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## An Evaluation of a Multidisciplinary Implementation of Evidence Based Practice in Prediabetes

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**An Evaluation of a Multidisciplinary Implementation of Evidence Based Practice in  
Prediabetes**

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A Dissertation Submitted to The Graduate School at the University of Missouri- St. Louis  
in partial fulfillment of the requirements for the degree  
Doctor of Nursing Practice with an emphasis in Family Nurse Practitioner

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Abstract

**Problem** Over 70% of prediabetic patients progress to full diabetes. There are over 80 million American adults who are diabetic. Diabetes is the costliest chronic disease that often leads to many other health issues.

**Methods** This QI project utilized a descriptive observational design. Quantitative data was collected via retrospective chart review. Primary data collected was documentation of a patient visit to the registered dietician and the hemoglobin A1c (HbA1c) of patients who followed up in the office after the referral.

**Results** Eight patients followed up to the office for a second visit (n=8). Four patients did see the registered dietitian and four of the patients did not. There was a statistically significant decrease in the mean of the HbA1c of the entire sample. Those who saw the registered dietitian did not significantly lower their HbA1c but did more so than those who did not see the registered dietitian.

**Implications for Practice:** Results of this QI project suggests that identification and discussion in office may be enough to lower HbA1c in prediabetic patients. Due to the small sample size, there was no statistical significance to show that seeing a registered dietitian made a significant decrease in HbA1c. However, this group did lower HbA1c more so than those who did not see the registered dietitian. Therefore, recommendations are made for a second PDSA cycle for this QI project with a larger sample size to have a more robust picture of the probable benefit of having a registered dietitian as a part of the multidisciplinary team in the care of prediabetic patients.

## **An Evaluation of Multidisciplinary Implementation of Evidence Based Practice in Prediabetes**

Eighty-eight million people in the United States ages 18 and older are prediabetic and many are undiagnosed (Centers for Disease Control and Prevention, 2020). Prediabetes is a health condition leading to diabetes, a complicated and costly chronic disease.

Prediabetes is diagnosed in a few different ways. A person is prediabetic when their hemoglobin A1c (HbA1c) falls between 5.7 and 6.4%, an oral glucose tolerance test (OGTT) of 140 mg/dl to 199 mg/dl, and/or a fasting plasma glucose (FPG) value between 100 mg/dl to 125 mg/dl (American Diabetes Association, 2021). While men are affected at a higher rate than women, prediabetes is indiscriminate and can affect anybody, no matter their education level or ethnic or racial background (Centers for Disease Control and Prevention, 2020). The American Diabetes Association states that up to 70% of individuals who are prediabetic progress to diabetic (Tabák, et al., 2012).

Numerous complications are attributed to diabetes including stroke, heart disease, kidney failure, vision loss, nerve damage and more (Centers for Disease Control and Prevention, 2019). Diabetes is the costliest chronic disease in the United States. Annually, one in every four dollars spent on healthcare is spent for people with diabetes and \$237 billion is spent on direct medical costs for diabetic care (Centers for Disease Control and Prevention, 2021).

Fortunately, dietary interventions can affect patients' diabetic status. In fact, the American Diabetes Association's (n.d.) "Diabetes Risk Overview" page for prediabetes focuses on diet and activity modification. Early lifestyle intervention is extremely important. Prediabetic patients can lower their risk for developing diabetes by losing

seven percent of their body weight and exercising at a moderate intensity for a minimum of 150 minutes each week.

In a consensus report published by the American Diabetes Association (ADA), Evert, et al (2019) provided guidelines regarding nutritional therapy for diabetic and prediabetic adult patients to healthcare providers. Evert, et. al (2019) specifically recommended collaboration between patients and registered dietitians to create an individualized dietary plan and aid with self-managed diabetes education. In addition to regular adjustments to the nutrition therapy as needed, the authors also recommended continued regular follow-up between the patient and their healthcare provider.

At a diabetes clinic located in the Midwest, patient hemoglobin A1c levels were routinely tested at their annual wellness visit, however there was no protocol implemented as to who or when to refer patients to a registered dietitian. The purpose of this proposed project was to evaluate the implementation of a protocol for provider referrals to a registered dietician for patients who are found to have an HbA1c in the prediabetic range (5.7%-6.4%). This proposed project used the Plan-Do-Study-Act methodology as the evidence-based practice framework to guide the project.

