secondary (optional) diabetes outcome measures based on review of the American Diabetes Association (ADA) Standards of Medical Care in Diabetes,<sup>21</sup> the World Health Organization's (WHO) recommended Package of Essential NCD interventions in low-resource settings,<sup>22</sup> and USAPI Standards for the Management of TB (tuberculosis) and Diabetes.<sup>23</sup> Each site used the Chronic Disease Electronic Management System (CDEMS), an open-source patient registry and data management software application to track diabetes outcome measures.<sup>24</sup> Learning sessions provided an opportunity for each team to receive and, in subsequent sessions, build-on their basic CDEMS training (i.e., processes for registry use, data entry and maintenance, data integrity, and reporting). Generally, development and maintenance of the each site's diabetes

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\*The citation is from the Internet site of The W. Edwards Deming Institute, located in Ketchum, Idaho, a non-profit organization founded in 1993 by W. Edwards Deming.

registry (clinical database) was the responsibility of trained data staff, using established policy and procedure, under supervision of their NCD Collaborative team lead or physician. Teams were also asked to submit monthly reports designed to measure progress in their site-specific quality improvement action plans.

## **Adapting the CCM to Pacific Culture**

### **Pacific Care Model**

In 2013, NCD Collaborative teams adapted the CCM, focusing on the value of local knowledge, cultural strengths, and traditional practices as an organizing framework for their collective work in the Pacific Islands (Figure 3). Local health professionals advocated for the adaptation of the CCM and branding of the Pacific Care Model (PCM) within the region, envisioning the need to navigate community and health system improvements beyond NCDs. The PCM uses the outrigger canoe and traditional navigation system to symbolize an organizing framework for collaborative work.

Throughout the Pacific, the canoe was traditionally a part of life. Successful journeys depended on a skilled navigator, capable captain, and crewmembers working collectively to navigate toward their goal, the destination. Similarly, the PCM provides a framework for NCD Collaborative teams to stay on course, collective in their goal to improve NCD care within local health systems and communities. The navigating stars characterize the six inter-related elements of the CCM known to guide system changes to ensure effective communication (represented by the canoe mast) between informed empowered patients and families and a prepared, proactive health care team, leading to patient and family centered services and improvements in health outcomes.<sup>17</sup>

## **Evaluation of the NCD Collaborative**

We based our evaluation on a mixed methods approach, using secondary data analysis. At the 2013 NCD Collaborative Summit, team storyboards showcased progression of improvement strategies, trends for selected diabetes care outcome measures (e.g., core and secondary; generated from each teams' CDEMS database, using standardized reporting templates), and community impact. Using the trend charts displayed in each teams' storyboard, our quantitative analysis targeted evaluation of diabetes care outcome measures reported at baseline and at 16-months after pilot initiation.

Additionally, we used the CFIR to guide qualitative analysis of facilitators and challenges reported by the teams during the implementation of the pilot. Implementation facilitators and challenges were abstracted from team reports (e.g., through storyboards, team learning session presentations and discussions, and learning session evaluations), using qualitative content analysis and mapped onto the CFIR framework. For example, when participating teams reported individual, team, or system-level facilitators or challenges related to the NCD Collaborative implementation, they were noted as a reflective statement and coded under the applicable CFIR domain and construct. One author, using interpretative and inductive reasoning, completed the abstraction and mapping. We asked each of the NCD Collaborative

teams, their respective Director of Health and Minister of Health, and PCDC leadership to review the results and incorporated their feedback.

## Evaluation Outcomes

### Diabetes care outcomes measures

Table 1 shows improvements in diabetes care outcomes measures, shared by pilot teams for their focus population, across several clinical indicators. For example, improvements from baseline to 16 months in mean A1c were reported in Kosrae (13.0% to 09.4%), Pohnpei (11.2% to 10.4%), Yap (09.2% to 08.8%) and Majuro (11.0% to 09.0%) with a median decrease of 01.4 percentage points across sites. Teams noted general improvements across sites in all measures, with median improvements ranging from 14 percentage points for blood pressure control to 72 percentage points for annual foot exams and 76 percentage points for self-management goal setting.

### CFIR mapping

Box 3 provides summarized descriptions of facilitators and challenges reflected in the Collaborative teams' reports, which were analyzed and mapped to corresponding CFIR domains and constructs. Implementation facilitators were found across each of the five CFIR domains. For example, within the intervention characteristics domain, a key stakeholder (Former Minister of Health) regarded the NCD Collaborative as an internally developed program "that will allow the Pacific to move toward sovereignty in health." Team leads and physicians also reported positive perceptions about the advantages of the NCD Collaborative, reporting that clinic redesigns (e.g., new clinic days or one-stop shop) and the multi-disciplinary approach increased access and quality of services. Additionally, while acknowledging the complexity of the CDEMS and need for more training, team members recognized its flexibility for adaptation to unique needs within the Pacific region (e.g., adding betel nut use to tobacco assessment and tuberculosis screening due to high comorbidity with diabetes). Team members were especially appreciative of the NCD Collaborative learning session design (e.g., "Our voices are being heard" and "We will use these skills to help improve our system and services"). Within the context of patient needs and resources (outer setting), mixed perceptions were also noted with one patient describing the benefits of the NCD Collaborative (e.g., nutrition counseling), while team members reported challenges with inadequate diabetes self-management education supplies and patient dissatisfaction due to limited availability of medications.

