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CREATE AN INFORMATICS SOLUTION TO DETERMINE WHETHER THE
PRIMARY CARE PROVIDERS REFER PATIENTS TO 'MOVE!' PROGRAM

By

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Master of Public Health

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An abstract of

A thesis submitted to the Faculty of the
Rollins School of Public Health of Emory University

In partial fulfillment of the requirements for the degree of

Master of Public Health in Executive MPH Program

2015

Abstract

CREATE AN INFORMATICS SOLUTION TO DETERMINE WHETHER THE
PRIMARY CARE PROVIDERS REFER PATIENTS TO 'MOVE!' PROGRAM

By Rincy Varughese

Research studies indicate that diabetes can be prevented or delayed from developing if diabetes is identified at its early stage (Phillips, Ratner, Buse, & Kahn, 2014). Lifestyle changes and /or medication could be used to delay or reduce the incidence of diabetes (Knowler et al., 2002).

The goals of this thesis is to create an informatics solution to analyze 1535 patients participated in the "Screening for Diabetes and Prediabetes Study" and determine whether the primary care providers referred patients to 'MOVE!' Program.

The informatics solution analyzed VA primary care provider's action for Diabetes, High Risk, low Risk and Normal Glucose Tolerance (NGT) patients. The results reveal that higher percent of the patients with prediabetes were referred to 'MOVE!' Program.

Even though higher percent of prediabetes patients were referred to MOVE! Program, the analysis show that approximately 40% of the patients rejected in participating in the MOVE! Program. The informatics solution could be further modified to determine the efficiency of PCP referral and reasons for rejecting to participate in MOVE! Program.

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Special thanks to Melissa Alperin, MPH, MCHES, Kathleen R. Miner, PhD, MPH,MCHES and Laurie Gaydos, PhD for all the support and direction.

I would like to gratefully and sincerely thank Christine Jasien for all the support she provided on VA's informatics system and Jane Guidot for the VA administrative support.

I also would like to thank my daughter, my husband, my mother, family and friends for their support and encouragement.

I also want to dedicate this work to my beloved father who won't see me graduate, the late M. Varghese who really inspired me to join this course.

Contents

Introduction

 Each year approximately 1.5 million people develop diabetes mellitus (DM) and by 2050 this number could reach 39 million (Saaddine et al., 2006). This also means, a person with diabetes could lose 10 to 15 years of their life (Narayan, Boyle, Thompson, Sorensen, & Williamson, 2003). Recent studies suggest that, diabetes can be prevented or delayed from developing if diabetes is identified at its early stage (Phillips, Ratner, Buse, & Kahn, 2014). At least 25% of Americans have unrecognized pre diabetes and early diabetics. Lifestyle changes and /or medication could be used to delay or reduce the incidence of diabetes (Knowler et al., 2002). Complications associated with the disease, results in damage or failure of various organs such as the kidneys, eyes and nerves. People with type 2 diabetes also have high risk for coronary heart disease (CHD), peripheral vascular disease, hypertension and stroke. Delaying or preventing diabetes not only have health benefits, but also offer cost savings.

For instance diabetic retinopathy is a leading cause of blindness among Americans. More than $472.1 million federal money could be saved if patients with diabetes receive recommended care (Javitt et al., 1994). However in US, level of care provided to patients with diabetes mellitus is varied (Beckles et al., 1998).

Implementing recommendations and under use of recommended practices were also noted during various studies (Kenny, Smith, Goldschmid, Newman, & Herman, 1993).

Problem Statement

The purposes of this thesis is to create an informatics solution to analyze 1535 patients participated in the "Screening for Diabetes and Prediabetes Study" and determine whether the primary care providers referred patients to 'MOVE!' Program.

Atlanta VA medical center is a good setting to assess the care received by pre-diabetes and early diabetes patients from their primary care providers. For "Screening for Diabetes and Pre diabetes Study" at Atlanta VA primary care, around 1535 patients completed Glucose Challenge Test (GCT) followed by Oral Glucose Tolerance Test (OGTT). Glucose Challenge Test (GCT) is a new screening test and Oral Glucose Tolerance Test (OGTT) is considered as a gold standard test to identify pre diabetes and early diabetes. However it is unknown how many pre-diabetes and early diabetic's patients receive appropriate care from their primary care providers.

Theoretical Framework

 Oral Glucose Tolerance Test (OGTT) is considered as a gold standard test to identify prediabetes and early diabetes. Even though OGTT is sensitive, it's inconvenient; time consuming and expensive (Leiter et al., 2001). Using Glucose Challenge Test (GCT) to screen diabetes patients offered benefits such as reduced cost, efficiency and convenience (Phillips et al., 2009).

In order to evaluate the care provided during primary care follow-up visits, patient data was extracted from the VINCI database .This data contained only Atlanta VAMC patients. All data requested fell under the scope of the approved IRB#199-2002 section IX. The extracted data was exported into SAS.   The data was analyzed using SAS's Statistical function to answer below research questions.

Research Question

The goal of this thesis is to create an informatics solution to answer the following research question.

• Will primary care providers refer patients to 'MOVE' Program once patients are identified with prediabetes?

•Null Hypothesis: Higher percent of participants with prediabetes **will** be referred to 'MOVE' program.