A question was written to guide the literature review: In prediabetic adults aged 18-70 years, what is the effect of consultation with a registered dietician on HbA1c over a three-month period?

### **Review of Literature**

The key search engines used were UMSL Library Summon, CINAHL, and PubMed. The searched terms were: *prediab dietitian*, "*prediab\* diet, prediab\* AND*

*diet,\* prediab\* nutrition, prediab\* intervention.* From these terms, 169,448 publications were first populated.

Next, inclusion and exclusion criteria were applied. The inclusion criteria consisted of journal articles, publications in the English language, published within the last five years, and scholarly & peer-reviewed publications including randomized control trials, systematic reviews, retrospective reviews, one case review, and one cross-sectional study. The exclusion criteria consisted of non- English publications, books, published over five years ago, and non-peer reviewed articles. After adding the inclusion and exclusion criteria to the search, the refined search resulted in 74,330 articles. After reviewing abstracts for the inclusion and exclusion criteria, and relativity to the project's purpose and goals, 39 articles were fully reviewed.

Google and the American Diabetes Association's (ADA) website was searched. While searching these, the American Diabetes Association's guidelines regarding nutritional therapy for diabetic and prediabetic patients was found (Everett, et al., 2019). The final number of publications used for this literature review is six and includes three studies focused on observation of current diets relative to diabetes and three articles discussing the use of registered dietitians in relation to diabetes.

Pestoni, et al., (2020) observed the effects of diets regarding diabetic status. The researchers used data from a previous cross-sectional study. After inclusion and exclusion criteria were applied, the study included 1305 people; 698 people had a normal glucose tolerance, 495 of were prediabetic, 49 were undetected diabetic, and 99 had "prevalent" diabetes. The type of food the sample population was consuming was self-reported through a frequency food questionnaire (FFQ). Using a multinomial logistic regression

model, the authors found that a Western diet containing more red meat, refined grains, and alcohol had a significantly higher risk of prediabetes with an odds ratio (OR) of 1.92; 95% (confidence interval [CI] 1.35, 2.73). In other words, someone with a Western dietary pattern is at almost twice as likely of developing prediabetes. Of note, almost 80% of men in this sample followed a Western diet. Therefore, a prudent diet of fruits, vegetables, and whole grains is recommended.

Similarly, Shen, et al. (2020) had recommendations to avoid a Western diet and have a diet of mainly fruits, vegetables, and whole grains. Shen, et al. (2020) conducted a cross-sectional study among a convenience sample of 1761 people aged 45 to 59 years old who lived in China. Participants were asked to complete a questionnaire regarding their dietary patterns. Three major dietary patterns were identified: Western, traditional Southern Chinese, and grain-vegetable patterns. By using a multivariate logistic regression analysis, results showed that 17.3% of the sample had prediabetes, the majority of which followed a Western diet (OR= 1.54; 95%, CI: 1.068- 2.059). Therefore, those who were prediabetic were at least one and a half times more likely to follow a Western diet than those who were not prediabetic. Those who were prediabetic were also significantly younger, smoked cigarettes, and had a higher prevalence of obesity.

Chen, et al. (2018) set out to explore whether a plant-based diet was more beneficial in the prevention of type 2 diabetes than an animal-based diet. Their aim was to examine whether there was an association between the level of adherence to a mostly vegan or plant-based diet versus a diet rich in animal-based foods with insulin resistance, type 2 diabetes, and prediabetes. Chen, et. al (2018) analyzed the data of 6,798

participants aged 45 or older from three sub-cohorts of the Rotterdam Study. Participant data spanned a period of almost 20 years (1989-2008), with participants undergoing in-office follow-up examinations or home interviews every three to five years. The authors created a plant-based dietary index based on two previous models that consisted of 23 food categories. Twelve were plant-based and 11 were animal-based. The index measured adherence with zero indicating low plant-based adherence and 92 indicating high plant-based adherence. The authors used Cox proportional-hazards regressions to examine associations of the index with the risk of prediabetes and type 2 diabetes. The authors then used hazard ratio to show the prevalence of prediabetes in plant-based diets to those who had an animal-based diet. A hazard ratio of one would be equal between two groups; a hazard ratio less than one would mean that the chosen group is less likely to experience an event, condition, etc. In this study, findings showed those who followed a plant-based diet were at a lower risk for prediabetes (HR= 0.89; 95% CI: 0.81). The study was limited in that it includes self-reports and much of the sample was similar age and ethnicity. In conclusion, a plant-based diet was found to be recommended for those with prediabetes.