We also noted mixed perceptions, reported by team members, across other CFIR domains (i.e., inner setting, individual/team member characteristic, and process of implementation). For example, team members regarded the NCD Collaborative as enabling a broader base of interdepartmental collaboration, while also reporting challenges with sustaining consistent team meetings, orientation of new members, and clarity of team member roles and responsibilities. Team physicians also noted the effectiveness of the NCD Collaborative in instituting system change (e.g., universal screening for gestational diabetes) and engagement of senior leaders to help remove barriers and increase interdepartmental cooperation, while



others perceived challenges in establishing clinical care policy and guidelines, maintaining the engagement of senior leaders, and involvement of busy physicians.

## Discussion

The implementation of the NCD Collaborative, under the leadership of PCDC and local health professional trainers, has produced encouraging outcomes. Each team reported improvements in diabetes self-management goal setting and support, a key element of diabetes care, which is critical to reducing the risk of diabetes-related complications and improving quality of life.<sup>19</sup> During the 16-month pilot, most teams also saw improvements across several clinical performance measures including blood pressure control and screening exams. Three sites noted a one-percentage point (or near) drop in average A1c with a median reduction of 1.4 percentage points. This is clinically important because a percentage point drop in A1c lowers the risk of diabetes microvascular complications (i.e., eye, kidney, and nerve diseases) by 40%.<sup>25</sup>

The CFIR provided an organizing framework to identify key implementation factors that help inform the continued adaptation, scale-up, and sustainability of the NCD Collaborative within the region. Mapping of the facilitators and challenges reported by the team members provided valuable information related to emerging themes (e.g., those related to outer setting, inner setting, and process of implementation) and highlights essential lessons learned during the pilot implementation. These include:

- Ministers and Directors of Health who were engaged in the NCD Collaborative process provided support in leveraging and sustaining system change.
- A focus on the value of local knowledge, cultural strengths, and traditional practices may play a significant role in continued implementation and sustainability.
- Learning session environments, using local trainers, facilitated strong peer networks, communication, and team activation.
- Involvement of content-experts (familiar with NCD prevention and management in low-resources settings) helps strengthen and accelerate consensus development and adoption of evidence-based standards of care and best practices.
- Community partners (multi-sector) enhanced the availability of self-management support and resources.
- As staffing changes occur, orientation to the NCD Collaborative is critical for consistency in health system change and quality improvement.
- Expansion and alignment of regional, federal, and international partnerships and resources may serve to maximize support and expand reach of the NCD Collaborative.
- Use of public domain software (i.e., CDEMS) enabled team members to establish diabetes registries, input data, and generate clinical reports to monitor

trends (individual and aggregate), guide management decisions, and develop change strategies.

- Continued CDEMS training may translate to improved care for other NCDs (i.e., cancer and CVD) within the USAPI.

The NCD Collaborative has helped participating teams integrate evidence-based practice into low-resource health care systems. We recognize that this initial evaluation has some limitations. First, reliability issues inherent with implementing a clinical data management system at each pilot site limited the scope of data analysis. Second, the clinical performance measures and outcomes were from a relatively small sample. However, as NCD Collaborative teams expand NCD registries and improve data system management, it is anticipated that a high-quality, reliable database will emerge to sustain progress in public health research, policy, practice, and education within the region. Third, the qualitative data abstraction and coding was completed by one author, creating the possibility of bias in how the qualitative data were abstracted and mapped under the CFIR.

## Conclusion

Collaborative efforts and engagement of local trainers and teams to apply systematically the NCD Collaborative in their health settings, can improve health care quality and outcomes in some USAPI communities. The CFIR model provided a framework for synthesizing implementation facilitators and challenges and informing the continued adaptation, scale-up, and sustainability of the NCD Collaborative across the region. Essential lessons learned may enable other low-resource health care systems to effectively implement a collaborative model to improve health outcomes of their constituents.

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**Box 1****SUMMARY DESCRIPTION OF THE FIVE DOMAINS OF THE CONSOLIDATED FRAMEWORK FOR IMPLEMENTATION RESEARCH<sup>A</sup>**

| Domain                         | Description   |
|--------------------------------|---|
| Intervention characteristics   | Refers to characteristics of the intervention being implemented within a particular system and stakeholder perception of the intervention including: intervention source (external or internal) and legitimacy; quality/validity of evidence supporting the effectiveness and advantage over other alternatives; its adaptability, complexity, and trialability (i.e. testing on a small scale).          |
| Outer setting                  | Refers to external context of organization: patient needs and resources, partnerships, pressure from outside entities to implement, and external policies and incentives.   |
| Inner setting                  | Refers to internal context of organization: structural characteristics (i.e., size, maturity, and complexity), networks and communication, cultural norms and values, implementation climate (i.e. tension for change, compatibility, priority, and incentives), and readiness for implementation (i.e., availability of resources and leadership engagement).  |
| Characteristics of individuals | Individual or team level qualities that influence behavior change including: staff knowledge and belief about the intervention, self-efficacy (i.e. belief in their own capabilities to effect change), and their individual stage of change. Additional characteristics include individual identification with the organization and other personal attributes (i.e. motivation, tenure, learning style). |
| Process                        | Includes four key activities that promote uptake of an intervention: 1) level of planning prior to implementation, 2) engagement of organizational stakeholders (i.e. opinion leaders and champions), 3) execution of the implementation according to plan, and 4) systematic reflection and evaluation of the quality of implementation and intervention.  |

<sup>a</sup>Damschroder LJ, Aron DC, Keith RE, et al. Fostering implementation of health services research findings into practice: a consolidated framework for advancing implementation science. *Implement Sci.* 2009;4 Suppl 1:50.

