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Treatment Plans for Diabetes Management During Hurricane Maria in Puerto Rico

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Walden University

College of Health Sciences

This is to certify that the doctoral study by

Joel De La Cruz Oller

has been found to be complete and satisfactory in all respects,
and that any and all revisions required by
the review committee have been made.

Review Committee
Dr. Cheryl Cullen, Committee Chairperson, Health Sciences Faculty
Dr. Suzanne Paone, Committee Member, Health Sciences Faculty
Dr. Suzanne Richins, University Reviewer, Health Sciences Faculty

The Office of the Provost

Walden University
2019

Abstract

Treatment Plans for Diabetes Management During Hurricane Maria in Puerto Rico

by

Joel De La Cruz Oller

MA, Walden University, 2015

BS, University of Puerto Rico, 1991

Doctoral Study Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Healthcare Administration

Walden University

November 2019

Abstract

The purpose of this study was to evaluate the health outcomes of diabetic patients in Puerto Rico, before, during, and after Hurricane Maria, in 2017. The Department of Health in Puerto Rico provided the secondary data for the variables low-density lipoproteins (LDL) cholesterol, hemoglobin A1C (HbA1c), mortality, and consumer price index (CPI). The inclusion criteria were participants for whom electronic data were available before, during, and after Hurricane Maria; the sample size was 450. The theoretical framework for this investigation was the health outcomes and impact assessment. The data were analyzed by univariate and analysis of variance (ANOVA) to compare means and normality test analysis. Results of this study revealed that before Hurricane Maria, diabetics in Puerto Rico did not have control of their health. The American Diabetes Association (ADA) guideline for Hgb AIC is < 7.0; prior to Hurricane Maria Hgb AIC was 7.30 and after it was 7.21. The ADA LDL goal is <70.0; the prior mean was 91.2 and after mean was 91.3. The null hypothesis was retained. Prior to the hurricane, 15 diabetic patients died, and after 666 patients died as a result of diabetes; the CPI for healthcare increased 1.56% after the hurricane; indicating there is a relationship. The results of this study may contribute to social change by informing leaders that diabetes patients treatments outcomes must be within the CDC and ADA guidelines, and effective planning for medical treatment of patients with chronic illnesses is necessary before, during, and after a natural disaster.

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Dedication

I dedicate this dissertation to my mother, Nicaz Oller, and to my sons Esther, Joel Jeremias, and Uriel Ramon. Sabina Almanza Santos to you. Also, to my best friend, Maria Del Carmen Castillo. Thomasina for you. They are my purpose, my motivation, and the light that guides my journey through Walden University's doctoral program. God always!

Acknowledgments

I firmly acknowledge Dr. Cheryl Cullen for her vast knowledge and enthusiasm and her always supportive and kind treatment of my dissertation. Following her advice, my dissertation will become a tool for positive social change. I thank Dr. Anastacio Emiliano Sosa, my friend, for his complete cooperation and guidance in the creation of this study. Finally, to my brother Jabes De La Cruz, who always supported me to finish this project. Always to Reshma Beharry and Annette Tucker Osborne friends.

Table of Contents

List of Tables

Section 1: Literature Review and Foundation of the Study

Literature Review

The effective prevention and management of patients with noncommunicable diseases, especially those with diabetes mellitus, may have the potential to improve the quality of health and reduce the healthcare spent for commercial and government third-party payers in Puerto Rico and the United States (Ryan et al., 2015). The World Health Organization (2016) argued that because people were living longer, the prevalence of noncommunicable chronic diseases was more significant than of acute communicable diseases. The literature showed that, over time, patients faced the risk of poor management of diabetes and lack of patient health literacy, failure of licensed medical practitioners to follow standardized protocols, and a lack of access to diabetes mellitus care (Delea et al., 2015; Gross et al., 2003; Coon & Zulkowski, 2002; Hunt, Valenzuela, & Pugh, 1997.

Ryan et al. (2015) and Tonelli, Wiebe, Nadler, Darzi, and Rasheed (2016) described that after a natural disaster, the government focus may be to prioritize medical assistance to reduce the possible spreading of communicable diseases and immediate trauma. In developed countries, the risk of spreading communicable diseases is small compared to the risks that patients could develop complications with chronic illness, such as diabetes mellitus, when unable to access supplies, medications, and access to care (Delea et al., 2015; Gross et al., 2003).

Natural disasters, such as Hurricane Maria, require a precoordinated response that integrates all levels of emergency response, including patients with diabetes mellitus in

the top five categories of urgency (Buse, Tanaka, & Hawkes, 2017). Preventive actions need to be concise and accurate in medical treatments for noncommunicable disease and adequate diabetes management protocols. Understanding patients' living environment and their financial conditions could help to create a prevention plan that is responsive to the health needs of patients with chronic illnesses, such as diabetes. Proper healthcare management during and after natural disasters that require emergency procedures may potentially avoid medical complications for patients with chronic illness, especially diabetes (Allweiss & Albright, 2011; American College of Endocrinology, 2013; Fonseca et al., 2007; Heptulla et al., 2016; Lee et al., 2016; Steven, 2017).

Problem Statement

During and after a natural disaster, health organizations are tested to the maximum of their capacity. Hurricane Maria devastated the healthcare infrastructure in Puerto Rico, and the island is still facing challenges in delivering quality, cost-effective healthcare (Santos & Howard, 2017). A more significant challenge involved the treatment of people with diabetes during the natural disaster. Healthcare organizations needed to react according to a pre-established natural disaster plan. As part of the plan, healthcare organizations allocate resources and identify strategies for health management (National Syndromic Surveillance Program, 2017). Identification of a correlation, if any, of the emergency medical protocols of the American Diabetes Association (ADA) and Center for Disease Control and Prevention (CDC) for diabetic patients during a natural disaster, may be an effective evaluation tool for quality, cost-effective healthcare delivery during Hurricane Maria (Department of Health, Health Promotion Secretariat, Chronic

Diseases Prevention and Control Division [DHHPS, CDPCD], 2015). A precoordinated effort could significantly reduce the barriers to effective healthcare management and improve delivery of medical care during a natural disaster (Powers et al., 2015).

The consideration of financial and economic decisions needed to be evaluated to identify how to optimize the use of resources and offer the best quality services to patients, especially diabetic patients (Lurie, Manolio, Patterson, Collins, & Frieden, 2013). A gap in the literature existed regarding management of diabetes during a natural disaster, such as Hurricane Maria, in Puerto Rico. Thomas and Kaplan (2017) explained that after Hurricane Maria, delays in the pharmaceutical manufacturing of diabetes medications resulted in shortages not only in Puerto Rico but nationwide. Proper preventive action plans in a natural disaster may improve effective healthcare management for diabetic patients. The results of this study, regarding the status and effectiveness of the preplan actions and the application of the medical protocol during Hurricane Maria informs healthcare leaders and policymakers regarding the effectiveness of the action plans and the status of diabetic patient health measures prior to Hurricane Maria. Quality of care for the diabetic patient will reduce cost and improve the health outcomes of diabetic patients for chronic management and during and after natural disasters, such as Hurricane Maria.

Purpose of the Study

The purpose of the study was to review secondary data, not previously collect for research, regarding the health outcomes of patients with diabetes prior to, during, and after Hurricane Maria in Puerto Rico. An evaluation of the quality and cost outcomes

using ADA and CDC disaster protocols on health outcomes for diabetic patients were the baseline (ADA, 2007; CDC, 2018; DHHPS, CDPCD, 2015). The correlation, of the impact on patient outcomes, specifically mortality, measured by glycosylated hemoglobin (Hgb A1C), LDL cholesterol, and mean systolic blood pressure; effectiveness and timeliness of care as measured by mortality rates and body mass index (BMI), age, and gender of diabetic patients; and the per capita cost of diabetes care was measured to inform healthcare leaders and policymakers in Puerto Rico regarding the potential opportunity to develop a natural disaster protocol for diabetes management. Possible complications of diabetes are angina, myocardial infarction, stroke, and other peripheral artery diseases (ADA, 2017). These medical conditions have a negative impact on the quality of life of diabetic patients who do not have glycemic control. This doctoral study contributes to the body of literature regarding the impact of the lack of a current protocol to support patients with diabetes during a natural disaster in Puerto Rico. The results of this study inform healthcare providers and third-party payers regarding the health status of diabetics before Hurricane Maria and the importance of improving care quality, in general, to ensure care is maintained during and after a potential natural disaster. The improvement of health and glycemic control will reduce cost and reduce mortality rates (Greenhalgh, Howick, & Maskrey, 2014).

Significance of the Study

The outcomes of the study have provided new information regarding the status of health management of diabetic patients in Puerto Rico, before, during, and after Hurricane Maria. This information may be used a guide to develop programs and

protocols to meet the ADA and CDC guidelines for glycemic control for diabetics. This study informs the Puerto Rico healthcare leaders, physicians, government officials, and other stakeholders regarding the necessary features, plans, or protocols required to respond to the challenge of diabetic patient medical care prior to and during a natural disaster.

Dzau, Lurie, and Tuckson (2018) explained that after Hurricane Katrina in New Orleans, Louisiana, the difficulties that healthcare organizations confronted were 80% decrease in hospital capability and 75% of the clinic's protection net shut down. Noncommunicable diseases during a storm or cyclone could be affected at the level that diabetes exacerbates them and subsequent complications could lead to death (Dzau et al., 2018). This evidence demonstrated a lack of preparedness, improper location of resources, and inadequate adherence to protocol treatments for diabetic patients.

Fonseca et al. (2009) evaluated glycosylated hemoglobin (Hgb A1C), mean systolic blood pressure, and LDL (cholesterol level) as part of ADA protocol for diabetic treatment during a natural disaster. The results of the study showed an increase in a parameter in all three levels in patients during Hurricane Katrina. The cost of healthcare treatment increased significantly during a natural disaster. Situations like this may create inequality in receiving quality medical treatment; diabetic patients with higher incomes may have greater access to medical care during a natural disaster than patients with lower incomes (Fonseca et al., 2009). According to Cefalu, Smith, Blonde, and Fonseca (2006), some diabetic patients presented difficulties in obtaining quality care because of insulin availability in a natural disaster. Healthcare organizations must have taken measures to

monitor the possibility of disease complications for diabetic patients during a natural disaster. During and after hurricanes, diabetic patients' health could have deteriorated as a result of inappropriate management of healthcare delivery, which could ended in disease complications (Blanchet et al., 2017).

Research Questions and Hypotheses

The impact on patient outcomes, specifically mortality, measured by glycosylated hemoglobin (Hgb A1C), LDL cholesterol, and mean systolic blood pressure; effectiveness and timeliness of care as measured by mortality rates by BMI, age, and gender; and the per capita cost of diabetes care. The research questions that follow seek to identify a correlation, if any, of patient outcomes and demographics, and the possible impact of the natural disaster Hurricane Maria.

RQ1: What is the correlation, if any, of the ADA and CDC action plan for diabetic management during a natural disaster and patient quality of care measured by increased Hgb A1C, increased LDL cholesterol, and systolic blood pressure before and after Hurricane Maria in Puerto Rico?