Kerrison, et al. (2017) also observed dietary and physical activity practices and the relation with prediabetes. This systematic review consisted of nine randomized control trials with a total of 4,695 patients diagnosed with prediabetes. All patients' glycemic control was measured after dietary and exercise intervention. Six of the nine studies found it was beneficial to diabetic patients that dietary changes and at least 150 minutes of weekly exercise should be implemented in patients with diabetes mellitus; in all but one study did this lower the incidence of diabetes. Of the three studies left, one



study recommended 70,000 steps a week, once recommended patients participate in resistance training, and one study simply encouraged “lifestyle modification.”

Although the American Diabetes Association recommends the use of registered dietitians in the care group for prediabetic patients, many healthcare providers do not include registered dietitian referrals for patient follow-up. Speaker, et al., (2021) conducted a retrospective review through which 16,713 newly diagnosed prediabetic patients were identified in primary care offices within a large hospital system. With a primary outcome of identifying any attempt at treatment for patients with prediabetes, the researchers examined patterns of treatment amongst primary care providers and used multivariable logistic regression to determine the association between provider specific treatment rates and patient characteristics with patient treatment. Treatments identified for inclusion were a pharmacological prescription, referral to endocrinology, bariatric care, referral to a MTN (medical nutrition therapist- much like a dietitian), or diabetes education. Across the sample, the researchers found that only 20.4% received treatment; and 11.3% of the patients were referred to a nutritionist. However, only 140 patients that were referred to the nutritionist followed through and completed a visit with the nutritionist. MTN referral was more commonly provided to younger, female patients with a high BMI. African American patients were also more likely to be referred to an MTN than Caucasian patients.

Zeman, et al. (2021) conducted a retrospective review on a convenience sample of 3,142 patients that had an HbA1c greater than or equal to 7.0% and/or had a body mass index (BMI) greater than or equal to 35 at a neighborhood health center in Boston, Massachusetts. One group saw a registered dietitian. Another group only saw a primary

care provider. According to analysis by independent samples t-test and Pearson Chi-square tests, those who saw the registered dietitian had a statistically significant decrease in HbA1c compared to those who only saw a primary care provider at 12 and 24 month follow ups. Those who saw the registered dietitian also had lost significantly more weight at three, 12, and 24 months. Those who saw the registered dietitian at least once had a mean change of hemoglobin A1c of  $-0.8 \pm 0.2$  (95% CI -1.0 to -0.5) at 12 months and  $-0.6 \pm 0.1$  (95% CI -0.8 to -0.3) after 24 months. Limitations to this study include medication used was not discussed and not every patient followed up at the same time. However, this study showed realistic outcomes in a clinical setting in implementing the use of registered dietitians.

In conclusion, despite the American Diabetes Association's recommendations including a registered dietitian on the multidisciplinary care team of a prediabetic patient, there is a gap in evidence regarding the effect that a registered dietitian can specifically have on prediabetic patients. However, there are multiple studies that discovered that dietary intervention can positively impact the status of diabetes.

The purpose of the proposed project was to evaluate the implementation of referring patients identified with pre-diabetes to a registered dietitian. The goal was for patients who followed through seeing the registered dietitian that his or her HbA1c lowers at least by 0.2% after three to four months. The primary outcomes were measured through a retrospective chart review. The first outcome measure was the number of patients referred to the registered dietitian, and the number of patients who saw the dietitian. The second outcome measure was the percentage of patients seen by the registered dietitian whose hemoglobin A1c three months after the visit to the dietitian

has decreased. Secondary outcomes measures included gender, age, BMI, ethnicity, zip code and insurance type. The question guiding this project was: In pre-diabetic adults aged 18-70 years, what is the effect of consultation with a registered dietician on HbA1c over a three-month period?

## **Methods**

### **Design**

This QI project utilized a descriptive observational design. Quantitative data was collected via retrospective chart review. Primary data collected was documentation of a patient visit to the registered dietician and the HbA1c of patients who followed up in the office after the referral.