**Box 2****EXAMPLES OF PACIFIC CHRONIC DISEASE COUNCIL'S LEADERSHIP AND LOCAL HEALTH PROFESSIONAL TRAINERS ROLE IN THE NON-COMMUNICABLE DISEASE COLLABORATIVE PILOT**

| Health Professional (Number of trainers) | Clinical Practice Role               | Primary Role  | Jurisdiction Support <sup>a</sup>    |
|--|--------------------------------------|---|--------------------------------------|
| PCDC Leadership (3)                      | Public Health                        | Overall planning, implementation, and evaluation        | FSM, National Palau                  |
| Physician (4) <sup>b</sup>               | NCD care and management <sup>b</sup> | 1 Learning session content preparation and delivery     | 1 FSM, Yap State                     |
|  |                                      | 2 Facilitation and consensus building:                  | 2 RMI, Ebeye                         |
|  |                                      | a. ADA Standards of Medical Care in Diabetes            | 3 Palau                              |
|  |                                      | b. Gestational diabetes screening and management        |                                      |
|  |                                      | c. WHO PEN guidelines                                   |                                      |
|  |                                      | d. Tuberculosis and diabetes screening and management   |                                      |
|  |                                      | e. Diabetes foot screening                              |                                      |
|  |                                      | f. Rapid cycle quality improvement methods and tools    |                                      |
| Registered Nurse (3)                     | NCD Community Health Center(s)       | 1 Learning session content preparation and delivery:    | 1 FSM, Chuuk State and Pohnpei State |
|  |                                      | 1 Diabetes foot screening and self-management education | 2 RMI, Ebeye                         |

|                             |                              |  |   |  |                    |
|-----------------------------|------------------------------|--|---|--|--------------------|
|                             |                              |  | 2 | Diabetes self-management education tools (culturally relevant) |                    |
|                             |                              |  | 3 | Practical application of the Pacific Chronic Care Model        |                    |
| Nutrition Related (1)       | Public health administration | Learning session content preparation and delivery: Nutrition education tool encouraging use of local foods |   |  | FSM, National      |
| Community Health Worker (1) | NCD Community Health Center  | Learning session content preparation and delivery: Diabetes foot screening and documentation template      |   |  | FSM, Pohnpei State |
| Data Specialist (2)         | Public health                | Learning session content preparation and delivery: Basic CDEMS training                                    | 1 |  | Palau              |
|                             |                              |  | 2 |  | FSM, Yap State     |

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<sup>a</sup>Jurisdiction support included senior leadership concurrence for trainer role (including time away from clinical practice setting in manpower shortage area); trainers received a nominal stipend and travel support from PCDC.

<sup>b</sup>Each physician trainer had direct clinical practice roles (community health centers or hospital-based) in NCD Care and Management; specific medical training ranged across medical specialties (i.e., internal medicine, anesthesiology, pediatrics, pain management, obstetrics/gynecology, orthopedic).

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**Box 3**

**MAPPING OF THE PACIFIC CHRONIC DISEASE COUNCIL'S NON-COMMUNICABLE DISEASE COLLABORATIVE IMPLEMENTATION FACILITATORS AND CHALLENGES TO THE CONSOLIDATED FRAMEWORK FOR IMPLEMENTATION RESEARCH<sup>a</sup>**

| Domain and Construct                | Facilitator (source)   | Challenge (source) |
|-------------------------------------|--|--------------------|
| <i>Intervention characteristics</i> |  |                    |
| Source                              | <ul style="list-style-type: none"> <li>• A proactive collaborative response to NCDs “will provide the refuge, the safety net that will allow the Pacific to move toward sovereignty in health; NCDs and comorbidity (i.e., TB and CVD) can only be managed through collaborative process” (Former Minister of Health).</li> <li>• “Approach to NCDs must be data driven ... the CCM is a huge step in the right direction” (External partner)</li> </ul> |                    |
| Evidence and strength               | <ul style="list-style-type: none"> <li>• WHO<sup>b</sup> and ADA<sup>c</sup> recommend evidence-based CCM as cornerstone for NCDs</li> <li>• Use of local health professionals familiar with CCM strength of evidence and practical experience with the health disparities collaborative</li> </ul>  |                    |
| Relative advantage                  | <ul style="list-style-type: none"> <li>• “Streamlines patient flow and services”, “establishing new clinic days”, “one-stop-shops to increase access to services” (Team leads)</li> <li>• “Multi-disciplinary approach of the CCM incorporated into NCD management allows caregivers ability to anticipate needs of the patients” (Team physician)</li> <li>• “The CCM is greatly aiding us in strengthening our ongoing collaboration among</li> </ul>  |                    |

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|                              |   | the Dept. of Health Services Public Health, clinical staff, community clinics, and community council members ...” (Team physician)  |  |
| Adaptability                 | <ul style="list-style-type: none"> <li>• CCM model adapted to Pacific context (e.g., PCM, Figure 2)</li> <li>• Integration of several evidence-based medical guidelines (i.e., ADA medical standards<sup>c</sup>; WHO PEN<sup>d</sup>; LEAP<sup>e</sup>; TB and diabetes screening<sup>f</sup>)</li> <li>• “The thing that I like about this software (CDEMS), is that it’s flexible ... user can add on usable options (data entry) ... ” (Team member)</li> </ul> | <ul style="list-style-type: none"> <li>• Need evidence-based clinical protocols and policy based on resource availability (Team lead, Senior Lead)</li> </ul>   |  |
| Complexity                   | <ul style="list-style-type: none"> <li>• “CDEMS is worth the investment—good work will be reflected later” (Team physician)</li> </ul>  | <ul style="list-style-type: none"> <li>• CDEMS linkages “difficult for outer islands” (Team lead)</li> <li>• “Two data reporting systems are too much”—CDEMS not on central server (Team lead)</li> </ul> |  |
| Design quality and packaging | <ul style="list-style-type: none"> <li>• “Our voices are being heard ... we update on our situations (learning sessions)”; “... working together on how to improve” (Team member)</li> <li>• “... By far the best training ... looking forward to the next” (Team member)</li> <li>• “... Open discussions ... storyboard presentation ... PDSA ... we will use these skills to help improve our system and services” (Team member)</li> </ul>                      | <ul style="list-style-type: none"> <li>• Need more CDEMS “hands on” training (Data staff)</li> <li>• Need more group work during learning sessions (Team member)</li> </ul>                               |  |
| Costs                        |   | <ul style="list-style-type: none"> <li>• Limited resources to extend learning sessions beyond core team members</li> </ul>  |  |
| <i>Outer Setting</i>         |   |   |  |