H_0: There is a correlation between the ADA and CDC action plan for diabetic management during a natural disaster and patient quality of care measured by increased Hgb A1C, increased LDL cholesterol, and mean systolic blood pressure of diabetic patients, before and after Hurricane Maria in Puerto Rico.

H_a: There is no correlation between the ADA and CDC action plan for diabetic management during a natural disaster and patient quality of care measured by

increased Hgb A1C, increased LDL cholesterol, and mean systolic blood pressure of diabetic patients, before and after Hurricane Maria in Puerto Rico.

RQ2: What is the impact, if any, of effectiveness and timeliness of care related to the ADA and CDC standard emergency management plans, as measured by mortality rates, BMI, age, and gender of diabetic patients, before and after Hurricane Maria?

H_0: There is an impact of effectiveness and timeliness of care related to the ADA and CDC emergency management plans, as measured by mortality rates, BMI, age, and gender of diabetic patients, before and after Hurricane Maria.

H_a: There is no impact of effectiveness and timeliness of care related to the ADA and CDC emergency management plans, as measured by mortality rates, BMI, age, and gender of diabetic patients, before and after Hurricane Maria.

RQ3: What is the correlation, if any, of per capita cost of diabetes management in Puerto Rico, before and after Hurricane Maria?

H_0: There is a correlation of per capita cost of diabetes management in Puerto Rico, before and after Hurricane Maria.

H_a: There is no correlation of per capita cost of diabetes management in Puerto Rico, before and after Hurricane Maria.

Theoretical Foundation for the Study

The theoretical framework for this research is the health outcomes and impact assessment (Khoja, Durrani, Scott, Sajwani, & Piryani, 2013). In a study regarding the evaluation of the effectiveness of an e-health program, the health outcomes and impact assessment provides an effective measure regarding the effectiveness of health

interventions (Khoja et al., 2013). Components of the health outcomes and impact assessment include “change in disease or health status, impact on quality of life, and change in health indicators” (Khoja et al., 2013, p. 50). Application of this framework to this study is appropriate as an assessment of the health status of diabetic patients in Puerto Rico before and after Hurricane Maria, which may inform healthcare leaders, government officials, and physicians regarding the need, if any, to develop a noncommunicable disease disaster plan to improve patient outcomes.

This study provided evidence, that will be discussed in chapter four, that can drive medical practitioners to create an effective model to guide efficiently planning and implementing medical protocols toward effective management of noncommunicable diseases, such as diabetes, during natural disasters (Iskander, Rose, & Ghiya, 2017). Disaster plan management goals of the ADA provided further context to measure the effectiveness of the medical and health outcomes of diabetic patients in Puerto Rico during Hurricane Maria.

Nature of the Study

The nature of this study was quantitative, correlational research that utilized secondary data, not previously collected for research. The sources of secondary data were from the Puerto Rico Department of Health, the Department of Emergency Medicine, the CDC, and the ADA. The Statistical Package for Social Sciences (SPSS) was used to illustrate the correlation between the variables, which inform healthcare leaders and healthcare policymakers in Puerto Rico, regarding factors that may have contributed to

inadequate healthcare management and quality medical care delivery for diabetic patients during Hurricane Maria and future potential natural disasters.

Literature Search Strategy

The strategy for the literature search was to use various scholarly databases with specific Boolean phrases and restrict the search to peer-reviewed sources between the years 2013 to 2018. The databases searched were Medline and ProQuest through Walden University Library and Google Scholar. In addition, used the public websites for the CDC, the ADA, the Department of Health in Puerto Rico, and the Department of Emergency Medicine. The keywords and Boolean phrases used were *Hurricane Maria health, Hurricane Maria diabetes, Hurricane Maria noncommunicable diseases, natural disaster health management, natural disaster noncommunicable disease management, Hurricane Maria health management evaluation, Hurricane Maria noncommunicable disease evaluation,* and *evaluation of noncommunicable disease management in the United States after a natural disaster*.

Table 1

Summary of Literature Review Keywords and Boolean Phrases

Keywords	Google Scholar	Other sources
Hurricane Maria health	29,800	103
Hurricane Maria diabetes	2,900	4
Hurricane Maria Noncommunicable diseases	417	0
Natural disaster health management	1,530,000	11
Natural disaster noncommunicable diseases management	21,400	0
Evaluation Hurricane Maria diabetes	2,440	0
Evaluation Hurricane Maria health management	17,900	0
Evaluation of noncommunicable diseases during a natural disaster	21,000	0

Literature Review Related to Key Variables and/or Concepts

A review of the literature is an objective review of the scientific knowledge on a subject to determine if the questions and hypotheses of the investigation can be based in theory. Previous research related to this study was used to explain and support the ideas applied to the study. A compilation of the previous evidence of the health administration of diabetic patients during a natural disaster supports the relevance and timeliness of this research study. A discussion of the relevant literature to support the justification of the study, the variables, and a review of previous studies follows. Identification of the gap in the literature supports the relevance of this study to healthcare administrators.

Definitions

BMI: A ratio of body mass index that can indicate if a person is an underweight, normal weight, overweight, obese, or morbidly obese (Dobner & Kaser, 2018).

Diabetes: A blood metabolic disease diagnosed after an Hgb A1c > 6.5 %, a glucose test in fast of 126 mg/dl or over and any time of 200 mg/dl or over (ADA, 2015).

LDL Cholesterol: High risk for diabetic patients is LDL Cholesterol over 70 mg/dl (ADA, 2015).

Systolic blood pressure: High risk for diabetic patients is blood pressure of 130 mmHg and over (ADA, 2015).

Morbidity: The frequency of a person in a given population will develop a disease in a specific time (World Health Organization, 2016).

Per capita cost: The average of individual costs for receiving a service or product (Mamaril et al., 2018).

Action plan during a natural disaster: Healthcare protocol that should be implemented during a natural disaster (Baruah & Kumar, 2014).

Patient quality of care: Medical care received according to reasonable viability of resources by professionals, medication, and facilities (ADA, 2015).

Historical Perspectives

The medical protocols for diabetes management in Puerto Rico were prepared by the DHHPS, and CDPCD. Medical protocols for other common chronic diseases are also contained therein. The purpose of these medical protocols is to provide clinical guidelines based on medical evidence, diagnoses, and treatments for specific illnesses. Physicians and health organizations must use these protocols to guarantee quality healthcare delivery. For healthcare insurance providers, these protocols are also a useful tool to maintain and manage quality healthcare administration. Medical protocols are established according to laboratory parameters and clinical manifestations of screening, diagnoses, and treatment of patients (Ray et al., 2017).

Medical protocol emphasizes prevention and avoidance of disease complications. According to the División de Prevención y Control de Enfermedades Crónicas, Secretaría Auxiliar para la Promoción de la Salud (2012), diabetes was the third most common cause of death (10.1%) in Puerto Rico in 2010; the top two were cardiovascular diseases (17.8%) and cancer (17.7%). These chronic diseases need adequate healthcare management to provide quality medical services and to maintain financial sustainability

for the stakeholders involved in the delivery of care (World Health Organization Expert Committee on Biological Standardization, 2018). Specific Health 2020 objectives were established to increase the number of chronic disease data resources offered and the number of monitoring and evaluation reports of chronic diseases to support the expansion of chronic disease management programs. The goal was that the updated policies and disease management policies and protocols would advance the prevention and control of chronic disease (División de Prevención y Control de Enfermedades Crónicas, Secretaría Auxiliar para la Promoción de la Salud, 2012). Another objective was to increase the number of primary care centers and apply one or more mechanisms to the expanded chronic care model. The goal to prevent, control, and manage chronic disease in each stage of life is also part of the Health 2020 goal. Finally, the number of policies and regulations that encourage people to pursue healthy and safe environments and healthy foods also increased for the Health 2020 plan (División de Prevención y Control de Enfermedades Crónicas, Secretaría Auxiliar para la Promoción de la Salud, 2012).

The Milken Institute School of Public Health (2018) at George Washington University conducted a study that included data from the census to observe mortality rates from 2010 to February 2018. The data revealed that the general population of Puerto Rico was reduced by 8% between mid-September 2017 and mid-February 2018. Mortality was at an expected rate in August 2017, but from September 2017 through February 2018, researchers found a noticeable increase in mortality (George Washington University, Milken Institute School of Public Health, 2018). The report estimated 2,975 deaths directly or indirectly associated with Hurricane Maria. The study concluded that at

the time of Hurricane Maria, the government agency for public safety in Puerto Rico had no formal disaster and emergency risk communication plans in place. Subsequently, the Puerto Rican government was not prepared to communicate health-related reports and mortality surveillance as needed to effectively respond to the emergencies. The report also indicated a notable lack of readiness by physicians preparing death certificates and subsequent reports to the proper government channels.

Kishore et al., (2018) explained that an adequate physical infrastructure is essential to provide and delivery quality healthcare services and understand the effects of natural disasters in a community. Kishore et al. (2018) explained that 4,645 deaths were directly caused by Hurricane Maria, but the public was informed that the official death count was 64. Some of these mortality reports were used to calculate and compare the mortality report for the same period a year before and investigate the causes of death, infrastructure loses, or considerable damage and displacement. The mortality report after Hurricane Maria grew 72 times the year before (Kishore et al., 2018). Kishore et al. (2018) provided information and evidence that the death toll could have been as much as 70 times greater than the original report from the Puerto Rican government.

Hurricane Maria's main destruction to Puerto Rican infrastructure was to roads, tele-communications, electricity, delivery of medical supplies, and access to healthcare. Some causes of death were attributed to flying debris and to the loss of critically necessary medical care (Kishore et al., 2018). The most difficult disruptions of medical services included the inability of accessing medicine, respiratory equipment, and dialysis services due to road damage and the lack of electricity. Medical facilities were closed,

physicians were unavailable to provide care, and 9-1-1 services were not available. Healthcare leaders, administrators, healthcare providers were responsible for the lack of planning to ensure emergency power and medical supplies (Kishore et al., 2018).

Strategies, Plans, and Protocol

The strategy used by the U.S. government after Hurricane Sandy was to organize and send mobile medical units, intended to provide services to communities that had been hit the hardest by the hurricane, that were in need of medical services (Lien et al., 2014). Strategies included quickly assessing the community needs, preparing the mobile health unit, activating recruited staff, and evaluating the program and final feedback (Lien et al., 2014). The pre-planning phase of this operation, prepared volunteers, workers, organized supplies and had people in strategic areas so that aid was deployed as soon as possible (Lien et al., 2014).

In the case of hurricane Sandy, the mobile health unit operated for approximately 4 months providing services to citizens ages 3 months to 91 years. A total of 1,160 citizens were helped, and resource outcomes proved this was an effective measure to activate during a natural disaster. According to Childers, Mayorga, and Taaffe (2014), a strategy to evacuate people from acute and long-term healthcare facilities is necessary. A life-plan model that guides emergency evacuations and informs patients and healthcare workers of the process, resources, and leadership during and after the emergency is needed in the pre-planning phase until a real situation occurs. Claver (2013) explained that providers of comprehensive care for elderly people should consider that many bio-psycho-social barriers may prevent quality care during natural disasters. The evacuation

process could psychologically impact older adults and could introduce complications to their illnesses. Ensuring patients and families are familiar with emergency evacuation plans is essential for success.