### **Setting**

This QI project took place in an adult primary and endocrinology care clinic affiliated with a large academic hospital institution in a Midwestern state. The clinic sees approximately 22,000 patients per year. The clinic employs a staff of three physicians, one nurse practitioner, one registered nurse diabetes educator, seven medical assistants, two receptionists, and one office manager.

### **Sample**

This project used a convenience sample of newly diagnosed prediabetic patients 18 years and older. Patients not diagnosed with prediabetes were excluded. Patients receiving care between September 14, 2021- December 14, 2021, and diagnosed with prediabetes composed the sample for this proposed project. The diagnosis of prediabetes had been determined by a HbA1c of 5.7%-6.4%.

### **Planning**

Referral to a registered dietician was determined to be a goal of the practice to decrease the hemoglobin A1cs of patients diagnosed with prediabetes. In fall 2021, providers were educated by the clinic NP, who is the student PI site mentor, regarding the need to refer to the dietician for the sample population. Providers were then educated on criteria for the sample population, asked to implement a referral and then record the patient's medical record numbers. Providers were also educated to check another HgBA1c at three months post referral to the dietician.

### **Interventions**

Referral of all newly diagnosed prediabetic patients to a registered dietitian at the chosen clinic was led by the Doctor of Nursing Practice candidate. An HbA1c measurement was determined by the participating providers if indicated during the visit. The HbA1c was recorded in the medical record and the provider made the referral during the same visit. The patient was responsible for contacting the registered dietitian via phone or email provided at the visit. The HbA1c was reassessed approximately four months later via retrospective chart review, assuming the patient came to his or her three month follow up appointment.

### **Data collection and analysis**

Approximately four months after the referral to the registered dietitian, a retrospective chart review was conducted starting in January 2022. Data collected included: HbA1c at initial referral appointment, HbA1c at three month follow up appointment, if the patient followed through with the registered dietitian, sex, age, ethnicity, body mass index (BMI) at both visits, zip code, and if the patient has public or private insurance. The patients were de-identified by using the first initial of the month

they were referred followed by the day and then another number depending how many patients were referred on that day. For example, O041 would be the first patient referred on October fourth.

### **Approvals**

Written formal approval was requested and obtained from the setting clinic's Human Research Protection Office on 10/21/2021. The project was approved and determined to be a non-human subject research project. Approval from the Institutional Review Board (IRB) at University of Missouri- St. Louis was also received prior to starting data collection.

## **Results**

### **Demographics**

Fourteen patients were screened as newly diagnosed prediabetic patients within the allotted referral time frame. However, only 8 patients followed up for a second office visit. The sample consisted of 8 patients aged 28 to 68 years, with a mean of 58 years (SD= 13.17). There were four female and four male patients. There were five participants that identified as white or Caucasian and only three participants that identified as black or African American. All participants were from St. Louis City, St. Louis County, or Jefferson County, MO. All participants had private insurance coverage.

### **Registered Dietitian referrals**

A paired-sampled t-test was conducted to show the difference of hemoglobin A1c at the first appointment versus the follow up appointment of all eight patients included in the project (see Table 1). The results showed a statistically significant decrease of hemoglobin A1c from the first appointment (M= 5.80, SD= 0.11) to the follow up

appointment ( $M= 5.61$ ,  $SD= 0.16$ ;  $t(8)=2.6$ ,  $p<0.05$ ). The mean decrease between the two appointments was 0.19 with a 95% confidence interval (CI) between 0.18 and 0.36.

Then, a paired-sampled t-test was then conducted to show the difference of body mass index (BMI) at the first appointment versus the follow up appointment with all participants. The results showed a statistically insignificant decrease of BMI from the first appointment ( $M= 36.40$ ,  $SD= 11.66$ ) to the follow up appointment ( $M= 35.14$ ,  $SD= 11.50$ ;  $t(8)=1.88$ ,  $p=0.102$ ). The mean decrease between the two appointments was 1.25 with a 95% confidence interval (CI) between -0.32 and 1.83. Therefore, regarding all eight participants, the HbA1c and BMI both lowered, but only the HbA1c was lowered significantly.