|   |  |  |
|---|--|--|
| Patient needs and resources                       | <ul style="list-style-type: none"> <li>• “ ... Individualized report enables patients to visualize their progress and renew interest in caring for and understanding of their NCD ... ” (Team physician)</li> <li>• “Weekly self-management education ... with translation of materials to local language” (Team member)</li> <li>• “Nutrition counseling ... I think that’s good part of the clinic, we feel more concerned about our own health” (Patient with diabetes)</li> </ul>  | <ul style="list-style-type: none"> <li>• Limited supplies and resources for self-management (Team member)</li> <li>• “Patient dissatisfaction due to limited availability of medications” (Team member)</li> <li>• Need for “health assistant (community health worker) training” (Team lead)</li> </ul> |
| External polity and incentives<br>Cosmopolitanism | <ul style="list-style-type: none"> <li>• HRSA and CDC reporting requirements link to core clinical performance measures</li> <li>• “Regional focus helps bring us together” (Team lead)</li> <li>• Teams linking with community-based NCD Councils and “involving other NGOs ... tobacco, substance abuse programs” (Team leads)</li> <li>• Department of Agriculture and Land Grant College provides home gardening assistance (Team lead)</li> <li>• “ ... Stakeholder mapping ... effective communication ... with community partners useful for our collaborative work” (Team member)</li> </ul> | <ul style="list-style-type: none"> <li>• “Work is too much ... partnerships are critical ... ” (External partner)</li> </ul>   |
| Peer pressure                                     | <ul style="list-style-type: none"> <li>• “CDEMS is good it shows us where we need to improve” (Team lead)</li> <li>• “ ... When we share with others ... provides an opportunity to learn” (NCD Coordinator)</li> <li>• “PDSA useful in building team and</li> </ul>   |  |

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|                            |   | <ul style="list-style-type: none"> <li>identifying roles” (Team lead)</li> <li>“ ... Hard at the collaborative start; we involved everyone not just one MD; helps build a sustainable program” (Team physician)</li> </ul> |  |
| <i>Inner Setting</i>       |   |  |  |
| Networks and communication | <ul style="list-style-type: none"> <li>“We learned we need to change our schedule ... because it’s not effective, ... having hard time meeting with each other” (Team member)</li> <li>“ ... Work closely with NCD nurses with service delivery and follow-up” (team member)</li> <li>“Wider range of interdepartmental collaboration” (Team physician)</li> <li>“Primary care of NCD patients now shared between Dispensary and Public Health” (Team physician)</li> </ul>                             | <ul style="list-style-type: none"> <li>Need consistent team meetings (Team lead)</li> <li>Clarity re: team member roles and responsibilities (Team physician)</li> </ul>   |  |
| Culture                    | <ul style="list-style-type: none"> <li>“Important to acknowledge those who contribute to development of collaborative— who was part of the journey ... journey continues even with many changes” (Team member)</li> <li>“Patient assistants (CHWs) ... valuable asset ... help explain medical treatment (by physician)— local medicine is popular ... some do not want to add other meds (may contaminate local medicine) ... help to check on patients lost to follow-up” (Team physician)</li> </ul> |  |  |
| Structural Characteristics | <ul style="list-style-type: none"> <li>Hired new “community NCD outreach workers (effective in referring clients to central clinic)” (Team lead)</li> <li>“Director helped us solve data sharing (i.e. linking lab system) challenges” (Data lead)</li> </ul>   | <ul style="list-style-type: none"> <li>Staffing changes and shortages (Team lead)</li> <li>Lacking orientation of new team members (Team lead)</li> <li>Limited supplies (i.e.</li> </ul>                                  |  |

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|                              | <ul style="list-style-type: none"> <li>• “Core team members able to access CDEMS through server” (Team lead)</li> <li>• “Need to ... institutionalize ... set up standard operating procedures (policy/guidelines) ... want quality care and good outcomes” (Senior leader)</li> <li>• “Momentum to build NCD registry from Asst. Secretary of Health” (Team lead)</li> </ul>  | <p>screening supplies and reagents) and increased costs of therapy (Team lead)</p>   |
| Implementation climate       | <ul style="list-style-type: none"> <li>• “Changing the system is not easy ... introduce CCM to senior leaders ... required attendance ... took three mtgs ... Now we consistently update; important because we borrow their staff from time-to-time” (Team physician)</li> <li>• We will be struggling in the beginning but I will email trainers” (Team member)</li> <li>• “NCD policy and clinical protocols with CMEs developed ... senior leaders and clinical providers support implementation” (Team lead)</li> <li>• “MDs reporting appreciation of data entry and CDEMS reports” (Data lead)</li> <li>• “Access to existing clinical databases (across clinical services) help build registry/CDEMS” (Team physician)</li> </ul> | <ul style="list-style-type: none"> <li>• Train more providers on use of CDEMS (Team physician)</li> <li>• MDs need to be more supportive of CDEMS (i.e. review summary reports) (Team member)</li> <li>• More CDEMS technical assistance on data management and reporting (Data staff)</li> <li>• Communicable disease outbreaks in community cause shifting of resources and manpower with less resources available for NCD (Team physician)</li> </ul> |
| Readiness for implementation | <ul style="list-style-type: none"> <li>• “Providing a monthly report to senior leaders help leverage resources (i.e. data management, A1c reagents, team member additions)” (Team lead)</li> <li>• “Use PDSA across CCM elements to target improvements in health outcomes ... help organize greater group to do a better job” (Team physician)</li> <li>• “Core team members have access to</li> </ul>  | <ul style="list-style-type: none"> <li>• Need consistent engagement of senior leaders (Team lead)</li> <li>• Some sites report challenges with CDEMS access, data input and management</li> <li>• Assignment and commitment of NCD MD lead (Team lead)</li> </ul>  |