Alcorn (2017) identified that before Hurricane Maria the healthcare system in Puerto Rico was stretched to its limit and already had difficulty meeting basic healthcare needs. One of the main difficulties after the natural disaster was a lack of communication and the lack of electricity and backup emergency generators to keep healthcare centers functional. The general population also lacked electricity. At the time of Hurricane Maria, approximately 6,000 diabetes patients needed regular dialysis, but there was no plan in place to address this need during the natural disaster.

Puerto Rico is facing difficulties funding Medicaid. Approximately 1.4 million people receive Medicaid assistance for their healthcare and the healthcare policy makers in Washington DC, appear unwilling to continue to support or increase funding to the Medicaid System in Puerto Rico above the current policy formulas (Lavery, 2018). Lavery (2018) reported that few hospitals were able to provide acute care, and after Hurricane Maria, 71% of pharmacies were closed and unable to dispense needed medications.

The application of protocol involves strategies and plans that contribute to prevention and mitigation in the event of a natural disaster. Roman (2018) posits that before Hurricane Maria, Puerto Rico's healthcare deficit to care for the 3.4 million citizens was over $80 billion. The fragile system had a disastrous result after the hurricane. Even 10 days after Hurricane Maria passed through Puerto Rico, only nine out

of 69 hospitals were connected to the electrical grid, and most emergency rooms and urgent care facilities were inoperable (Roman, 2018).

How the Plan Should Be Developed

The establishment of some healthcare protocols arose after Hurricane Maria. Horsburgh (2018) explained that different data sets must be collected, monitored and analyzed, as critical zone observatory data to monitor the environment and natural disaster projection, publicly available population health data, and health data needed for research, to inform stakeholders, healthcare policy makers, and administrators of the results. Other required data includes drinking water monitoring, and other sanitation controls. Geospatial data to provide information on road opening, access to hospitals or temporary acute care venues, and safe transportation are needed and should be part of the pre-planning phase. Satellite data to inform storm development and natural disaster monitoring is also necessary to plan supplies and personnel (Horsburgh, 2018).

The emergency response protocol and strategic plan needs to include an ethical component to ensure *the mission first but people always*. According to Johnstone and Turale (2014), nurses and other health workers, dealing with catastrophic events, need to have ethical preparedness. Some of the ethical dilemma that health workers could face are low morale, fear, loss of trust, and misinformation. In New Orleans after Hurricane Katrina physicians and nurses were arrested for conducting merciful killings to older people. The dilemma was level of pain that the patient was suffering versus the length of time of the inevitable actual death of natural causes. A protocol must be developed,

communicated, and trained to ensure nurses and physicians are prepared to make euthanasia decisions and are protected under the protocol (Turale, 2014).

The creation and application of healthcare protocols that have specific policy to address the management of chronic illness is necessary. The communication of the protocols, preparation to ensure health professionals understand the information, adequate supply storage, and public understanding of where services can be obtained are necessary for the success of the program. The plan must be created, practiced, communicates, and then executed in a timely and efficient manner, when needed (Rose, Murthy, Brooks, & Bryant, 2017).

Cordes et al. (2017) explained there are two main consideration to have in case of a natural disaster one is the displacement of people and the second is the possibilities of outbreak of contagious diseases. In other to prevent or minimize the occurrence of these events healthcare protocols must be created, practiced, and communicated prior to a natural disaster occurrence. As part of the planning of evacuation, shelter availability must be part of the plan.

The Gap in the Literature

Demaio et al. (2013) stated that in other to reduce adverse health risk and to provide an effective humanitarian response to health outcomes during and after a natural disaster a comprehensive strategic plan that received collaboration from all stakeholders private and public sectors needs to be developed. A significant challenge is to bring the relevance to the stakeholders of the preparedness for non-communicable disease in the acute response or emergency of natural disasters. For these reasons, studies need to be

conducted in other to comprehend morbidity and mortality outcomes as a direct or indirect result of the existence of non-communicable diseases. This situation brings awareness of how to overcome or face the challenge of noncommunicable disease effectively during a natural disaster. A protocol to respond with the appropriate government and organizations policies, which would be the standard procedures and the available resources appropriate to respond during an emergency caused by a natural disaster and relate to noncommunicable diseases. The main issue is the lack of information of morbidity, of evidence-based guidelines, and the subsequent result of healthcare outcome during an emergency.

Ryan (2015) explained as a result of the growing occurrence of natural disease around the world the difficulties of noncommunicable disease during an emergency have increase affecting healthcare delivery. The problems presented during and after a natural disaster in getting access to food, water, equipment, primary medical care, and essential medical treatment could complicate the existing condition for those with noncommunicable diseases. Ryan (2015) concluded that medical services disrupted after the occurrence of a natural disaster were due to a loss of electricity, damage to the transportation infrastructure and mandatory evacuations.

The risk for the worsening of the diabetic condition could result in death. The study recommends applying the Sendai Framework for Disaster Risk Reduction: 2015-2030, to minimize the impact of natural disaster in the people with diabetes. Baruah, and Kumar, (2014), in this study, discovered that most of the effort in a natural disaster is directed to the instantaneous effect and do not take into consideration the negative

consequence to the people with chronic illness. The negative impact of the disruption of medical service to diabetic patients are the health complications and economic problem for the long-term as well as the immediate economic consequence. The solution for a natural disaster preparedness plan must be the collaboration of the state and community governments and must follow healthcare policies and guidelines. The goal should maintain quality healthcare delivery that enhances lives and deliverer the needed resources (Baruah, & Kumar, 2014).

Aitsi-Selmi, Egawa, Sasaki, Wannous, and Murray (2015) prepared a policy outline from the United Nations to address climate change, health, and general progress. The main objective was to create procedures that create a safe environment to protect the living. The aspects to focus on the infrastructure are safe hospitals and schools with the consideration of physical healthcare and mental healthcare as well. The outcome would be a higher well-being higher by reducing the risk of a natural disaster. The study explained that a natural disaster is not natural as the damage happens to artificial infrastructure, and the danger appears as the interaction of contact with the inhabitants, the ecological vulnerabilities, financial, social, and physical. The new approach of healthcare management during and after a natural disaster requires focus on the classified vulnerabilities, hazards, and their assessment and identification as the principal objective of the strategic plan. The government and stakeholders must recognize and influence people in the community to attain improved financial and social progress paths.

Quast and Mortensen, (2015) posit that children with diabetes during a natural disaster such as Katrina present a challenge to obtain proper care. A comparison was

made with children in Louisiana that not receive the impact of Hurricane Katrina with those that live in the area in Louisiana that receive the greater impact of Hurricane Katrina. The parameters to measure controlled diabetes management were eye exam, glycosylated hemoglobin Hgb A1c, and microalbumin present in urine. Results identified that the children received the same or better treatment, based on the three parameters, after Hurricane Katrina (Quast and Mortensen, 2015).

A study of Hurricane Katrina survivors by Tomio and Sato (2014) revealed that the primary objective of disaster preparedness was to avoid the exacerbation of the chronically ill patient during and after a natural disaster. Adequate preparedness met three criteria: utilization of evidenced-based planning and measurement, second inform the community of chronically ill patients in a logical and consistent manner, and three make sure the plan is practical and achievable. Of the Hurricane Katrina survivors 17% had at least one chronic illness. Based on a comprehensive disaster plan, the majority of those with exacerbated chronic illness were evacuated when they arrived at shelters to ensure sufficient medical management to prevent complications.

Ko, Strine, and Allweiss (2014) found that a relevant part of natural disaster preparedness for people with diabetes, who needed specialized medicines and supplies, to ensure management of the disease, were not prepared. The study results showed a startling conclusion that diabetics were no more prepared for an emergency or natural disaster than those with no chronic illness. The recommended plan that diabetics are to always have at least three days medicine and supplies on hand, had little compliance. On average people with diabetes annual percentage rate (aPR) was 1.09 to have an

evacuating plan and aPR of 1.04 to have 3-days medicine on hand. The startling conclusion of this study was that people with diabetes were no better to prepare for a natural disaster than those without chronic illness.

Ochi, et al., (2014) looked to discover the causes and consequence of lost drugs and the difficulties to obtain prescription refills during and after the event of a natural disaster such Hurricane Katrina. The first problem is the evacuee lost medications during the evacuation process and the second was a lack of information to obtain new prescription medications. After a natural disaster, an increase in burden throughout and immediately after a disaster period is the same for developing and developed nations. Interruption of medication to the diabetic patient could lead to multiple complications to their chronic conditions and elevate the cost of medical treatments. A specific example from Hurricane Katrina was that 38% of children with chronic illness did not have their medications at the time of evacuation, and as a result, 58% had a disruption of medical care. Concerning prescription refills after Hurricane Katrina, the majority of patients who came to the emergency room were looking for refills. A positive finding was those patients who did have a stockpile of at least one month's medications demonstrated better outcomes as long as medications were not lost during the evacuation process.

Veenema, Rains, Casey-Lockyer, Springer, and Kowal (2015) presented shelters as tools to provide healthcare as well as safety and protection for the adverse elements during natural disasters. The evaluation of shelters should be first on healthcare personnel such as nurses and physician with an adequate number. The preparation and service that should be provided are medication management and access to medication. The infection

diseases control, medication prescription, medical referral, and mental health service. The final objective should be a quality assessment of service delivered to a patient with noncommunicable diseases and others.

Lee et al. (2016) researched the diabetic patients that after Hurricane Sandy use the emergency room in New York City in geospatial analysis. In this study use the data from all-payer that include the location where they come from, medical diagnoses and comorbidities and insurances status among other information. Most of the patients that came to the emergency room were Medicare patients. Also, in many cases the comorbidities such as high blood pressure, a complication of resent medical procedures and chronic skin ulcer. The principal causes that diabetic patients visited the emergency department after Hurricane Sandy were for heart attack, new prescriptions, refill prescriptions, drug abuse, and dialysis. Conclusions of the study were that diabetic patients become more vulnerable after a natural disaster and preparation for a natural disaster for this type of patient is essential, especially for cardiovascular events (Lee et al.,2016).

Impact of Medical Treatments Plans

The evaluation of a medical treatment plan is necessary first, to avoid repeating past mistakes, and second to corroborate the application of evidence-based medical treatment. Schneider, (2016) explained that in Hurricane Katrina the communication coordination was not properly planned but was resolved in a timely manner. Concepción-Acevedo et al. (2018) discussed that after Hurricane Maria hit Puerto Rico, access to all communication was nearly impossible. The solution to both of these situations is to

ensure a backup redundancy plan for communications that would provide adequate communication should the current active plan fail (Schneider, 2016). The plan for emergency response should be coordinated by government authorities who perform a disaster rehearsal every year. The plan would require emergency medication storage, vaccines, medical supplies, and medical equipment. The supplies would be strategically placed, based on evacuation plans to ensure access when required. The preparedness for laboratory testing would consist of ensuring basic blood tests and x-rays could be done at the emergency site. Moving patients and specimens for additional testing to the continental United States, or other area could be done when safe. Finally, healthcare organizations must be prepared for an alternative way to report the result for the testing of the pathogen during and after a natural disaster (Concepción-Acevedo et al., 2018). All stakeholders must evaluate the response to past emergency response and apply the information learned when creating plans to ensure positive outcomes.