A paired-sampled t-test was conducted to show the difference of hemoglobin A1c at the first appointment versus the follow up appointment with those who saw the registered dietitian between the initial and follow up appointments. Results showed there was not a statistically significant decrease of hemoglobin A1c from the first appointment ( $M= 5.75$ ,  $SD= 0.06$ ) to the follow up appointment ( $M= 5.53$ ,  $SD= 0.15$ ;  $t(4)=3.0$ ,  $p=0.058$ ). The mean decrease between the two appointments was 0.23 with a 95% confidence interval (CI) between 0.01 and 0.46. Therefore, this data shows that those who did see the registered dietitian lowered their hemoglobin A1c, but not the difference was not statistically significant.

When analyzing the data gathered from those who did not see the registered dietitian, similar results were found. From the initial appointment ( $M= 5.85$ ,  $SD= 0.13$ ) to the follow up appointment ( $M= 5.70$ ,  $SD= 0.14$ ;  $t(4)=1.13$ ,  $p=0.339$ ), the HbA1c decreased. The mean decrease between the two appointments was 0.15 with a 95%

confidence interval (CI) between -0.27 and 0.57. Therefore, this data shows that those who did not see the registered dietitian lowered their hemoglobin A1c, but again, not enough to be considered statistically significant. Of note, those who saw the registered dietitian had a greater magnitude of decrease in HbA1c than those who did not see the registered dietitian (see Figure 1 and Table 1).

Body mass index was similarly examined between those who saw the reregistered dietitian and those who did not. The change in BMI between the groups were not found to be significant. This is shown in Figure 2 and Table 1.

### **Discussion**

Implementation of this quality improvement project resulted in the ability to answer the study question: In prediabetic adults aged 18-70 years, what is the effect of consultation with a registered dietitian on HbA1c over a three-month period? Overall, the outcome suggested that consultation with the registered dietitian did not prove to significantly lower the patients' HbA1c.

The overall sample significantly lowered their HbA1c, meaning that possibly screening and educating patients to eat healthy and exercise regularly in office is enough to steer patients in the right direction. However, it is important to note that those who did follow through seeing the registered dietitian lowered their HbA1c more so than those who did not.

Limitations to this study include its small sample size and the time frame allotted. Future PDSA cycles should include a larger sample size, and the window of screening be extended. In addition, having a reminder system or a more streamlined interdisciplinary communication process may be helpful. For example, if the patients had a MyChart or

text message reminder that he or she was referred to the registered dietitian, the sample size may be bigger. Also, in this setting, the registered dietitian was not aware of who was referred; it was the patients' responsibility to reach out to the registered dietitian. Future recommendations also include that the registered dietitian is given a weekly list of patients referred and then she can reach out to the patient.

Another improvement for future cycles includes following patients in three-month increments for a longer time. This would hopefully allow for continuity of data to support regular use of the registered dietitian and follow up visits. Because those who saw a registered dietitian were able to decrease their HbA1c more so than those who did not, a bigger sample size and longer data collection time frame may find a statistically significant decrease.

### **Conclusion**

Gatherings from this quality improvement project showed the benefit of screening for prediabetes and possibly the benefit of including a registered dietitian in the multidisciplinary care team for patients with this diagnosis. However, because of this project's limitations, further study should take place to gather more robust data regarding the effect registered dietitians have on prediabetic patient's hemoglobin A1c.

This project has proven to be a foundational aspect of the achievement of the Doctor of Nursing Practice degree. From gathering current literature and scientific studies, organizing, and communicating with a multidisciplinary team, choosing a quality improvement project that effects such a large population in healthcare, to gathering and analyzing data, and advocating for changes in practice that are evidence based, results in



practice of each of the 13 DNP Essentials, therefore taking a large step in preparation to becoming a doctorally prepared advanced practice nurse practitioner.

