

## Clinical Study

### Clinical outcomes of a diabetes education program for patients with diabetes mellitus in the Micronesian community in Hawaii

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Received: March 2016  
Accepted: May 2016

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#### ABSTRACT

**Objective:** Hawaii has diverse population made up of a cultural mix of different races. Due to different cultural and social influences and language barrier, many of the under-served population who migrated to Hawaii and having diabetes mellitus may be susceptible to long-term complications due to uncontrolled hyperglycemia and medication nonadherence. The purpose of this study was to evaluate the impact of a diabetes education program on the clinical outcomes in patients with diabetes mellitus in the Micronesian community of Hawaii.

**Methods:** This study included patients over age 18 years, with a diagnosis of type 2 diabetes mellitus. The diabetes education program was customized for its weekly classes to fit to the under-served population. Data were collected on participants on the 1<sup>st</sup> day and then 6 months after attending the education program. Data on primary and secondary endpoints were collected and analyzed.

**Findings:** The mean glycosylated hemoglobin A<sub>1c</sub>, fasting blood glucose, and triglyceride levels of participants fell significantly from baseline after attending the diabetes education program for 6 months. No significant changes were observed in other secondary outcomes during the study time period.

**Conclusion:** Based on our findings, the diabetes education program that was tailored to the Micronesian population was successful in achieving glycemic goals, enhancing medication adherence, improving clinical outcomes, and also preventing long-term complications among its participants.

**Keywords:** Clinical outcomes; diabetes education program; Micronesian; Ohana; type 2 diabetes

## INTRODUCTION

An estimated 29.1 million Americans have diabetes mellitus, accounting for 9.3% of the United States population based on the 2014 National Diabetes Statistics Report.<sup>[1]</sup> In 2012, the total cost for treating diabetes in the United States was estimated of \$245 billion,<sup>[1]</sup> where majority of it were spent on the treatment of long-term complication.<sup>[2]</sup> Poor

glycemic control manifested in costly and lifelong morbidities, which could have been managed by healthy eating, regular physical activity, and treatment with medication lowering blood glucose levels.<sup>[3]</sup> Improving glycemic control in patients with type 2 diabetes mellitus can prevent or delay the onset, or slow the progression of microvascular and some macrovascular complications.<sup>[4-7]</sup> The American Diabetes Association (ADA) has stated that long-term

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DOI: 10.4103/2279-042X.185740

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**How to cite this article:** Chong MT. Clinical outcomes of a diabetes education program for patients with diabetes mellitus in the Micronesian community in Hawaii. *J Res Pharm Pract* 2016;5:205-11.

maintenance of glycosylated hemoglobin (HbA<sub>1c</sub>) levels of  $\leq 6.5\%$  is an important indicator of blood glucose control<sup>[8]</sup> and would not be categorized as having high risk for diabetes.<sup>[9]</sup>

Hawaii is known as the melting pot of the Asia-Pacific region based on the diversity of its people. Under the Compact of Free Association Act<sup>[10,11]</sup> with the United States, the Micronesians had access to many US programs and services including health care. In addition, many groups of people throughout the Asia-Pacific region have immigrated to Hawaii for more opportunities or a better life.<sup>[12,13]</sup> When newcomers arrive to Hawaii, often times they are not assimilated to the American culture, eating habits to adopt a much healthier and different life style. Moreover, these people may not be accustomed to what known as “Western Medicine” as they are accustomed to the use of traditional medicine depending on individual culture, background, and belief.<sup>[14]</sup>

Some Micronesian patients with diabetes mellitus living in Hawaii do not store their medications properly due to the lack of knowledge and education on medication use. Continuous medication nonadherence along with comorbid conditions makes many Micronesian patients susceptible to the long-term complications as a result of uncontrolled hyperglycemia.<sup>[15]</sup> Unknowingly, many Micronesian patients associate these long-term complications with the clinical actions or side effects due to the “Western Medicine” treatment plan. These misconceptions influence many of them to opt out of treatment in fear that they will develop these long-term complications, thus creating another barrier for effective management of their diabetic condition. Couple with other barriers such as language, social influence, low-health literacy, high-sugar food intake, and different life style, the Micronesian population has higher prevalence of diabetes.<sup>[16-19]</sup> In order to prevent further long-term complications, to improve medication adherence, and to optimize drug therapy in such patients, a tailored diabetes education program was launched. In a case report by Chong,<sup>[20]</sup> it was demonstrated that such specially tailored type of diabetes education program could help to improve clinical outcomes in a Micronesian patient with uncontrolled hyperglycemia. The objective of this study was to evaluate the feasibility and the effectiveness of a diabetes education program on the clinical outcomes of Micronesian patients with diabetes mellitus.