Healthcare organizations must be included in the emergency preparedness plans and participate in the annual disaster drill. Evaluation after the planned and actual external disaster, is essential to ensure plans are updated, especially if unexpected incidents occurred. This study demonstrates that evaluation of the pre-Hurricane Maria status, what occurred during, and then after and the impact of medical treatment for diabetes management is essential (Stilianakis & Consoli, 2013). Use of decisions-making mathematical, economical, and computer science models is essential to be able to predict the outcomes and plan for them (Stilianakis & Consoli, 2013). This quantitative study

may inform management response to a natural disaster and the impact of that management response.

Diabetes Management During a Natural Disaster

According to of the ADA (2014), the scope to avoid diabetes complications patients need self-management and execution of health education recommendations to reduce long-term complications. The delimitations for creating an effective glycemic reduction are the appropriate use of medications (Nathan, 2013). The limitation of this study would be patients from Puerto Rico who received diabetes medical care in Centro de Diabetes in Puerto Rico. Rubino et al. (2016) established the specific aspect in which surgical intervention must be indicated for Type 2 Diabetic. The stakeholders involved in reimbursement, medical evaluation, and patient engagement should be evaluated. The risk-benefit-complications of surgical intervention to prevent further complication in diabetic patients should be discussed and documented.

Causes for Developing Diabetes

De Souza et al. (2015) explain that a person could develop diabetes if the patient consumed both trans-unsaturated fats and saturated fats. Possible complications could also result in the development of cardiovascular disease that increases the mortality rate. De Souza et al. (2015) concluded that saturated fats do not increase the complication of diabetes but trans-unsaturated fat could increase the risk of developing diabetes.

Khunti et al. (2015) describe that insulin users could risk developing hypoglycemic conditions. The development of hypoglycemic could them promote many causes of mortality and coronary diseases. The development of cerebral vascular disease

increases with hypoglycemic. Finally, the improper management of insulin intake could create disease complications for the diabetic patients.

Alegre-Díaz, (2016) describes how patients with inadequate blood glycemic levels could develop diabetes. Some of the cause might be access to proper medical care because lack of economic resources. The poor glycemic control could be the cause for developing diabetes that in case of a natural disaster could exacerbate. The recommendation is to plan holistic treatment to maintain adequate glycemic control.

Diabetes Management

Jones, (2015) explained that researchers in Canada discovered a gap between diabetes diagnose and better management that could affect the quality of treatment. The solution to respond to diabetes management was to create a model of collaboration among primary physician, nurses, and other healthcare workers. The recommendation was for health team to focus on education for explained the guidelines of evidence base diabetes treatments, training patients in self-management diseases and maintain adherence to treatment. This model required planning and regulation in order to prevent chronic complications.

Powers et al. (2017) indicated that the primary focus of diabetes management should be focused on diabetes self-management and healthcare professional support to patients with the diabetes diseases. Diabetes needs daily monitoring and as result patient need to make daily decisions. Applying effective practices of self-management in diabetes could promote better health outcomes. Diabetes self-management is the major

component of proper monitoring and self-treatments and the sustained behaviors that promote the proper practice of a diabetes patients.

Lee et al. (2016) explained that the use of smart cell phones could improve education support. The proposal is to monitor HgbA1c, arterial tension, LDL, weight, and life style. The innovation of this treatment is the application of health technology to provide holistic treatment. The result for patients could prevent diabetic disease complications.

Diabetes Risks of Comorbidities

ADA (2015) explained that the objective of care and the patient strategic plan is to prevent diabetes complications. Diabetic complications will lead to co-morbidities that seriously impact the health and economic status of the patients due to disabilities and medical care. An effective coordination based on age and gender is necessary.

Klimek, Kautzky-Willer, Chmiel, Schiller-Frühwirth, and Thurner, (2015) developed a study that classified patients according to their age and gender to identify the risk of co-morbidity. A new discovery was found that linked diabetes and development of Parkinson disease. A significance among gender was a correlation between sleep disorders and congestive heart failure. A correlation between females and developing high blood pressure and developing Type 2 Diabetes increased as age increased.

Long-Term Effects

Hou, Carter, Hewitt, Francisa, and Mayor (2016) as unsupervised self-management of diabetes could create a negative effect on patients. The result demonstrated that the use of the phone could maintain an adequate level of glycemic

control. A correlation between younger patients and the use of the cell phone application, had better outcomes. The optimum result was obtained when physicians and patients collaborated on outcomes and medical plan.

Gorst et al. (2015) the risk of adverse effect increased with long-term poor glycemic control. The study focused on the effect of macro and micro vascular diseases that develop. A correlation between development of nephropathies, cardiovascular events, and retinopathies in patients with long-term poor glycemic control, resulting in increased morbidity and mortality (Gorst et al., 2015).

Assumptions

The main assumption for planning and implementation of disaster protocols is that they would reduce risk by sustaining patient health and management of chronic illness. The risk reduction plan would reduce the existing risk conditions and avoid new risk conditions through preventive actions that are adopted in anticipation to reduce the hazard and exposure to diminish the vulnerability of people, improve the means of survival, goods, infrastructure, and ecological resources, to avoid or minimize injury and losses in case of dangerous physical actions (Saunders, Grace, Beban, & Johnston, 2015).

The sustainability implies the assumptions that would eradicate poverty, end hunger, achieve security and better nutrition, and promote sustainable agriculture. An effective plan would also ensure a healthy life and promote well-being for all for all ages. Finally, an effective, well-executed plan would guarantee an inclusive and equitable quality education and promote lifelong learning opportunities for all (Saunders, Grace, Beban, & Johnston, 2015). The evaluation and research of the protocols during a natural

disaster could explain why and how many indicators decrease or increase during and after a natural disaster.

Scope and Delimitations

The scope of this study used a sample of a secondary data from "El Centro de Diabetes para Puerto Rico." The study compared univariate, and bivariate variables for this quantitative research. The study addresses if ADA and CDC protocol for natural disaster of diabetes care was executed during Hurricane Maria. How the variables were affected by the protocol's execution during the Hurricane. This study examined health outcomes before and after Hurricane Maria to inform healthcare administrators regarding the access to care and medical resources, and the outcomes of quality healthcare to patients affected by Hurricane Maria. The assessment of result of healthcare after a Hurricane devastate the island of Puerto Rico a U.S. territory that abide by U.S. healthcare protocol could provide example of what can be done to improve better results during a natural disaster.

The population sample for this study is limited to the sample provide by the "El Centro de Diabetes para Puerto Rico" that is approximately five thousand patients. This sample contains patients from different parts of the Island of Puerto Rico but does not represent specific towns or cities. The theories that would not be investigate are the government ineffective policies, racial bias, and political motives. The theory could provide external validity to this investigation. The generalizability of this investigation could be used to inform healthcare administrators and healthcare policy makers to

recommend and to provide adequate disaster plans and protocols to apply in case of natural disaster in Puerto Rico and the United States.

Summary of the Literature Review

This section included a review of the literature related with the evaluation of the impact of medical treatment plans for diabetes management during Hurricane Maria in Puerto Rico. The theoretical framework the health outcomes and impact assessment were investigated. The correlation if any, between the ADA and CDC action plan for diabetic management during a natural disaster and patient quality of care measured by increase Hgb A1C, increased LDL cholesterol, and systolic blood pressure before and after Hurricane Maria in Puerto Rico. The impact, if any, of effectiveness and timeliness of care related to the ADA and CDC standard emergency management plans, as measured by mortality rates, BMI, age, and gender of diabetic patients, before and after Hurricane Maria. The correlation, if any, of per capita cost of diabetes management in Puerto Rico, before and after Hurricane Maria providing new perspective to the gap in literature were reviewed.

Section 2: Research Design and Data Collection

Introduction

In Section 1 of this document, provided a review of the current literature on the evaluation of the impact of medical treatment plans for diabetes management during Hurricane Maria in Puerto Rico, with an emphasis on historical perspective; was addressed the approach and justification using strategies, plans, and protocols, and also discussed the gap in the literature. The research reviewed the ADA standards compared to the actual plan in place for the care of diabetics during a natural disaster in Puerto Rico. In section 2, was presented the research design rationale, the methodology, and threats to validity.

Research Design

In this quantitative research study, investigated the health outcomes of patients with diabetes before, during, and after Hurricane Maria in Puerto Rico. The research evaluated the quality and cost outcomes using the ADA disaster protocols (ADA, 2007; CDC, 2018; DHHPS, CDPCD, 2015). The compare means of the impact on patient outcomes—mortality, measured by glycosylated hemoglobin (Hgb A1C), LDL cholesterol, and mean systolic blood pressure; effectiveness and timeliness of care as measured by mortality rates and BMI, age, and gender of diabetic patients; and the per capita cost of diabetes care—may inform healthcare leaders and policymakers in Puerto Rico regarding the potential opportunity to develop a natural disaster protocol for diabetes management. Possible health complications of diabetes include angina, myocardial infarction, stroke, and other peripheral artery diseases (ADA, 2017).

The analysis methodology that was applied in this study was based in SPSS statics software. The independent variables of RQ1 are increased Hgb A1C, increased LDL cholesterol, and systolic blood pressure before and after Hurricane Maria in Puerto Rico. The dependent variable for RQ1 is the ADA action plan for diabetic management during a natural disaster and patient quality of care. The independent variables of RQ2 are the mortality rates, BMI, age, and gender of diabetic patients before and after Hurricane Maria. The dependent variable for RQ2 is the impact, if any, of effectiveness and timeliness of care related to ADA standard emergency management plans. The independent variable of RQ3 is the consumer price index of Puerto Rico, before and after Hurricane Maria. The dependent variable for RQ3 is the ADA action plan for diabetic management during a natural disaster and patient quality of care. The analyses applied in this research was univariate analysis, compare means analysis, and normality test analysis (Albright, & Winston, 2014).

Population, Sampling Procedure, and Power Analysis

In this research secondary data obtained from El Centro de Diabetes para Puerto Rico. Calculations of the power analysis, for this investigation applied the G*Power 3.1.9.2 statistical software to determine the minimum sample size. The error probability that was considered as 0.05, and the power (1-β err probability) was 0.95 for this study. The confidence level of the SPSS version 24 software was applied to analyze the sample size for the data collected for ten months after September 2017. The population total was 450 based on the patients who received healthcare during Hurricane Maria from El Centro de Diabetes para Puerto Rico, San Juan (El Centro de Diabetes para Puerto Rico,

2018). The researcher used different codes for the dependable variables from the ADA action plan for diabetic management during a natural disaster to measure patient quality of care. After performing G*Power 3.1.9.2 statistical software, the minimum sample size was 161 for each variable. The minimum number of participants was 220 for RQ1, RQ2, and RQ3. The data from each participant must include results before and after Hurricane Maria in Puerto Rico.

The RQ1 examined the impact, if any, of effectiveness and timeliness of care related to ADA standard emergency management plans and the independent variables Hgb A1C, LDL cholesterol, systolic blood pressure, before and after Hurricane Maria in Puerto Rico. The RQ2 examined the mortality rates, BMI, age, and gender of diabetic patients before and after Hurricane Maria. The RQ3 examined the per capita cost of diabetes management in Puerto Rico, before and after Hurricane Maria.