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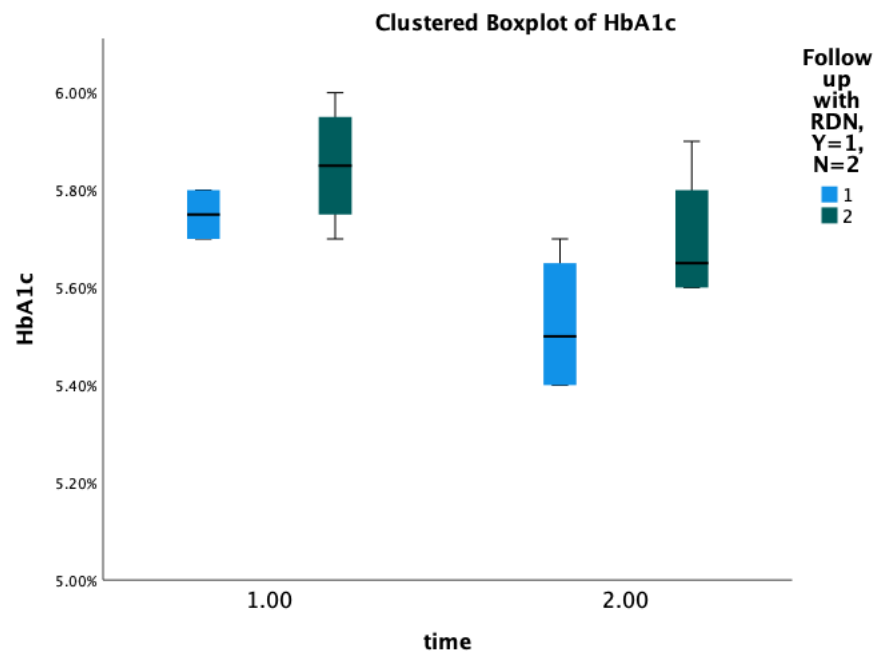
**Table 1**

*Means and Standard Deviations of HbA1c for All Participants and Separated by RD Follow Up*

Patients	HbA1c visit 1 (M;SD)	HbA1c visit 2 (M;SD)	BMI visit 1 (M;SD)	BMI visit 2 (M;SD)
Saw the RD	5.75; 0.06	5.53; 0.15	35.77; 14.08	34.64; 13.91
Did not see the RD	5.85; 0.13	5.70; 0.14	37.02; 10.87	35.65; 10.64
All participants	5.80; 0.11	5.61; 0.16	36.40; 11.66	35.14; 11.48

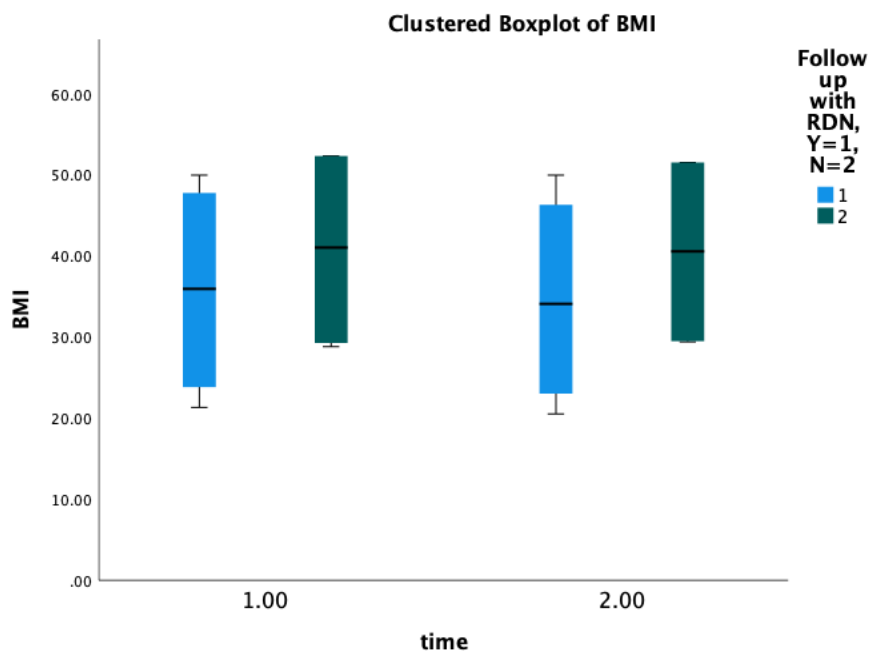
*Note.* Output obtained using *IMB SPSS Statistics for Windows, version 27.0*

Figure 1



Note. Output obtained using *IMB SPSS Statistics for Windows, version 27.0*

**Figure 2**



*Note.* Output obtained using *IMB SPSS Statistics for Windows, version 27.0*