## METHODS

Hilo Bay Clinic, an only Federally Qualified Health Center in Hilo, provides primary care services to

a large population in Hilo and surrounding areas, serving about 45,000 people. As the only safety-net health care provider in the area, Hilo Bay Clinic provides primary care, children and women services, preventive care, and dental services through the federally qualified 340B subsidized healthcare plan that reaches out to low-income people and also the uninsured. In 2006, Hilo Bay Clinic initiated a diabetes education program to meet the needs and demands of the Micronesian population in Hawaii to self-manage their disease condition. This modified diabetes education program is known as the “Ohana Diabetes Education Program” [Table 1].<sup>[20]</sup> The word “Ohana” in Hawaiian language means “family,” and thus promotes a very friendly and family-like environment to help educate and support the patients in understanding and managing their diabetes. In 2009, an ambulatory care pharmacist was added to the interprofessional team to provide medication therapy and monitoring patients’ clinical outcome.

Patients visited this clinic were enrolled in the diabetes education program from July 1, 2010 to January 1, 2012 over a 18 months period. Patients were considered eligible to participate in this program, if 18 years of age and above, had type 2 diabetes mellitus, or had multiple chronic conditions, or were on multiple medications, or were recently diagnosed with diabetes mellitus. Patients were excluded if found not willing to comply with medication adherence, not residing in Hawaii or considered difficult in keeping up with their regular clinic visit. A total of thirty individuals participated in this diabetes education program. The study was approved by the University of Hawaii Institutional Review Board. The diabetes education program was advertised throughout the local community and by word-of-mouth by the participants.

The program was organized on two separate days. Classes on Wednesdays were primarily targeted to the Marshallese patients, whereas classes on Thursdays were scheduled for the Chuukese as they were all Hawaii residents that came from the Micronesian Islands. The customized weekly diabetes education classes were administered by a dietitian and an advanced nurse practitioner in a group setting,<sup>[20]</sup> based on ADA standard guidelines as shown in Table 1. Classes included learning about the disease progression, healthy eating and living, physical activity or exercise, medication therapy and monitoring, management of acute and long-term complication, preventive care, and goal settings. Blood glucose level and blood pressure were recorded during each class. Each class had an interpreter who spoke either Marshallese or Chuukese language to facilitate participants’ learning, enhance adherence,

**Table 1: Classes included in “Ohana” diabetes education program\*\***

Class	Title of the class	Purposes of the class taught in “Ohana” diabetes education program
Class 1	Diabetes disease process	Describe the definition, signs, symptoms, pathophysiology and treatments
Class 2	The basics of eating	Describe how food groups can impact blood glucose and reasons for meal planning
Class 3	Physical activity and exercise	Describe the effects of physical activity in blood glucose, and help create individual exercise program
Class 4	Medication	Describe the purpose, action, use, side effects and administration of medication and insulin used to treat diabetes
Class 5	Monitoring your diabetes	Improve patient and family knowledge about the purposes of blood glucose self-management and monitoring, how to record blood glucose readings and to understand the results
Class 6	Prevent, detect and treat acute complication and personal health habits	Describe how to incorporate good health habits (foot and skin care, dental care, recognizing and preventing infections) into daily living
Class 7	Managing blood glucose	Describe the management of blood glucose during hypo-or hyperglycemia, ketones and ketosis, and managing sick days
Class 8	Long-term complications	Describe the various chronic complications and associated symptoms, ways to monitor and prevent complications
Class 9	Goal setting and problem solving	Describe effective ways to set and carry out goals for better self-management of diabetes