Data Collection and Instrumentation

After the Walden University Institutional Review Board approved the study, the data was obtained from El Centro de Diabetes para Puerto Rico. The researcher acknowledged a confidentiality agreement to obtain access to the electronic records. El Centro de Diabetes para Puerto Rico provided an electronic record that the researcher analyzed as the principal investigator, under the confidentiality agreement terms.

This research is a quantitative study based on secondary data provided and audited by the program director of El Centro de Diabetes para Puerto Rico. The variables collected were Hgb A1C, LDL cholesterol, systolic blood pressure, BMI, gender, age,

and per capita cost of care for diabetic patients before, during, and after Hurricane Maria, in Puerto Rico.

Operational Definitions of Variables

Table 2 displays the operational definitions of variables that were applied in the data analysis. It was defined as ADA standard emergency management plans for diabetic management during a natural disaster and patient quality of care as nominal variables in the statistical analysis. It was defined as Hgb A1C, LDL cholesterol, and systolic blood pressure as scale variables in the statistical analysis. It was defined as the effectiveness and timeliness of care related to ADA standard emergency management plans as nominal variables in the statistical analysis. It was defined mortality rates, age, as scale variables, BMI as ordinal variables, and gender of diabetic patients as a nominal variable. It was defined per capita cost of diabetes management in Puerto Rico, before and after Hurricane Maria, as a scale variable in the statistical analysis.

Table 2

Operational Definitions of Variables

Name	Measurement	Variable values
ADA standard emergency management plans for diabetic management	Nominal	(0) management plan (1) no management plan
Patient quality of care	Nominal	(0) patient quality care (1) no patient quality care
Hgb A1C	Scale	
LDL cholesterol	Scale	
Systolic blood pressure	Scale	
Effectiveness and timeliness of care	Nominal	(0) effective (1) not effective
Mortality rates	Scale	
BMI	Ordinal	(0) ≤ 25 (1) > 25
Age	Scale	
Gender	Nominal	(0) Male (1) Female
Per capita cost of diabetes management	Scale	

Data Analysis

Data analysis for the research was conducted by applying IBM SPSS version 24 statistical software. Descriptive statistics in all variables compared the percentage, mean, standard deviation, mode, and variance and to observe graphical representation. To RQ1, RQ2, and RQ3, as part of the research was applied univariate analysis and compare means analysis and normality test analysis to accept or reject the hypothesis.

The researcher conducted data cleaning and screening procedures by eliminating any inaccurate or corrupt data. First, the researcher, conducted an update of all data and eliminated any corrupt data as a result of transmission, storage, writing, and reading the data. The researcher checked for missing data and used a code of 999 to indicate that data was no response by the participant or filed by the original researcher. The approximate

size of the data was near 450 participants recorded initially in Excel and encoded in SPSS. All data were verified before any analysis on the following: (a) missing data, (b) normality, (c) linearity, (d) outliers, (e) multicollinearity, and (f) homoscedasticity (Van den Broeck, Cunningham, Eeckels, & Herbst, 2005).

Research Questions and Hypotheses

RQ1: What is the correlation, if any, of the ADA and CDC action plan for diabetic management during a natural disaster and patient quality of care measured by increased Hgb A1C, increased LDL cholesterol, and systolic blood pressure before and after Hurricane Maria in Puerto Rico?

H_0: There is a correlation between the ADA and CDC action plan for diabetic management during a natural disaster and patient quality of care measured by increased Hgb A1C, increased LDL cholesterol, and mean systolic blood pressure of diabetic patients, before and after Hurricane Maria in Puerto Rico.

H_a: There is no correlation between the ADA and CDC action plan for diabetic management during a natural disaster and patient quality of care measured by increased Hgb A1C, increased LDL cholesterol, and mean systolic blood pressure of diabetic patients, before and after Hurricane Maria in Puerto Rico.

RQ2: What is the impact, if any, of effectiveness and timeliness of care related to the ADA and CDC standard emergency management plans, as measured by mortality rates, BMI, age, and gender of diabetic patients, before and after Hurricane Maria?

H_0: There is an impact of effectiveness and timeliness of care related to the ADA and CDC emergency management plans, as measured by mortality rates, BMI, age, and gender of diabetic patients, before and after Hurricane Maria.

H_a: There is no impact of effectiveness and timeliness of care related to the ADA and CDC emergency management plans, as measured by mortality rates, BMI, age, and gender of diabetic patients, before and after Hurricane Maria.

RQ3: What is the correlation, if any, of per capita cost of diabetes management in Puerto Rico, before and after Hurricane Maria?

H_0: There is a correlation of per capita cost of diabetes management in Puerto Rico, before and after Hurricane Maria.

H_a: There is no correlation of per capita cost of diabetes management in Puerto Rico, before and after Hurricane Maria.

Analysis Techniques

The analysis began with frequencies especially for the nominal and ordinal variables. After analyzed the estimation, then the following analysis to each research questions was applied. Analyzed RQ1, the frequencies, one sample t test and normality was used. Analyzed RQ2, the frequencies, one sample t test and normality will be used. Analyzed RQ3, the frequencies, one sample t test and normality was used. Faraway (2016) explained that logistic regression models used in the analysis of data from the health sciences allow us to achieve an investigation of the results in explanatory and predictive terms. This analysis also allows knowing the strength of association by relating the risk factors with the effect studied independently and know the predictive value of

each one of them or the model as a whole. But it must be considered and above all understand that they are one more tool in the statistical analysis method for binary nominal dependent variables that in turn have relation with independent variables nominal, ordinal and scale. In the multinomial regression models, it is assumed that the counts of the Y categories have a multinomial distribution. This distribution is, in turn, a generalization of the binomial distribution. This method applied ideally to health management, epidemiology, public health studies, and healthcare administration that need a study cluster can benefit from multinomial logistic regression (Austin, & Merlo, 2017). A correlation coefficient measures the degree to which two variables tend to change at the same time. The coefficient describes both the force and the direction of the relationship. The Pearson correlation evaluates the linear relationship between two continuous variables. A relation is linear when a change in one variable is associated with a proportional change in the other variable (Koo, & Li, 2016).

Interpretation of Results

RQ1, 2 and 3 the frequencies, one sample t test and normality will be responded. The frequencies or univariate analysis of the mean, and standard deviation. The condition is significance of $P < .05$ (Frankfort-Nachmias & Leon- Guerrero, 2015). The one sample t test would compare means. The condition is $P < .05$ (Wagner, 2012). The normality test is used to explain that the sample has a normal distribution. The condition is $P < .05$ (Wagner, 2012).

Threats to Validity

To avoid threats to validity, the design of this research excluded alternative explanations of the results. First action was to be looking for a single explanation that we will ideally obtain. The results of this research answered the research questions will have only one interpretation, which would be that the independent variables are responsible for the changes in the dependent variable through the application of statistical analysis rules for secondary data statistics. The threat to limitation was conditioned for any error interpreting the secondary data of this investigation.

External Validity

The first consideration for this investigation was the testing of reactivity identified by the relevance of the investigation. As the secondary data was provided directly by the healthcare organization, it indicates the relevance of this investigation (Leviton, 2017). The external validity was to provide the scope and method in which the results of an experiment can be generalized to different variables and tests. The objective was to check on interaction effects of selection and experimental variables (Candioti, De Zan, Cámara, & Goicoechea, 2014). The variables were so specific that can be measured in a quantitative study as dependent or independent variables. Considering the above, some precautions should be taken when generalizing the results. This study considered threat as some state has been contained within in the investigation that could limit generality such definition, including and not limited to the ADA action plan for diabetic management during a natural disaster and patient quality of care. Maintain the variables that relate and explained the research questions

Internal Validity

Internal validity refers to the degree to which an investigation dismisses another reason of the results, that is, to the grade that the handling of internal validity is accountable for fluctuations in the external validity (Leviton, 2017). Contemplate subsequently, the variables that can upset the internal validity; variables that have been considered threats to the research question or hypothesis. An investigation that controls the subsequent threats minimize the uncertainty of inferences or alternative explanations. A treat to internal validity is history that are external events that could happen while the investigation is applied. Maturation represents another threat to internal validity as the participants could change but because this is secondary data investigation is not for this investigation. The same criteria for testing, instrumentation, and experimental mortality, and selection-maturation interaction would not apply for this study would not affect this research (Walden University, 2018).

Construct Validity

Construct validity describes whether an investigation demonstrates what it was intended to do or do not. It denotes to whether the functioning meaning of a variable indeed reproduces the true theoretical significance of a theory. This research will construct validity using demonstration and proof provided by the proof of statistical result (Dijksterhuis et al., 2013). The statical testing of frequencies, one sample t test and normality in this research was used. Construct validity is accessible as a necessary condition when testing the efficiency of an evaluation instrument on a given statistical variable.

Ethical Procedures

This research met the requirements of Walden's standards; this is a Walden doctoral healthcare administration research. Previously to obtain the secondary data was required the approval of the Institutional Review Board at Walden. As a prerequisite a letter of confidentiality and approval to use the secondary data from the "Centro de Investigaciones, Educación y Servicios Medicos para la Diabetes de Puerto Rico" was obtained. The IRB approval number for this study was 03-29-190441245.

Permission

The IRB evaluated ethical consideration and provide permission to access secondary data and proceed with the statistical analysis. All data provided by this study only contain secondary data, regarding the effects of the natural disaster, Hurricane Maria, on patients with diabetes, who live in Puerto Rico. Our dissertation advisor assured that all criteria to protect the subjects of the secondary data as established. The acceptance and reviewed of the data were limited to be used only in this work.

Ethical Concerns

This work only used the secondary data for this quantitative research. This study had as principal considerations respect for people as autonomy, informed consent if needed, beneficence, no maleficence, and justice (Pozgar, 2014). The secondary data acquisition took place at the "Centro de Investigaciones, Educación y Servicios Médicos para la Diabetes de Puerto Rico" locations. The data was prepared by the "Centro de Investigaciones, Educación y Servicios Médicos para la Diabetes de Puerto Rico" clerical employees or personal authorized. This study contributed to verify what strategy,

planning and execution must be taken prior, during and after a natural disaster such as Hurricane Maria and the ethical consideration in the management of this data.

Treatment of Data

The Data provided was protected by using data backups, data encryption, only we would have access controls, verifying input validation, and information corroboration (Sanchez-Gomez, Diaz, & Arroyo, 2016). The secondary data was used in the investigation. The data was in storage for the time regulated by Walden. The integrity and safety of the information would be the adherence to secure data procedures; the Walden recommended procedures and policies of handling data. Finally, for the examined of the data that was encrypted on our personal computer and separate backup storage.

Summary

The methodological design of this research was summarized by describing how the general plan that indicates or provides guidance on what was done to answer the research question and subsequently demonstrate the hypothesis. As this section explained the procedures to the methodology approach to our quantitative research. Any probable threats to validity was addressed identified and resolved. Also, precaution was proposed in measuring the information to increase consistency were delineated and were minimize validity. The next section presented the findings and discovery of this research.