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|  |  | <ul style="list-style-type: none"> <li>CDEMS through server” (Team lead)</li> <li>“Static trend line for several clinical indicators ... PDSA cycle helped resolve – now doing more outreach to rural areas” (Team lead)</li> </ul>   |  |
| <i>Team Member (Individual) Characteristic</i> |  |   |  |
| Knowledge and beliefs about intervention       |  | <ul style="list-style-type: none"> <li>“Establishing clinical protocols helps decrease the variability between providers” (Team physician)</li> <li>“Changes good for clinic population ... universal gestational diabetes screening ... we did not have that prior to the collaborative” (Team physician)</li> <li>“Individualized patient progress reports enable patients to visualize their progress and become more active in the management of their illness” (Team physician)</li> </ul> | <ul style="list-style-type: none"> <li>Need clinical care guidelines ...”(MDs) still stick to their own” (Team physician)</li> <li>Variability in application of TB and diabetes guidelines (Senior lead)</li> <li>Need to set up “policy/ guidelines so not dependent on one MD – everyone understands their role” (Senior lead)</li> </ul> |
|  | Common goal  | <ul style="list-style-type: none"> <li>“For God and for my country ... two things people will make changes for ... collaborative is worth the investment – good work will be reflected later” (Team physician)</li> </ul>   |  |
|  | Self-efficacy  | <ul style="list-style-type: none"> <li>“I have learned a lot that will improve our care to our people” (Team member)</li> <li>“ ... Team reports are better than last two sessions” (Team lead)</li> <li>“I have learned a lot ... how to correct the mistakes we’ve made” (Team member)</li> </ul>   |  |
| Combined efforts                               | <ul style="list-style-type: none"> <li>“ ... Focusing more on community education not just clinical” (Team member)</li> <li>“ ... Existing system of collaboration among the community, CHCs, and DHS continues to be a major asset in advancing health</li> </ul> | <ul style="list-style-type: none"> <li>Support needed from Senior leadership to fill gaps and integrate with hospital and clinic system – CCM can help organize greater group to do a better job (Senior lead)</li> </ul>   |  |

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|                                  | <ul style="list-style-type: none"> <li>care” (Team physician)</li> <li>“ ... Observed the need for more staff helping patients achieve their self-management goals ... ” (Team lead)</li> <li>Partnership with community is key strength ... help with incentives, outreach, and education. Data from collaborative helps drive community support” (Team lead)</li> </ul>  | <ul style="list-style-type: none"> <li>Need to institutionalize this program (collaborative model) (Senior lead)</li> </ul>   |
| <i>Process of Implementation</i> |  |   |
| Planning                         | <ul style="list-style-type: none"> <li>“PDSA ycle used ... to organize clinic design ... patients who are well-controlled scheduled every 2–3 months; those poorly controlled (2–4weeks) ... we know have protocol for med refills” (team member)</li> </ul>   | <ul style="list-style-type: none"> <li>More time for group work and planning during learning session (Team member)</li> </ul>   |
| Engaging                         | <ul style="list-style-type: none"> <li>“Senior leaders help remove barriers and increase interdepartmental cooperation” (Team physician)</li> <li>“Team members should see their role as primary responsibility ... not just an added job ... part of daily work ... assigning roles and not just small jobs ... find that folks are more committed ... team work becomes better” (Team lead)</li> </ul>                   | <ul style="list-style-type: none"> <li>Need consistent engagement of senior leaders (Most teams)</li> <li>Need commitment of physician champion (MDs rotate/change) (Team lead)</li> </ul>  |
| Executing                        | <ul style="list-style-type: none"> <li>Having come across some technical difficulties we ... realize how important the data registry is and by association how pivotal our data clerks are” (Team physician)</li> <li>Action plans, developed at each learning session, using “PDSA help us organize” (Team member)</li> <li>“Expectation to carry-out tasks between team meetings and report back” (Team lead)</li> </ul> | <ul style="list-style-type: none"> <li>Need for cross-training beyond MD (i.e. nurses and patient assistants) (Team lead)</li> <li>Need an “all purpose form to keep better track of self-management and nutrition education ... these services are performed but not well documented” (Team lead)</li> </ul> |

|                                  |  |   |
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| <p>Reflecting and evaluating</p> | <ul style="list-style-type: none"> <li>• “In the registry, it provides us what we need to work more on, and those that miss their appointment, we will follow up ...” (Team physician)</li> <li>• “Advantage to having a collaborative team—you are never alone” “The way forward is the Collaborative. This is the way to succeed” (Team physician)</li> <li>• “... Worth the investment ... good work will be reflected later” (Team physician)</li> <li>• “Bobs and weaves in the canoes—but staying strong”; “We asked 10 people ... pretend they were in a canoe ... showed how paddlers can set the direction and speed ... need to work together ... on NCDs” (External partner)</li> </ul> | <ul style="list-style-type: none"> <li>• “Scaling up primary care ... is a major challenge ... requires careful planning ... matching workload to resources, extending beyond diabetes ... and showing impact on population health” (External partner)</li> </ul> |
|----------------------------------|--|---|

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<sup>a</sup>Damschroder LJ, Aron DC, Keith RE, et al. Fostering implementation of health services research findings into practice: a consolidated framework for advancing implementation science. *Implement Sci.* 2009;4 Suppl 1:50.