\*\*Classes were taught by a dietitian, advanced nurse practitioner, medical practitioner, or pharmacist

and improve dialog. This program also helped to develop an “Ohana” atmosphere by creating a successful care and learning environment to build trust and lasting patient-provider partnership. Following the classes, patients with abnormal laboratory values would meet with the interdisciplinary team consisted of an advanced nurse practitioner, pharmacist, dietitian, and interpreter. This team would provide appropriate counseling, referral to specialists, and medication management to the patients through an interdisciplinary approach as a normal clinic visit. During this time, the pharmacist was able to recommend drug therapy by initiating, modifying, or discontinuing medication. This collaborative practice, automatically enabled patients’ follow-up visit in an easy and very friendly and familiar manner. In addition to the weekly classes, monthly community outreach events were held by the interdisciplinary team outside the clinic to reach out to the larger community. These social events were held in the park or on the beach or in a community center.

Participants’ data were collected at the 1<sup>st</sup> day of their visit or enrollment as a baseline and then 6 months later during the class. Data on primary and secondary endpoints were collected and analyzed, which was not limited to glycosylated HbA<sub>1c</sub>, fasting blood glucose (FBG) level, blood pressure, lipid panel only. Continuous variables were analyzed using Student’s *t*-test. A *P* ≤ 0.05 was considered statistically significant.

## RESULTS

A total of thirty Micronesian individuals participated in the “Ohana” diabetes education program at Hilo Bay Clinic. Participants’ demographic characteristics

**Table 2: Patients’ characteristics, medical conditions and comorbidities<sup>[22]</sup>**

Patients’ characteristics	Micronesian patients (n=30)
Demographic characteristics	
Age (years)	56±8.1
Male	14 (46)
Female	16 (54)
Weight (pounds)	180±38.3
BMI	32.1±5.7
Number of patients using tobacco	5 (16)
Medical conditions	
Diabetes mellitus	30 (100)
Cardiovascular disease <sup>a</sup>	21 (70)
Dyslipidemia	22 (73)
Stroke	2 (6)
Pulmonary disease <sup>b</sup>	7 (23)
Malignancy	4 (13)
Depression	1 (3)
Seizures	4 (13)
Gastrointestinal disease <sup>c</sup>	3 (10)
Comorbidities <sup>d</sup>	
0 comorbidity	3 (10)
1 comorbidity	7 (23)
2 comorbidities	11 (36)
3 comorbidities	9 (30)

Data are expressed either as mean±SD or *n* (%). <sup>a</sup>Cardiovascular disease includes=Hypertension, myocardial infarction, angina pectoris, and heart failure, <sup>b</sup>Pulmonary disease includes=Asthma, chronic obstructive pulmonary disease, and emphysema, <sup>c</sup>Gastrointestinal disease includes=Peptic ulcer, gastric reflux, duodenal ulcer, and diarrhea, <sup>d</sup>Comorbidities include=Diabetes mellitus, hypertension, and dyslipidemia. SD=Standard deviation, BMI=Body mass index

and medical conditions were presented in Table 2. It is obvious from this table that majority of the patients had 2 or more conditions namely diabetes, and/or hypertension, and/or dyslipidemia. Both, male and female were equal in number with a mean age of 56 years (+/- 8.1). The mean weight of patients was

180 pounds with an average body mass index of 32.1 suggesting that most patients were obese. Five (16%) patients were tobacco users; however, seven (23%) of participants had pulmonary diseases. Few patients also had gastrointestinal diseases and seizures.

Ninety percent of patients enrolled in the program were taking low-dose aspirin. Most patients were also prescribed with either an angiotensin converting enzymes (ACEs) inhibitor or angiotensin receptor blockers (ARBs) and a lipid-lowering agent. About one-third of the patients were treated with long-acting insulin injection. During this diabetes education program, all patients received both flu and pneumonia vaccines.