Section 3: Presentation of the Results and Findings Section

Introduction

The purpose of this research study was to evaluate the effect of healthcare treatment plans for diabetes management in Puerto Rico before and after Hurricane Maria. The researcher sought to identify potential correlations that affect the health care standards of the CDC and ADA. RQ1 assessed Hgb A1C, LDL cholesterol, and systolic blood pressure before and after Hurricane Maria in Puerto Rico for patients in the sample. RQ2 assessed the mortality rates, BMI, age, and gender of diabetic patients, before and after Hurricane Maria. Finally, RQ3 assessed per capita cost of diabetes management in Puerto Rico, before and after Hurricane Maria. The decision to choose either the null hypothesis or alternative hypothesis was based on the statistical significance of an increase of the parameters that may indicate a reduction in the quality of health outcomes.

Section 3 reviewed the data collection of the secondary data set and presented any discrepancy that was discussed in the original plan presented in Section 2. The researcher discussed the descriptive statistics and demographics of the sample including how the sample relates to the population of this study. The results of this study were presented in a univariate manner to explain the preliminary conclusion. Further analysis presented the statistical tests used to answer each research question and accept or decline the null hypotheses. Tables and figures were used to illustrate the findings.

Data Collection of the Secondary Data Set

Data groupings for the time frame categories before, during, and after Hurricane Maria are as follows: before Hurricane Maria had the date range of July 16, 2016 to

September 15, 2017; during Hurricane Maria had the date range of September 16, 2017 to Oct 2, 2017; and after Hurricane Maria had the date range of October 3, 2017 to Oct 4, 2018. The secondary data variables for RQ1 were Hgb A1C, LDL cholesterol, and systolic blood pressure of diabetic patients. The secondary data variables for RQ2 were mortality rates, BMI, age, and gender of diabetic patients. The secondary data variable for RQ3 was per capita cost of diabetes management in Puerto Rico, before and after Hurricane Maria and was obtained from "Indices de Precio al Consumidor" (indicadores.pr, 2019).

The Discrepancy from the Original Plan of Section 2

Data regarding the cost of healthcare management for diabetic patients was not available for both before and after Hurricane Maria. Instead, the researcher used the consumer price indices of Puerto Rico to have some level of comparison of healthcare costs before and after Hurricane Maria. The consumer price index includes all medical services and has diabetes in the results, but the researcher was unable to obtain health cost data specific to diabetes. The researcher obtained mortality data from a review article as that data point was not available from the original database as expected. Additionally, data was only available for the before and after time periods. During Hurricane Maria, data was not collected and recorded due to the impact of the natural disaster.

Baseline Descriptive and Demographic Characteristics of the Sample

The sample baseline descriptive was analyzed for frequency and percentage, mean, maximum and minimum, mode, sum, standard deviation, and variance. The researcher used a comparison of the mean to decide on greater than or equal or not equal

to decide to accept or reject the hypothesis. The demographics of the samples are Hgb A1C, LDL cholesterol, and systolic blood pressure before and after Hurricane Maria in Puerto Rico. The mortality rates, BMI, age, and gender of diabetic patients, before and after Hurricane Maria. Finally, the cost of healthcare management for diabetic patients before and after Hurricane Maria in Puerto Rico. The participants were adults for all ages and genders. The race of participant was not measured but all participant were residents of Puerto Rico.

Description of the Sample Representation of Diabetic Patients of the "Centro para Diabéticos de Puerto Rico"

According to Frankfort-Nachmias (2017), a sample is a subset of observations from the population of interest. For this research the sample was taken from the diabetic patients that received health care in Centro para Diabéticos de Puerto Rico from September 16, 2016 to September 16, 2017, defined as before Hurricane Maria, and then from October 3, 2017, to October 4, 2018, defined as after Hurricane Maria. The sample taken from September 16, 2017, to October 2, 2017, defined as during Hurricane Maria, resulted in only three patients and would not make a significant representation of the population. The patients selected for this research study had to be in both the before and after group to be considered as part of the sample. A list of patients that received care in the two periods was made and the researcher selected the first 238 patients that were in both periods and also were diabetic. The margin of errors of 5% or p =0.05. The confidence level was 95% with a response distribution of 50%, and the minimum sample needs it would be 220.

Table 3 shows the sample of 238 participants. The sample had a majority of females, illustrating that in this population females were more frequently affected by diabetes. Some additional research could bring answer on why females were more affected by diabetes. Also, the age group of participants 61 to 80 years, represented more than half of the sample of participants. This statistic result could indicate that health organizations need to dedicate more resources to this age group.

The theoretical framework the health outcomes and impact assessment (Khoja, Durrani, Scott, Sajwani, & Piryani, 2013) relate to identified using information technology that the female population has more significant risk to develop diabetes and people that belong to the age group of 61 to 81. Health care organization could apply more effective information technology to identify groups in the population that need help. The identification of a group with a particular need could promote the application of better health care treatments.

Table 3

Population Demographics of Patients in the Study

Total	Number	%-age
Male	90	
Female	146	
Missing	2	
Age 18-30	7	2.90
Age 31-40	10	4.20
Age 41-50	24	10.10
Age 51-60	41	17.30
Age 61-70	65	29.80
Age 71-80	62	26.00
Age 81 and greater	23	9.70
Total	238	100.00

Results of Basic Univariate Analyses that Justify Inclusion of Covariates in the Model

Table 4 shows an ANOVA analysis that compares the mean for variables before and after Hurricane Maria. The difference of the means was within the standard deviation. The significance of not being able to compare the mean of blood pressure before Hurricane Maria did not allow the researcher to make a more precise evaluation of the overall health care treatment of diabetic patients. There was no correlation before and after that met the standard of Hgb A1c set forth by the ADA and the CDC, that indicates have to be < 7.00. The systolic blood pressure of 139 did not meet the standard for diabetic patients according to ADA and CDC standard of care. For this reason the researcher rejected the null hypothesis and accepted the alternative hypothesis that indicates there was no correlation between the ADA and CDC action plan for diabetic management during a natural disaster and patient quality of care measured by increase Hgb A1C, increased LDL cholesterol, and mean systolic blood pressure of diabetic patients, before and after Hurricane Maria in Puerto Rico. The test used to obtain *p*-value was Shapiro-Wilk. This test proved normality of the variable in the sample. All variables were significant at $p < 0.05$, with the exception of LDL after.

Table 4

Results Hgb A1C, LDL, & Systolic BP All Patients

Test	Hgb A1C Before	Hgb A1C After	LDL Before	LDL After	Sys BP Before	Sys BP After
Mean	7.31	7.21	91.86	90.09	N/A	139.76
Std Dev	1.40	1.37	35.22	31.35	N/A	17.22
Min	4.22	4.50	27.00	28.00	N/A	92.00
Max	13.17	11.80	244.00	192.00	N/A	195
Kurtosis	2.46	1.31	1.69	.104	N/A	.326
P Value	0.00	0.00	0.01	0.88	N/A	0.01

After comparing Table 5 for male patients and Table 6 of female patients, management of glycemic control was better for female patients while management of LDL was better for male patients. Overall female and male patients had similar results, though. The two groups, however, did not meet the ADA and CDC standard of care for diabetic patients because in aggregate they had an A1C > 7.0. There was not a significant difference from the two groups and the general group. This result allowed the researcher to reject the null hypothesis because was not correlation with ADA and CDC actions plans for diabetic managements. The test use to obtain *p*-value was Shapiro-Wilk providing proof of normality.

Table 5

Results Hgb A1C & LDL by Gender

	Hgb A1c Before	Hgb A1c After	LDL Before	LDL After
Males	90	90	90	90
Mean	7.39	7.31	88.45	88.23
Std Dev	1.40	1.41	37.23	30.55
Min	5.40	4.50	27	28
Max	12.30	11.40	244	190
Kurtosis	2.06	.84	3.60	0.65
P- Value	0.00	0.00	0.00	0.01`

Table 6

Results Hgb A1C & LDL by Gender

	Hgb A1c Before	Hgb A1c After	LDL Before	LDL After
Females	147	147	147	147
Mean	7.26	7.14	93.92	94.38.
Std Dev	1.42	1.36	33.79	31.29
Min	4.21	4.50	38	35
Max	13.17	11.40	200	192
Kurtosis	2.84	1.48	.38	-0.06
P- Value	0.00	0.00	0.00	0.01`

Table 7 shows a BMI mean of 30.30 which indicates obesity within the sample. According to ADA and CDC, diabetic patients should be within a normal weight to avoid future complications. Furthermore, the researcher did not have data before Hurricane Maria for BMI but data for after Hurricane Maria shows the sample was not in accordance of the ADA and CDC for emergency management planning. The mean age was 63.86 with a standard deviation of 13.75. These findings could indicate that the age range that needs more health resources for diabetic treatment are between the ages of 50

to 77. The mortality rate after Hurricane Maria was 46% higher for the same period time for diabetic patients. For RQ2, the researcher rejected the null hypothesis because there was no evidence of impact of effectiveness and timeliness of care related to the ADA and CDC emergency management plans, as measured by mortality rates, BMI, age, and gender of diabetic patients, before and after Hurricane Maria. A point to make even the researcher did not have data before Hurricane Maria for BMI the data after clearly show is not in accordance of the ADA and CDC for emergency management plan.

Table 7

Mortality rate, BMI, Gender and Age

	Mortality Before	Mortality After	BMI Before	BMI After	Gender	Ages
	15	666	N/A	238	238	238
Mean	N/A	N/A	N/A	30.30	N/A	63.86
Std Dev	N/A	N/A	N/A	6.40	N/A	13.75
Min	N/A	N/A	N/A	15.86	N/A	21
Max	N/A	N/A	N/A	53.84	N/A	93
P-Value	N/A	N/A	N/A	0.00	0.00	0.00

The result for mortality of diabetic patients in Puerto Rico, according to Fink, (2018, June 2) for the periods of September to October 2017, was 666. This number was 46% higher for the average of two years before of the same periods. This result demonstrated a very significant increase in diabetic mortality rate. This univariate result could help to not reject the null hypothesis of RQ2

Table 8

BMI After by Gender

	Male	Female
BMI After	90	147
Mean	30.04	30.48
Std Dev	5.43	6.95
Min	18.50	15.86
Max	50.80	53.84
P-Value	0.00	0.00

Table 8 show similar BMI after Hurricane Maria for both genders. A point to make was that for both genders were obese, and BMI was not in accordance of the ADA and CDC guideline emergency management plan. Because the data for BMI before was not available, the researcher was unable to make a correlation conclusion and the researcher rejected the null hypothesis because the BMI result were not according to ADA and CDC emergency management plans.

Table 9

Consumer Price Index in Puerto Rico of Medical Care Hospital Care Before and After Hurricane Maria

	Medical Care Before	Medical Care After	Hospital Care Before	Hospital Care After
Mean	150.48	152.88	125.33	127.39
Std Dev	1.35	1.04	0.31	1.67
Min	149.69	152.28	125.15	126.43
Max	151.27	153.48	125.58	128.36
p-Value	.00	.00	.00	.00

Because the researcher was not able to obtain per capita cost for diabetes, but the researcher was able to get it for healthcare. This research used consumer price index of Puerto Rico from the periods of September 2016 to October 2017 defined as before and

November 2017 to December 2018 defined as after. The variable of medical care and hospital care showed an increase in the mean. For the RQ 3, the researcher rejected the null hypothesis because there was no correlation of per capita cost of diabetes management in Puerto Rico, before and after Hurricane Maria. The number represented in Table 9 are US dollars for the periods mention.