<sup>b</sup>World Health Organization. Innovative care for chronic conditions: Building blocks for action. Global Report. Noncommunicable Diseases and Mental Health. Geneva: World Health Organization.

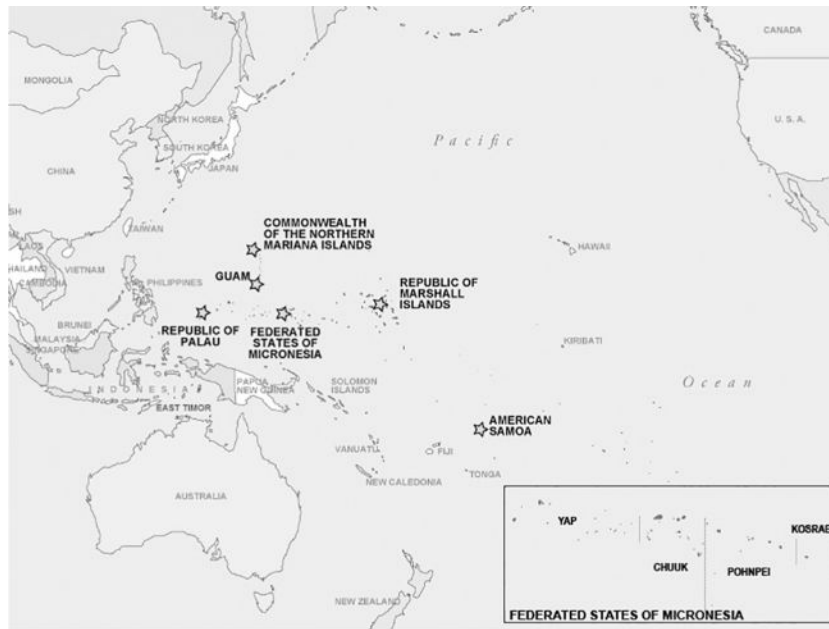
<sup>c</sup>American Diabetes Association. Standards of medical care in diabetes—2016. *Diabetes Care.* 2016;39(Suppl 1).

<sup>d</sup>World Health Organization.

<sup>e</sup>Lower Extremity Amputation Prevention.

<sup>f</sup>USAPI standards for the management of tuberculosis and diabetes 2010.





**Figure 1.**  
Map of U.S. Associated Pacific Islands.

## Padding Our Canoe to improve the health of the Pacific people Diabetes Prevention and Control Programs and the Pacific Chronic Disease Council 1986-2015

**1986**  
**CDC DDT and USAPI establish cooperative agreements** for diabetes prevention and control programs, renewed by 5-year cycles.

**1993**  
**DCCT confirms benefits of glucose control** to preventing complications of diabetes.

**1998**  
**HRSA Health Disparities Collaborative begins** grounded on the widely adopted CCM - By 2006, each USAPI jurisdiction joined the HRSA Diabetes Collaborative with varying levels of adoption.

**2000**  
**Pacific Diabetes Today and PDEP** provide technical assistance to engage communities and communicate health messages across USAPI including 41 culturally specific education materials.

**2002**  
**Diabetes Prevention Program confirms** type 2 diabetes can be prevented or delayed.

**2008**  
**USAPI panel presentation** at CDC DDT Diabetes Conference, Orlando, FL for the 1st time since funding began (1986).  
**Diabetes Pacific Summit convened by HHS** in Saipan, CNMI.

**PCDC established**, in liaison with NACDD. Bylaws adopted. Representatives appointed by Ministers of Health within each USAPI jurisdiction.

**2009**  
**HHS, led by CDC and PCDC, convenes Diabetes Pacific Forum** in Long Beach, CA, ranked PCDC recommendations to HHS:

1. Pacific diabetes educators, self-management education, and team care integrated with CCM.
2. NCD Collaborative training for the USAPI.
3. Integrated community-based diabetes and other chronic disease prevention and control strategies.
4. PCDC to engage PIHOA to address policy issues.
5. Coordinated and comprehensive healthcare systems within the region.
6. PCDC Coordinator.
7. Pacific Islands Health Disparities Research Center.

**Recommendations Accepted by HHS** in letter to PCDC signed by directors of DDT and Asia Pacific Region Office Global Affairs (HHS).

**CDC 5-yr. Cooperative Agreement** Integrated Tobacco, Diabetes Prevention and Control, and Behavioral Risk Factor Surveillance System begins with USAPI.

**2010**  
**PIHOA issues Declaration of Emergency Due to NCDs** - Board Resolution #48-01 "Declaring a regional state of health emergency due to the epidemic of NCD in the United States Affiliated Pacific Islands."

**USAPI Standards for the Management of TB and Diabetes established** by multiple partners, including CDC and PCDC.

**White House Initiative for Asian Americans and Pacific Islanders** recommendations, led by CDC, target USAPI health disparities include addressing TB and diabetes, lower extremity amputation prevention, and NCD Collaborative support.

**2011**  
**Assessments of USAPI conducted** supported by NIH, NIMHD with UH. Findings support renewal of CCM within the region.

**PIHOA creates NCD Health Leadership Council** with 11 affiliate members, including PCDC.

**United Nations General Assembly releases** "Political Declaration of the High-level Meeting on the Prevention and Control of NCDs".