The HbA<sub>1c</sub> levels improved significantly from baseline to 6 months among participant who attended the diabetes education program [Table 3]. The mean reduction in HbA<sub>1c</sub> levels was 1.2% over a 6-month period from 9.56% to 8.36% ( $P < 0.05$ ). Similarly, mean FBG levels decreased from 264 to 194 mg/dl, and this reduction was statistically significant ( $P < 0.05$ ). Mean triglyceride (TG) levels showed significant decrease from 154 to 129 mg/dl at 6 months period ( $P < 0.05$ ). However, no significant changes were observed in other secondary outcomes such as total cholesterol (TC), low density lipoprotein (LDL), high density lipoprotein (HDL), and blood pressure during the study period.

## DISCUSSION

The objective of this study was to understand how appropriately “Ohana” diabetes education program helped to optimize drug therapy in Micronesian patients for preventing long-term complications due to their uncontrolled hyperglycemia. In this program, patients had the opportunity to attend educational classes on a weekly basis as compared to most national programs that met monthly or quarterly for a limited and specific time. By meeting on a continual basis, the patients had access to continuity of health care and were able to adhere to their treatment plan through attending the weekly diabetes education session with monitoring and evaluation of progress by interdisciplinary team approach. In this way, patients could avoid missing doses because of running out of medication, which was a common occurrence among the Micronesian patients. Second, this study could remove the cultural, social, and other potential barriers to improve medication adherence. With continuous improvement in clinical outcomes, long-term complications, morbidity, and mortality can be prevented in patients with diabetes mellitus.

In this study, it was found that majority of the medical conditions were not being treated or

patients had no knowledge of their conditions. Most of the patients were nonadherence to medication therapy, and they were not aware of the proper use of medication prior to enrolling into the program during initial assessment at enrollment. Patients enrolled in the program were either had diabetes and/or hypertension, and/or dyslipidemia, with few patients also having gastrointestinal diseases and seizure disorder.

The “Ohana” diabetes education program demonstrated how to improve clinical outcomes for patients with diabetes. Patients seemed to be able to accept medical treatment better as compared to prior enrollment to the program. From Table 4, it was through the diabetes education program that 90% of the patients enrolled were eventually taking low-dose aspirin, with either an ACE inhibitor or an ARB (angiotensin II blocker) blocker and also a lipid-lowering agent. It was realized that if a patient was treated with insulin injection was considered to be “having terminal condition of the disease” by the Micronesian patients, although one-third of the patients in the program were treated with long-acting insulin injection. Proper education on the use and

**Table 3: Primary and secondary end points on day 1 and six months later**

Primary or secondary end points	Day 1 on enrollment	6 months after enrollment	P
Primary end points			
HbA <sub>1c</sub> (%)	9.56±1.96	8.36±1.74	<0.05
Secondary end points			
FBG (mg/dl)	264.62±124.41	194.62±89.44	<0.05
TG (mg/dl)	154.36±72.1	129.10±58.44	<0.05
TC (mg/dl)	179.56±32.14	170.10±32.97	NS
LDL (mg/dl)	108.83±28.16	103.43±26.73	NS
HDL (mg/dl)	40.26±8.04	40.26±9.67	NS
Systolic BP (mmHg)	128.56±15.82	132.36±24.81	NS
Diastolic BP (mmHg)	74.74±10.08	76.00±9.67	NS

Data are expressed as either mean±SD. HbA<sub>1c</sub>=Hemoglobin A<sub>1c</sub>, FBG=Fasting blood glucose level, TG=Triglyceride, TC=Total cholesterol, LDL=Low density lipoprotein, HDL=High density lipoprotein, SD=Standard deviation, NS=Not significant, BP=Blood pressure

**Table 4: Medication initiated during “Ohana” diabetes education program**

Types of medication taken by the patients during the program	Micronesian patients (n=30)
Aspirin (81 mg)	27 (90)
ACEI/ARB	20 (67)
Lipid-lowering drugs*	22 (73)
Insulin injection	9 (30)
Flu vaccination	30 (100)
Pneumococcal vaccination	30 (100)

Data are expressed as n (%). \*Lipid-lowering drugs include: Statins, fibrates, nicotinic acids, bile acid resins, fish oil preparations, ACEI=Angiotensin converting enzyme inhibitors; ARB=Angiotensin-II receptor blockers

disposal of insulin injection was taught during the weekly classes by the interdisciplinary team members. All patients attending classes received both flu and pneumonia vaccinations, which was the another benefit of this education program.