Results

Descriptive Statistic Presentation

The descriptive statistic used in this research was the first central tendencies that were mean, median, mode and sum. The other descriptive statics used in this research was the dispersion that are standard deviation, variance, range, minimum, maximum, and the standard errors mean. Finally, to prove the distribution the researcher used the skewness and kurtosis to the sample.

Evaluation of Statistical Assumptions

The first assumption was normality where was assumed that continuous variables were normally distributed and make a bell shape. A general rule is that a sample of 50 would be a normal distribution. The sample for RQ1 and RQ2 is 238 for RQ3 was based on consumer price index that would not apply to this test, but normal distribution is assumed in all research questions (Frankfort-Nachmias, & Leon-Guerrero, 2017). Also, used SPSS 24 analysis and explore in Tables 5, 6,7, 8 and 9 by demonstrating normality as all variable except LDL cholesterol after Hurricane Maria were normally distributed by applying Shapiro Wilk .

Applying, SPSS 24 analysis and explored in Table 9 with demonstrating normality as all variable were normally distributed for RQ3. The exceptions were variables Medical Care After, Before and After. The same for Hospital Care Before and After.

Report of Statistical Analysis Findings

RQ1: What is the correlation, if any, of the ADA and CDC action plan for diabetic management during a natural disaster and patient quality of care measured by increase Hgb A1C, increased LDL cholesterol, and systolic blood pressure before and after Hurricane Maria in Puerto Rico?

Ho: There is a correlation between the ADA and CDC action plan for diabetic management during a natural disaster and patient quality of care measured by increase Hgb A1C, increased LDL cholesterol, and mean systolic blood pressure of diabetic patients, before and after Hurricane Maria in Puerto Rico.

Ha: There is no correlation between the ADA and CDC action plan for diabetic management during a natural disaster and patient quality of care measured by increase Hgb A1C, increased LDL cholesterol, and mean systolic blood pressure of diabetic patients, before and after Hurricane Maria in Puerto Rico.

According to the ADA (2015), the normal weight person for BMI was from19 to 25 and overweight person BMI is from 25 to 30. Every BMI result above 25 could present greater risk for patients to develop health complications. The statics data presented in Table 4 were compare mean establish that after Hurricane Maria in Puerto Rico the Hgb A1C the mean decreases from before of 7.30 to an after of 7.21, the

increased the mean of LDL cholesterol from before of 91.86 to an after of 90.09 and the mean of systolic blood pressure demonstrated high blood pressure with an after of 139.76. For this reason, accept the null hypothesis because the Hgb A1C presented means that is not according to ADA and CDC standards. The LDL cholesterol had an increase of the mean that was above of the 70 mg/dl the parameter recommended by the ADA action plan for diabetic management during a natural disaster and patient quality of care. There was no data of systolic blood pressure before Hurricane Maria in Puerto Rico but after a present mean of high blood pressure of 139 that according to the new guidelines of American Heart Association set the new guide line of high blood pressure to a systolic blood pressure above 130 and ADA action plan for diabetic management during a natural disaster recommend target of under 140 for non-complicated patients and of under 130 for patient with cardio vascular risk was not within the standard of care.

RQ2: What is the impact, if any, of effectiveness and timeliness of care related to the ADA and CDC standard emergency management plans, as measured by mortality rates, BMI, age, and gender of diabetic patients, before and after Hurricane Maria?

Ho: There is the impact effectiveness and timeliness of care related to the ADA and CDC emergency management plans, as measured by mortality rates, BMI, age, and gender of diabetic patients, before and after Hurricane Maria.

Ha: There is no impact of effectiveness and timeliness of care related to the ADA and CDC emergency management plans, as measured by mortality rates, BMI, age, and gender of diabetic patients, before and after Hurricane Maria.

According to Fink, (2018) for the periods of September to October 2017 the number of deaths in a year for diabetic patients was 666 this number is 444 percent higher for the average of two years before of the same periods in Puerto Rico. As presented in Tables 7 and 8 mean for BMI presented 30.30 this indicates the above parameter recommended by the ADA standard emergency management plans. Using this evidence, the researcher accept the null hypothesis. In table 8 the significance test that has significance for BMI statically.

RQ3: What is the correlation, if any, of per capita cost of diabetes management in Puerto Rico, before and after Hurricane Maria?

Ho: There is a correlation of per capita cost of diabetes management in Puerto Rico, before and after Hurricane Maria.

Ha: There is no correlation of per capita cost of diabetes management in Puerto Rico, before and after Hurricane Maria.

Presented in Table 9 the mean for consumer price index in Puerto Rico for medical care from before of 150.48 to an after of 152.88. The Hospital Care from before of 125.33 to an after of 127.39 also demonstrated a significant increase. For this increase, the researcher rejects the null hypothesis. Table 9 demonstrated the statistical significance of 0 in all variables.

Post Hoc Analysis

According to Frankfort-Nachmias, and Leon-Guerrero, (2017) the only post hoc analyses for this research is the standard error of the mean. This measure will indicate how ample the dispersion of the particular sample used for the mean. After reviewing the

distribution, all standard errors of the mean were within the parameter expected for each research questions and one sample t-test.

Summary

RQ1: Reject the null hypothesis because even though there was no increase of the mean for Hgb A1C after a decrease with a mean of 7.31 that is above of 7.00 of the ADA recommendation (ADA, 2018) and LDL Cholesterol with a mean of 88.23 were not within the ADA recommendation of 70 mg/dl (ADA. 2018). Also, the mean for systolic blood pressure after Hurricane Maria was 139 of the ADA indicating high blood pressure (ADA. 2018). The action plan for diabetic management during a natural disaster and patient quality of care in Puerto Rico need to be improved.

RQ2: Reject the null hypothesis because there was an increase of the mean for the mortality rate for diabetic patients was 666 this number is 46 percent higher for the average of two years before of the same periods in Puerto Rico (Fink, 2018, June 2). Also, the BMI means was 30 the recommendation for the ADA standard emergency management plans for a diabetic patient is BMI > 27 use the drug to lower and BMI > 40 use surgery, this result of BMI clear indicating target is no achieved for quality care of diabetic patients (ADA. 2018).

RQ3: Reject the null hypothesis because there was increase of the mean for consumer price index in Puerto Rico for Medical Care from before of 150.48 to an after of 152.88, Hospital Care from before of 125.33 to an after of 127.39 These means demonstrate a significant increase. These results present an increase of per capita cost in

US Dollars of diabetes management indicate by the mean of consumer price index in Puerto Rico after Hurricane Maria.

As a Health Care Administrator, research and management should aim to provide quality care to patients and financial sustainability for healthcare providers. Addressing ethical concerns must put the patient in the center of healthcare delivery. Throughout the planning and proper execution of the management principle of prevention to save in the long run in healthcare could achieve a better financial result and improve quality care delivery for the community and individuals. As demonstrated in this research perhaps many healthcare authorities might not consider planning for chronic disease during a natural disaster part of a strategic plan could be a mistake.

Section 4: Application to Professional Practice and Implications for Social Change

Introduction

The purpose of this study was to review secondary data regarding the health outcomes of patients with diabetes prior to, during, and after Hurricane Maria in Puerto Rico, and to evaluate the quality and cost outcomes using the ADA and CDC disaster protocols on the health outcomes of diabetics (ADA. 2007; CDC, 2018; DHHPS, CDPCD, 2015). The researcher sought to compare means, of the impact on patient outcomes, specifically mortality, measured by glycosylated hemoglobin (Hgb A1C), LDL cholesterol, and mean systolic blood pressure. The effectiveness and timeliness of care was measured by mortality rates, BMI, age, and sex of diabetic patients. Last, the per capita cost of diabetes care could provide healthcare leaders and policymakers in Puerto Rico regarding the potential opportunity to develop a natural disaster protocol for diabetes management.

The principal findings in this research was an increase of Hgb A1C above the mean of 7.0 that according to ADA and CDC is < 7.0 (Riddle, 2018) and LDL Cholesterol was not within the ADA recommendation of 70 mg/dl (ADA, 2018). The mean for systolic blood pressure after Hurricane Maria was 139 and for the ADA, this measure indicates high blood pressure (ADA, 2018). An increase of the mean for the mortality rate for diabetic patients was assumed even though there was not official mortality rate but the amount of death by diabetic patients for that periods was 666 deaths in Puerto Rico. This number was 46% higher for the average of 2 years before the same period in Puerto Rico (Fink, 2018, June 2). The BMI mean was 47.0, the

recommendation for the ADA standard emergency management plans for a diabetic patient is if BMI > 27.0, used a drug to lower it, and if BMI was > 40.0, used surgery. This measurement of high BMI clearly indicates the target was not achieved for quality care of diabetic patients (ADA, 2018). Finally, an increase of the mean for consumer price index in Puerto Rico for medical care rose from 150, prior to Hurricane Maria, to 152 after Hurricane Maria. The consumer price index was an economic indicator which evaluates the changes of each month to the following months. This measure would indicate which are the price changes that a family unit gains in services and products that indicate a correct representation of consumption in a given region (Meyer & Habanabakize, 2018). Also, the hospital and related services from a before of 125 to an after of 127 demonstrated a significant increase of health price index. Together, these results presented an increase of per capita cost of diabetes management indicated by the mean of consumer price index in Puerto Rico after Hurricane Maria.

Interpretation of the Findings

The findings of this investigation confirmed that evaluation of health outcome is the necessary initiatives to avoid repeating past error and subsequently to verify the use of evidence-based medical treatment. The result in this investigation was Hgb A1C, HDL Cholesterol did not meet ADA and CDC standards of care for diabetic patients. Comparing with Schneider, (2016) described that in Hurricane Katrina, the general preparation to maintain adequate health care for patient was severely affected.

This research extends the knowledge from the peer review of section 1 indicated that the solution to respond to diabetes management was to create a model of

collaboration among the primary physician, nurses, and other healthcare workers (Jones, 2015). Because the healthcare plan was not implemented that include an adequate diabetes management plan, 666 diabetic patients died in Puerto Rico as a direct cause of Hurricane Maria. The discipline of healthcare administration facing a dynamic environment could include healthcare plans on diabetic management during a natural disaster.

Section 1 explained that diabetic complications would lead to co-morbidities that would severely impact the health and economic conditions to the patients for the high cost of medical treatments (ADA, 2015). This study presented that consumer price index of medicament and health care service increased after Hurricane Maria because it was not a plan to respond for a natural disaster such as Hurricane Maria. The study also presented how the information for diabetic drugs prices was difficult to obtain.

The findings of this research confirmed and expanded the knowledge that as part of the healthcare strategic plan would be consider prevention of complications of chronic disease protocols. These protocols should be applied to disaster areas during and after a natural disaster. One comparison was Hurricane Katrina in Louisiana, USA, according to Fonseca et al. (2009). Researchers evaluated Hgb A1C, mean systolic blood pressure, and LDL as part of the ADA protocol for diabetic treatments during a natural disaster. Their results showed an increase in the parameters in all three levels in patients during Hurricane Katrina.