**2012**  
**DOI and CDC sign MOI** to support development of a NCD Collaborative in the FAS. PCDC NCD Collaborative leadership team formed with Chair, Co-Chair, USAPI representatives, and consultants.

**NCD Collaborative pilot, 5 teams formed** in FSM - (Pohnpei, Kosrae, Yap, Chuuk) and Majuro, RMI to determine the feasibility of adapting the HRSA Collaborative approach to improve the quality of NCD prevention and management. The pilot relied significantly on the skills and leadership of PCDC and local health professional trainers.

**2013**  
**Study reports success of CHWs in diabetes care** in American Samoa.

**Hawaii Journal of Medicine Public Health** publishes Assessment of NCDs, Diabetes and Related Risk Factors, led by PCDC, supported by NIH.

**PCDC NCD Collaborative Summit** Pilot teams share health care improvements across baseline measures (i.e., A1c, foot screening, and self management support). Ministers and Directors of Health, PIHOA, and other partners salute the teams' success and affirm continued support.

**CDC 5-yr Cooperative Agreement** Public Health Actions to Prevent and Control Diabetes, Tobacco Use, Heart Disease, & Assoc. Chronic Disease Risk Factors and Improve Health begins with the USAPI, Virgin Islands, & Puerto Rico.

**2014**  
**PCDC and NCD Collaborative Summit** Collaborative teams share outcomes and chart course for sustainability and diffusion with PCDC membership and partners. Pacific leader recognizes the Collaborative as a 'move toward health sovereignty' in the Pacific.

**Pacific Care Model developed** - focusing on value of local knowledge, cultural strengths, and traditional practices as an organizing framework for collaborative work.

**OSTLTS - CDC DDT funding to support PCDC** NCD Collaborative expands to 7 teams working to improve their healthcare systems (FSM [Chuuk, Kosrae, Pohnpei, and Yap], RMI [Majuro and Enewe], Palau). PCDC continues planning to broaden and sustain the NCD Collaborative in the region.

**2015**  
**PCDC** updates bylaws.  
**PPTFI** partnership affirmed.

**PCDC and NCD Collaborative** learning session and CDC consultation on USAPI TB & Diabetes Standards (Sydney, Aus.).

**Pacific Basin Medical Assoc. Summit** - Physician champions share NCD Collaborative storyboards.

**FSM National NCD Summit** - FSM Collaborative teams share storyboards; FSM NCD resolution to support clinical tracking system.

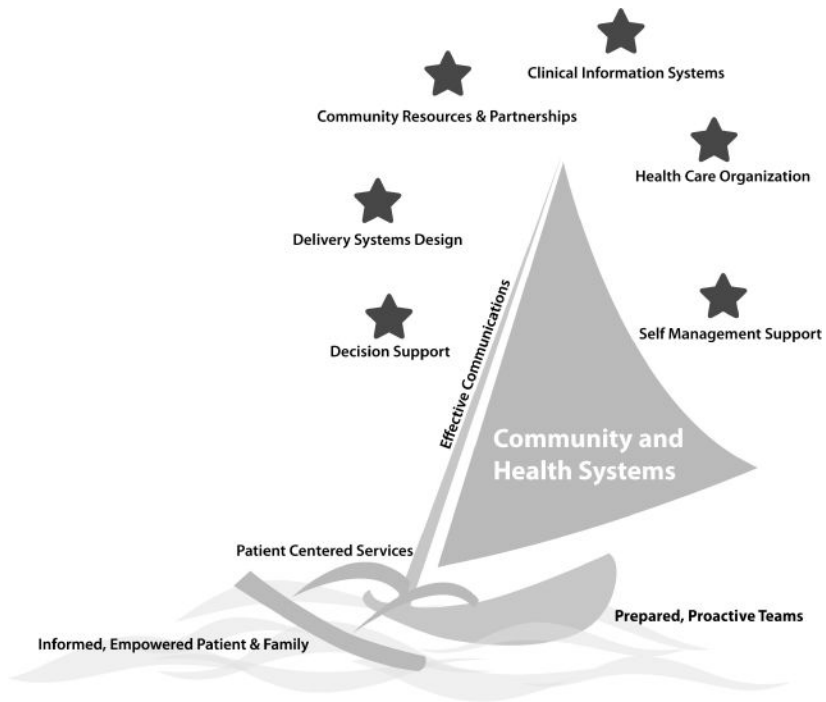


*"After the best leader's work is finished, the people say, we did it ourselves" Lau Tzu, Chinese philosopher, 600 -531BC*

### Abbreviations:

- **CDC**=Centers for Disease Control and Prevention
- **DDT**=Division of Diabetes Translation
- **CCM**=Chronic Care Model
- **CHWs**=Community Health Workers
- **CNMI**=Commonwealth of the Northern Mariana Islands
- **DCCT**=Diabetes Control and Complications Trial
- **DOI**=Department of Interior
- **FAS**=Freely Associated States
- **FSM**=Federated States of Micronesia, (States: Chuuk, Kosrae, Pohnpei, Yap).
- **HHS**=Health and Human Services (United States)
- **HRSA**=Health Resource Services Administration
- **NACDD**=National Association Chronic Disease Directors
- **NCD**=Non-communicable disease
- **NIH**=National Institutes of Health
- **NIMHD**=National Institute on Minority Health and Health Disparities
- **OSTLTS**=Office of State, Tribal, Local, Territorial Support
- **Palau**=Republic of Palau
- **PCDC**=Pacific Chronic Disease Council
- **PDEP**=Pacific Diabetes Education Program (National Diabetes Education Program)
- **PIHOA**=Pacific Islands Health Officers Association
- **PPTFI**=Pacific Partnerships for Tobacco Free Islands
- **RMI**=Republic of the Marshall Islands
- **TB**=Tuberculosis
- **UH**=University of Hawaii
- **USAPI**=United States Affiliated Pacific Islands

**Figure 2.**  
Padding our canoe to improve the health of the Pacific people: Diabetes prevention and control programs and the Pacific Chronic Disease Council 1986–2015.