Based on our findings, the Micronesian patients with type 2 diabetes who attended the "Ohana" diabetes education program demonstrated improved HbA<sub>1c</sub>, FBG, and TG levels over a 6-month period. The mean HbA<sub>1c</sub> for the patients was 8.36% [Table 3] after attending the program for 6 months, which was still considered high based on the ADA guidelines. Most of the Micronesian patients had HbA<sub>1c</sub> on an average 10% and above before arriving in Hawaii due to uncontrolled hyperglycemia.

Reduction in HbA<sub>1c</sub> by 1.2% in the first 6 months was considered statistically significant achievement for these patients due to long-term complications associated with uncontrolled hyperglycemia as demonstrated by UK Prospective Diabetes Studies.<sup>[4,5]</sup> The objective of this "Ohana" diabetes education program in its unique setting was to dissipate the stress, cultural, and social differences that the Micronesian patients may experience when coming into a new and unfamiliar healthcare environment. This program served as a bridge to enable such patients to build trust and feel comfortable with the healthcare providers as a result of meeting one-on-one to receive individualized care within a group environment. This diabetes education program in turn had provided ample opportunity and easy accessibility to health care to the Micronesian patients for immediate and consistent individualized treatment provided by the healthcare providers including advanced nurse practitioners and pharmacist. Due to certain cultural and social norms, the Micronesian people do not like to visit or obtain medical treatment for preventative care as they are used to the habit of making visit only when they are really "ill." This program, with no obstacle of making appointment for visits, would serve as a key approach to initiate therapy and continuity of care. Thus, if the Micronesian patients were to regularly attending such diabetes education program; over time, such unthreatened environment with repeated interventions would able to gradually improve clinical outcomes such as HbA<sub>1c</sub> by attaining targeted goal for the individuals. Similarly, the Micronesian patients had high FBG levels ranging from 250 to 350 mg/dl on their enrollment into the diabetes education program. Easy accessibility to the healthcare providers on continual basis at this diabetes education program and weekly blood glucose checks during the class resulted in huge drop in the FBG levels. With continuous reminders and educating patients that high FBG level

was not desirable, helped patients to understand and control their blood glucose level. It was also noticed that the program had effect on lowering the TG level but not on TC and LDL cholesterol levels. No change in HDL cholesterol level over the 6 months period may suggest involvement in minimum physical activity due to obesity among the patients. However, there were no changes in systolic and diastolic blood pressure over the 6-month period.

In this study, Micronesian patients improved on their primary endpoints, i.e., HbA<sub>1c</sub>, FBG, as well as TG levels over a noticeable short period of time. Greater impact on the clinical outcomes would result if patients continue to attend the diabetes education program with appropriate support and making consistent changes toward healthy living. It is yet to known, if this program eventually will be used as a model to enhance medication adherence and impart patient education; thus improving the quality of life, reducing healthcare cost, and preventing further progression of short- and long-term complications associated with chronic diseases such as diabetes.

Sample size of thirty could be a limitation of this study. However, continuous efforts are being made to promote awareness among Micronesian community for preventing chronic diseases. We have simultaneously initiated a mobile health screening project, as a community outreach program, especially tailored to the Marshallese population. This Marshallese Mobile Screening Clinic Project (MMSCP)<sup>[21]</sup> was initiated by a team of three pharmacy students and a faculty member at the University of Hawaii, Daniel K. Inouye College of Pharmacy. The team members traveled to churches and community events to offer health screening and education to the Marshallese people. Screening on HbA<sub>1c</sub>, blood pressure, and cholesterol level was conducted during this community outreach events, and the test results were interpreted to the participants. If participants were identified to have shown with abnormal screening results, they were referred and encouraged to attend the "Ohana" diabetes education program at Hilo Bay Clinic as described earlier. Chong *et al.*<sup>[21]</sup> in their study reported 59% of the participants actually enrolled in the diabetes education program at Hilo Bay Clinic upon referral from the health screening events with one-half of the participants were older than 40 years of age. This study also revealed that this MMSCP project in fact helped to prevent the progression of long-term complications due to uncontrolled hyperglycemia among the Marshallese people. It was believed that such health screening events would help to increase the sample size for future study. Another limitation of the study was to have a more effective control group in the study design. In this study, the