Another comparison could be made with a study by Baruah and Kumar (2014). They discovered that most of the effort in a natural disaster was directed to the immediate

effects of the disaster and did not take into consideration the negative consequence of people with chronic illnesses. The corroboration of the findings of this study, the negative impact of the disruption of medical services to diabetic patients resulted in health complications and economic problems for the long-term. In addition, patients suffer the negative immediate economic consequence for health care. As the costs of health care increased and the medication prices for diabetic patients increased after the natural disaster.

After Hurricane Maria in Puerto Rico, the diabetic patient condition was exacerbated, much like in Louisiana after Hurricane Katrina. According to Tomio and Sato (2014), the primary objective of disaster preparedness was to avoid the deterioration of chronically ill patients during and after a natural disaster. Adequate preparation, then, must be formalized into a plan with the following guidelines: (a) recommendations must be evidence-based, (b) the information to the population and the community must be logical, consistent and actualized, and (c) the plan must be practical and achievable.

The present study could compare with the assumption of a decision-making process based on mathematical, economic, and computer science models. (Stilianakis, & Consoli, 2013). The methodology of using a quantitative method to evaluate healthcare management response to a natural disaster points in the direction for assessing the impact of health management during a natural disaster. The finding of this study demonstrated that healthcare planning before and after Hurricane Maria affected adversely the diabetic patients.

Analysis and Interpretation of the Findings in the Context of the Theoretical Framework

The theoretical framework of this research was the health outcomes and impact assessment framework (Khoja, Durrani, Scott, Sajwani, & Piryani (2013). The effectiveness of an e-health program, the health outcomes, and impact assessment provided an effective means to inform leaders regarding the effectiveness of health interventions (Khoja et al., 2013). The evaluation of the impact of medical treatment plans for diabetes management during Hurricane Maria in Puerto Rico was analyzed using the quantitative method by selecting parameters that indicated the health outcomes and the impact to overall health, such as diabetes indicators, BMI and mortality rate. Finally, the effectiveness of medical treatments was analyzed by the increase of the mean of health parameters as well as healthcare related consumer price index median increase.

The health outcomes and impact assessment framework was an integrated process that was used to establish an influence on health outcomes and associated projects. This theoretical framework considers the proposals of policies and strategies that initially affect health and what was its effect on it. In this study, the parameters that would indicate the general health of a diabetic patient evaluated (Bayles et al., 2016). Finally, these results were compared with those established by the ADA and the CDC. After, this comparison was applied the result suggested that the health outcomes in some areas improved but did not improve enough in others. As result before Hurricane Maria, diabetic patients showed adverse consequences for their health when applying a theoretical framework.

A primary objective for the theoretical framework was to approach how to assess results and its usefulness for health care. The result of this study could present a guide to maintain a high standard of health care during a natural disaster. The result of the health impact of diabetic patients could be reached when it was to combine qualitative and quantitative evidence. After applied the theoretical framework of quantitatively measurable outcomes that indicate results that must improve before Hurricane Maria in Puerto Rico. The results obtained in the research suggested that the health results and the effects of the evaluation had impact to features planning for preparedness. This result could lead to improving both the planning and implementation of health care policies in case of natural disasters.

E-health was part of the theoretical framework of this study. By applying the data obtained from technological information sources, quantitative results could be obtained to interpret whether health care was adequate. The data collected from electronic media allowed the researcher to evaluate whether health care was beneficial to diabetic patients (Suciu et al., 2015). The methodology for this research was to applied e-health to discover that health care before and after Hurricane Maria was not adequate to the ADA and CDC standard of health care. The costs of health care and the price of medications for diabetic patients increased after Hurricane Maria in Puerto Rico.

The interpretation of the findings in this study points to a recommendation to apply healthcare strategies that improve the current health status of diabetic patients and create a plan to prepare for health maintenance within the targets of the ADA and CDC for diabetic patients during and after a disaster. The implementation of this protocols

could help to reduce the mortality rate for diabetics after a natural disaster. A proper Healthcare policy could avoid the increase of the health-related consumer price index in Puerto Rico after a natural disaster.

Limitations of the Study

The limitations of this research were defined according to the boundaries set by a statistics analysis, by the handling of the secondary data, and the sample (Gary, Cox, Crawford, 2016). The methodology of the investigation was a quantitative method of the evaluation of the impact of medical treatment plans for diabetes management during Hurricane Maria in Puerto Rico. The main limitation was the use of quantitative data, and the inability to obtain data regarding the specific cost of treatment for diabetic patients before and after Hurricane Maria. This issue of the cost of medication for diabetic patients represented a sensitive political issue. The final point was the mortality rate of the diabetic patient after the hurricane that was not available at the time of this study. The number of deaths for that period used in this study was 666 of patient with diabetes. This suggest an uneducated management of health care for diabetic patients after Hurricane Maria.

The validity of this research required exclusion of alternative explanations of the findings. The first action was to select parameters that could only be interpreted with a single reason that would ideally be obtained from the sample. Answering the research questions would have only one interpretation, which would be that the independent variables were either responsible or not responsible for the changes in the dependent variables through the application of statistical analysis rules for secondary data statistics.

The reliability of this research was the construction of validity using demonstration and proof provided by the evidence of statistical results (Dijksterhuis et al., 2013). The result of this studies presented statistic evidence of the sample data that proof the precision of our findings. The primary statistical tests used in this research was one sample t-test to compare the increase of the mean within a 95% confidence. The reliability of a measurement instrument referred to the level at which the repeated application of the instrument in a sample to the same variable or parameter produces the same results. A feature research could allow a more reliable tool to represent diabetics patients to be more similar to the general population will be the results obtained in subsequent investigations of this research.

Recommendations

A primary recommendation for future research is to secure data that was available before and after disaster events in order to provide a more accurate evaluation of the parameters in the sample. In addition, health institutions had to maintain digital data available for research in a user-friendly mode. According to the ADA (2014), the scope to avoid diabetes complications in patients requires self-management and self-execution of health education recommendations to reduce long-term complication. A new parameter should be inclusion of eating habits, exercise habits, sleeping time, and any toxic habits that might influence the health of diabetic patients in their electronic health records.

Finally, an assessment of the health literacy of the patient provided information on the adherence of medical treatment by the patients. Gorst et al. (2015) noted that the

risk of adverse effects of diabetes increases with poor glycemic control in the long-term. The study focused on the effect of macro and microvascular diseases development as a result of long term poor glycemic control (Gorst et al., 2015). The result of this study demonstrated that the health outcome findings may influence the development of nephropathies, cardiovascular events, and retinopathies (Gorst et al., 2015). The prevention of diabetic complication could only be achieved by providing effective health care administrations.

Implications for Professional Practice and Social Change

The analysis presented on this research considers the validity of the evidence-based practice of medical treatment for diabetic patients in Puerto Rico. The findings of the study variables evaluated the baseline evidence of healthcare outcomes before Hurricane Maria, which could inform healthcare leaders of the baseline compromised health status of diabetics to compare to compliance with ADA and CDC guidelines. This knowledge indicated the opportunity for social change to improve health outcomes of diabetics after a natural disaster. The result of the research would inform healthcare leaders regarding the significant increase of the mortality rates after Hurricane Maria could indicate the lack of preparedness to care for diabetics. Healthcare administrator would use this knowledge going forward would create significant social change by changing healthcare policy to ensure a disaster preparedness plan that includes diabetic supplies, medications, and access to health care is available.

Professional Practice

Program evaluation would provide recommendations to improve the evaluation of the impact of medical treatment plans for diabetes management during and after a natural disaster in Puerto Rico (Gary, Cox, Crawford, 2016). The creation of a learning organization must begin with human resources. Stakeholders would applied information technology that automatically investigates the result of medical treatment of the entire population of diabetic patients that receive medical treatment in any healthcare setting. Promote awareness to stakeholder on plans and application on prevention plans of natural disaster that need to be included in health policies and regulations.

Methodological, Theoretical, and Empirical Implications

The challenge in research was to construct the response of a general problem and express the answer in variables that can be measured. This type of methodology was called quantitative analysis (Gary, Cox, Crawford, 2016). The methodology for this research used secondary data from the "Centro Para Diabéticos de Puerto Rico" in Puerto Rico that were collected in patient electronic records and make a summary of relevant health variables in Microsoft Excel (MS Excel). These variables were the parameters that could be used to measure the evaluation for the impact of medical treatment plans for diabetes management before and after a natural disaster in Puerto Rico. The theory was to compare means for before and after a natural disaster. The increased of mean for parameters after a natural disaster would demonstrate the need for improvement of medical treatments plans to avoid health complications for diabetic patients. This theory could be used in general for other chronic diseases. According to Gary, Cox, and

Crawford, (2016), the empirical methods that were used in this research were the observation and measurement of the parameter selected to measure the research question. The formulation of hypothesis and subsequent rejection or not rejection of the hypothesis.

Positive Social Change

Natural disasters in the last decade constituted one of the main challenges of planning adequate responses to chronic health problems in the USA. The approach demonstrated in this research to respond adequately to a progressive social change is that which puts diabetic patients at the center of the health plan during a natural disaster. Healthcare organizations could consider as unacceptable that 666 patients with diabetes died in that period. This result implies the need for social changes that prevent this amount of death due to natural disasters.

The planning and evaluation of health outcomes in health organizations could consider as part of a social change that seeks to mitigate the risks of natural disasters. However, these studies had shown that, although there are basic knowledge and data to achieve critical social changes, they should have references such as the ADA and the CDC to achieve adequate health outcomes. Due to the amount of information necessary for the adequate management of natural disaster risks, the use of computerized techniques such as Information Technology was almost mandatory. The result of this research demonstrated that with the application of E-health, the results of HgB A1C, HDL Cholesterol, BMI, and others that provide effective monitoring of health outcomes could monitor.

Finally, for the individual and society, in general, the result of the study demonstrated the need for policies that promote a just and an affordable prices of healthcare service and medication to diabetic patients. The result of this research demonstrated the adverse effect of not having proper policies to control prices for diabetic patients during a natural disaster. Policies and law would protect society with their needs during a natural disaster to have affordable healthcare and medications.

The positive social change for this research could promote better healthcare practice to improve medical treatment to the individual. The results of this research would impact diabetic patients to become more productive as he or she to avoid the possible disabilities that could be a result of diabetic complications. In addition, avoided the high cost of medical treatments for diabetic complications such as eyes, heart, and kidney disease among others. The family would have a productive member that contributes to the family wellbeing as well as physically capable of collaborating in family matters. Finally, the organization such as place or work, communities, and organizations would have a member that can contribute socially and financially to the organization and the communities. The diabetic patient would not represent an economic burden to either one and allow organizations to use financial and physical resources to invest in a program that promotes the prevention of illness and improvement of health quality. This investigation would impact positively in the social and economic sustainability of the communities.

Conclusion

The result of this study provided evidence that may drive medical practice to create an effective model to guide healthcare professionals to efficiently plan and implement medical protocols toward effective management of non-communicable disease during a natural disaster (Iskander, Rose, & Ghiya, 2017). The results of the outcomes of the diabetic patient before and after Hurricane Maria could be used as a model to assess other chronic illness, such as congestive heart failure and chronic obstructive pulmonary disease and patient outcomes, including mortality rates. The researcher would informs healthcare and government leaders of the results of this study, could lead to development of healthcare policy to drive the creation of an effective chronic disease management plan for baseline health management and management during a natural disaster.

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