**Figure 3.**  
Community health systems.

SUMMARY OF CLINICAL PERFORMANCE MEASURES AND OUTCOMES AT BASELINE AND AFTER 16-MONTHS (ACHIEVED)-PACIFIC CHRONIC DISEASE COUNCIL'S NON-COMMUNICABLE DISEASE COLLABORATIVE PILOT

Table 1

| Measures <sup>a</sup>             | Outcomes <sup>b</sup>          |    |        |      |         |      |      |      |        |      |          |          |          |          |
|-----------------------------------|--------------------------------|----|--------|------|---------|------|------|------|--------|------|----------|----------|----------|----------|
|                                   | Federated States of Micronesia |    |        |      |         |      |      |      |        |      |          |          | RMI      |          |
|                                   | Chuuk                          |    | Kosrae |      | Pohnpei |      | Yap  |      | Majuro |      | Baseline | Achieved | Baseline | Achieved |
| Population of focus (N)           | 50                             | %  | 50     | %    | 50      | %    | 50   | %    | 50     | %    | 100      | %        | 100      | %        |
| Core (all sites) <sup>c</sup>     |                                |    |        |      |         |      |      |      |        |      |          |          |          |          |
| 2 A1c (last y)                    | 02                             | 92 | 02     | 100  | 00      | 74   | 28   | 72   | 12     | 17   | 74       | 12       | 17       | 74       |
| Average A1c <sup>d</sup>          | NA                             | NA | 13.0   | 09.4 | 11.2    | 10.4 | 09.2 | 08.8 | 11.0   | 09.0 | -01.4    | 11.0     | 09.0     | -01.4    |
| Self-management                   | 02                             | 86 | 14     | 98   | 00      | 76   | 02   | 60   | 00     | 60   | 76       | 00       | 60       | 76       |
| BP <130/80 mm Hg <sup>e</sup>     | 02                             | 28 | 20     | 34   | 30      | 58   | 24   | 32   | 42     | 38   | 14       | 42       | 38       | 14       |
| Foot exam (last y)                | 02                             | 90 | 14     | 90   | 55      | 84   | 10   | 82   | 22     | 70   | 72       | 22       | 70       | 72       |
| Dental exam (last y)              | 00                             | 86 | 16     | 90   | 05      | 65   | 00   | 60   | 02     | 36   | 60       | 02       | 36       | 60       |
| Flu vaccine (last y)              | 00                             | 92 | 00     | 52   | 65      | 34   | 26   | 64   | 53     | 78   | 38       | 53       | 78       | 38       |
| Secondary (optional) <sup>f</sup> |                                |    |        |      |         |      |      |      |        |      |          |          |          |          |
| Use of statins                    | 04                             | 44 | 14.3   | 62   | NA      | NA   | 07   | 27   | 18     | 68   | 43.85    | 18       | 68       | 43.85    |
| ACE Inhibitors                    | NA                             | NA | NA     | NA   | 08      | 40   | 04   | 41   | NA     | NA   | 34.5     | NA       | NA       | 34.5     |
| Aspirin use                       | NA                             | NA | 00     | 92   | 50      | 82   | 11   | 21   | NA     | NA   | 32       | NA       | NA       | 32       |
| Dilated eye exam (last y)         | NA                             | NA | NA     | NA   | NA      | NA   | 00   | 72   | 22     | 39   | 44.5     | 22       | 39       | 44.5     |
| TB screening                      | 00                             | 90 | 0      | 52   | NA      | NA   | 34   | 66   | 05     | 85   | 66       | 05       | 85       | 66       |

Abbreviations: RMI = Republic of the Marshall Islands; A1c = hemoglobin A1c; y = year; BP = blood pressure; NA = not available/applicable; TB = tuberculosis

<sup>a</sup>Measures (indicators) established using 2012 American Diabetes Association (ADA) Standards of Medical Care ([http://care.diabetesjournals.org/content/35/Supplement\\_1/S11.full](http://care.diabetesjournals.org/content/35/Supplement_1/S11.full)) and WHO Package of Essential Interventions for Non-communicable Diseases (PEN) ([http://www.who.int/cardiovascular\\_diseases/publications/pen2010/en/](http://www.who.int/cardiovascular_diseases/publications/pen2010/en/))

<sup>b</sup>Clinical performance outcomes assessed at pilot start (baseline) and at 16-months (achieved)

<sup>c</sup>Core measures: 2 A1c measures within the last 12 months (at least 3 months apart); documented diabetes self-management goal setting; A1c and B/P goals are based on patient characteristics and response to therapy; and documented foot exam (i.e. visual, sensory, and vascular)

<sup>d</sup>Based on 2012 ADA Standards of Medical Care: Achieve and maintain recommended levels of glycemic control (i.e., A1c <7% for most patients).

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Based on 2012 ADA Standards of Medical Care: Current ADA Standards recommend B/P <140/90 mm Hg

Secondary measures: statin therapy for 40 y of age; ACE inhibitor therapy 55 y of age; aspirin therapy (75–162 mg/day) men >50 y, or women >60 y of age who have at least one additional major risk factor (family history of cardiovascular disease, high BP, smoking, dyslipidemia, or albuminuria); and TB screening using Pacific-based guidelines.