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patients served as their own control as they were subjected to intervention by the interdisciplinary team after their baseline measurement at the time of study enrollment. Our future plan is to design a study comparing two groups, one group receiving the “Ohana” diabetes education, whereas the other group subjected to regular clinic visit. Third, the study period of 6-month was too short to elucidate long-term effect on clinical and patient outcomes,<sup>[23-31]</sup> which could be addressed in our future study.

In short, the “Ohana” diabetes education program was vital success for helping Micronesian patients to achieve their glycemic goals and to prevent long-term complications that was due to chronic disease such as diabetes mellitus.

## AUTHORS' CONTRIBUTION

Dr. Mok Thoong Chong contributed to this study.

### Acknowledgments

The author would like to thank Dr. Danita D. Henley who was a Pharm.D student at the University of Hawaii, Daniel K. Inouye College of Pharmacy, Charlotte Grimm, APRN, Keola Downing, Ph.D, and Richard Agenten, RN from Hilo Bay clinic for their help and contribution during the study.

### Financial support and sponsorship

Nil.

### Conflicts of interest

There are no conflicts of interest.

## REFERENCES

- Centers for Disease Control and Prevention. 2014 National Diabetes Statistics Report. This Document is Intended to Provide Up-to-Date Scientific Data and Statistics on Diabetes and its Burden in the United States; 2014.
- Boyle JP, Honeycutt AA, Narayan KM, Hoerger TJ, Geiss LS, Chen H, *et al.* Projection of diabetes burden through 2050: Impact of changing demography and disease prevalence in the U.S. *Diabetes Care* 2001;24:1936-40.
- Wagner EH, Sandhu N, Newton KM, McCulloch DK, Ramsey SD, Grothaus LC. Effect of improved glycemic control on health care costs and utilization. *JAMA* 2001;285:182-9.
- UK Prospective Diabetes Study Group. Intensive blood-glucose control with sulphonylureas or insulin compared with conventional treatment and risk of complications in patients with type 2 diabetes (UKPDS 33). *Lancet* 1998;352:837-53.
- UK Prospective Diabetes Study Group. Effect of intensive blood-glucose control with metformin on complications in overweight patients with type 2 diabetes (UKPDS 34). *Lancet* 1998;352:854-65.
- Stratton IM, Adler AI, Neil HA, Matthews DR, Manley SE, Cull CA, *et al.* Association of glycaemia with macrovascular and microvascular complications of type 2 diabetes (UKPDS 35): Prospective observational study. *BMJ* 2000;321:405-12.
- Knowler WC, Barrett-Connor E, Fowler SE, Hamman RF, Lachin JM, Walker EA, *et al.* Reduction in the incidence of type 2 diabetes with lifestyle intervention or metformin. *N Engl J Med* 2002;346:393-403.
- Rozenfeld Y, Hunt JS, Plauschinat C, Wong KS. Oral antidiabetic medication adherence and glycemic control in managed care. *Am J Manag Care* 2008;14:71-5.
- ADA. Standards of Medical Care in Diabetes – 2012: Diagnosis of Diabetes. *Diabetes Care* 2012;35:511-61.
- Riklon S, Alik W, Hixon A, Palafox NA. The compact impact in Hawaii: Focus on health care. *Hawaii Med J* 2010;69 6 Suppl 3:7-12.
- Shek D, Yamada S. Health care for Micronesians and constitutional rights. *Hawaii Med J* 2011;70 11 Suppl 2:4-8.
- Fitzpatrick-Nietschmann J. Pacific Islanders – Migration and health. *West J Med* 1983;139:848-53.
- Choi JY. Seeking health care: Marshallese migrants in Hawai'i. *Ethn Health* 2008;13:73-92.
- Zimmet P, Arblaster M, Thoma K. The effect of westernization on native populations. Studies on a Micronesian community with a high diabetes prevalence. *Aust N Z J Med* 1978;8:141-6.
- Reddy R, Shehata C, Smith G, Maskarinec GG. Characteristics of Marshallese with type 2 diabetes on Oahu: A pilot study to implement a community-based diabetic health improvement project. *Calif J Health Promot* 2005;3:36-47.
- Eason RJ, Pada J, Wallace R, Henry A, Thornton R. Changing patterns of hypertension, diabetes, obesity and diet among Melanesians and Micronesians in the Solomon Islands. *Med J Aust* 1987;146:465-9.
- Balkau B, King H, Zimmet P, Raper LR. Factors associated with the development of diabetes in the Micronesian population of Nauru. *Am J Epidemiol* 1985;122:594-605.
- Ringrose H, Zimmet P. Nutrient intakes in an urbanized Micronesian population with a high diabetes prevalence. *Am J Clin Nutr* 1979;32:1334-41.
- Cortes LM, Gittelsohn J, Alfred J, Palafox NA. Formative research to inform intervention development for diabetes prevention in the Republic of the Marshall Islands. *Health Educ Behav* 2001;28:696-715.
- Chong MT. Clinical outcomes of a diabetes education program: A six-month evaluation on a Marshallese patient in Hawaii. *Int J Pharm Teach Pract* 2013;4:731-4.
- Chong MT, Shimabuku SS, Lai Hipp C, Kim CL. Marshallese Mobile Screening Clinic Project (MMSCP). *Int J Pharm Teach Pract* 2015;6:2609-14.
- Chong MT, Yamaki J, Harwood M, d'Assalenaux R, Rosenberg E, Aruoma O, *et al.* Assessing health conditions and medication use among the homeless community in Long Beach, California. *J Res Pharm Pract* 2014;3:56-61.
- Thom DH, Willard-Grace R, Hessler D, DeVore D, Prado C, Bodenheimer T, *et al.* The impact of health coaching on medication adherence in patients with poorly controlled diabetes, hypertension, and/or hyperlipidemia: A randomized controlled trial. *J Am Board Fam Med* 2015;28:38-45.
- Lee JK, Grace KA, Taylor AJ. Effect of a pharmacy care program on medication adherence and persistence, blood pressure, and low-density lipoprotein cholesterol: A randomized controlled trial. *JAMA* 2006;296:2563-71.
- Dominguez K, Penman-Aguilar A, Chang MH, Moonesinghe R,

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- Castellanos T, Rodriguez-Lainz A, *et al.* Vital signs: Leading causes of death, prevalence of disease and risk factors, and use of health services among hispanics in the United States – 2009-2013. *MMWR Morb Mortal Wkly Rep* 2015;64:1-10.
26. Desborough JA, Sach T, Bhattacharya D, Holland RC, Wright DJ. A cost-consequences analysis of an adherence focused pharmacist-led medication review service. *Int J Pharm Pract* 2012;20:41-9.
  27. The American College of Preventive Medicine. Medication Adherence: Improving Health Outcomes Time Tool: A Resource from the American College of Preventive Medicine. Available from: <http://www.acpm.org/?MedAdhereTTProviders>. [Last accessed on 2016 Feb 20].
  28. World Health Organization. Adherence to Long-Term Therapies: Evidence for Action; 2003. Available from: [http://www.who.int/chp/knowledge/publication/adherence\\_full\\_report.pdf](http://www.who.int/chp/knowledge/publication/adherence_full_report.pdf). [Last accessed on 2016 Feb 20].
  29. Briesacher BA, Andrade SE, Fouayzi H, Chan KA. Comparison of drug adherence rates among patients with seven different medical conditions. *Pharmacotherapy* 2008;28:437-43.
  30. Brown MT, Bussell JK. Medication adherence: WHO cares? *Mayo Clin Proc* 2011;86:304-14.
  31. Egede LE, Gebregziabher M, Dismuke CE, Lynch CP, Axon RN, Zhao Y, *et al.* Medication nonadherence in diabetes: Longitudinal effects on costs and potential cost savings from improvement. *Diabetes Care* 2012;35:2533-9.