Definition of Terms

DM   Diabetes Mellitus

VA   Veterans Association

VINCI   VA Informatics and Computing Infrastructure

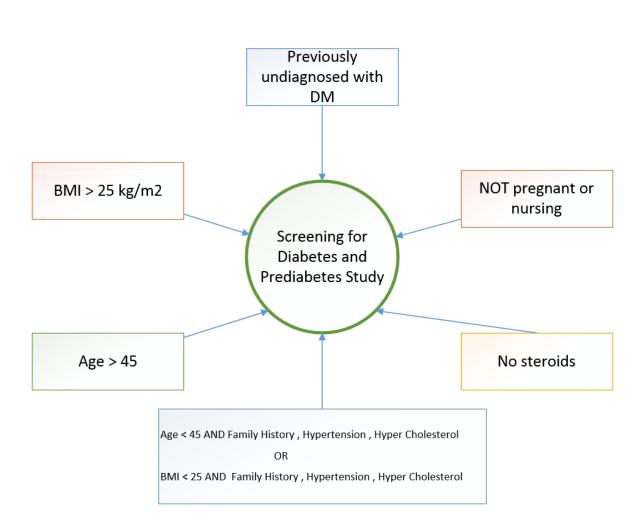CR Assist   A tool used by investigators/coordinators to manage participants, track study visits and submit electronic appointment request.

GCT   Glucose challenge test

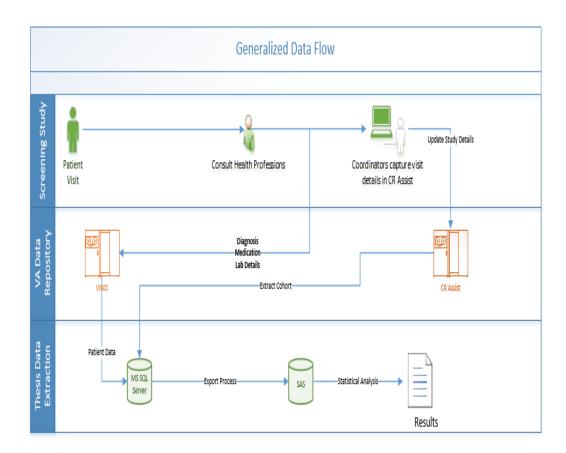|	
OGTT	Oral Glucose Tolerance Test
HbA1c	Glycated Hemoglobin [Not an acronym]
CHD	Coronary Heart Disease
DART	Data Access Request Tracker
MOVE	Managing Overweight and/or Obesity for Veterans Everywhere

Methodology

Population and Sample

Data Eligibility Context Diagram

- Previously undiagnosed with DM
- BMI > 25 kg/m2
- NOT pregnant or nursing
- Screening for Diabetes and Prediabetes Study
- Age > 45
- No steroids
- Age < 45 AND Family History , Hypertension , Hyper Cholesterol
  OR
  BMI < 25 AND Family History , Hypertension , Hyper Cholesterol

"Screening for Diabetes and Prediabetes Study" was conducted at Atlanta VA medical center primary care. During this study, 1535 patients completed both GCT and OGTT tests. Subjects were eligible for the study, if they were not previously diagnosed with diabetes, were not pregnant or nursing and did not use steroids such as glucocorticoids. The subjects were usually of age > 45 years and BMI > 25 kg/m2.However younger patients were also eligible for the study if they had family history of diabetes, hypertension, high triglycerides, abnormal cholesterol, minority race or history of diabetes in pregnancy.

To evaluate the research questions, patient data were analyzed from July 1st 2009 through December 31st 2014. These data entailed patients follow-up visits associated with diagnosis and referred to MOVE! Program.

Research Design

Generalized Data Flow

CR Assist, a tool utilized by investigators/coordinators to manage participants, track study visits and submit electronic appointment request, was used to select the eligible 1535 patients for the thesis.

Patient data such as demographics, visit, MOVE etc. were originated from VINCI (Veterans Informatics, Information, and Computing Infrastructure). This data repository was created using "Screening for Diabetes and Prediabetes Local (and National) Data Repository IRB#45787(199-2002): 201103014D".This data contained only Atlanta

VAMC patients. All patient data required for this thesis fell under the scope of the

approved IRB#199-2002 section IX.

Using SAS, statistical analysis was performed to evaluate the research question. The

results were then analyzed to decide if the null hypothesis should be   accepted or

rejected.

Functional Requirements

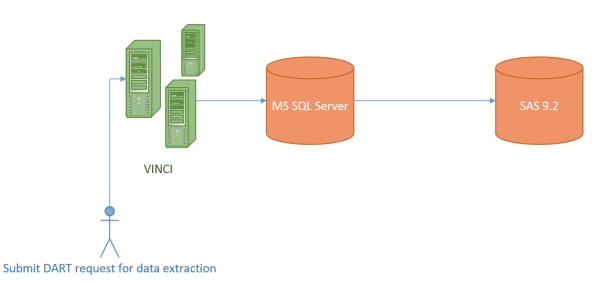The Functional Requirements for the thesis are listed below

Requirement Number	Description
R001	Create a line graph showing the **% referred to move program** over 5 year period for diabetes, prediabetes and normal patients.
R002	Create **Word Cloud** showing why patients did not participate in 'MOVE!' programs

Procedures

 The analysis to determine the clinical outcome for patients enrolled in "Screening for

Diabetes and Prediabetes Study" was performed in two steps. During the initial step,

patient data were collected. As part of second step, actual data analysis was performed. Please see "Plans for Data Analysis" section for more details. Below work flow diagram depicts high level procedures.

Requesting Data for Analysis

In order to extract data from "Screening for Diabetes and Prediabetes Study", a Data Access Request Tracker (DART) request was submitted. DART is an online SharePoint application that is used to req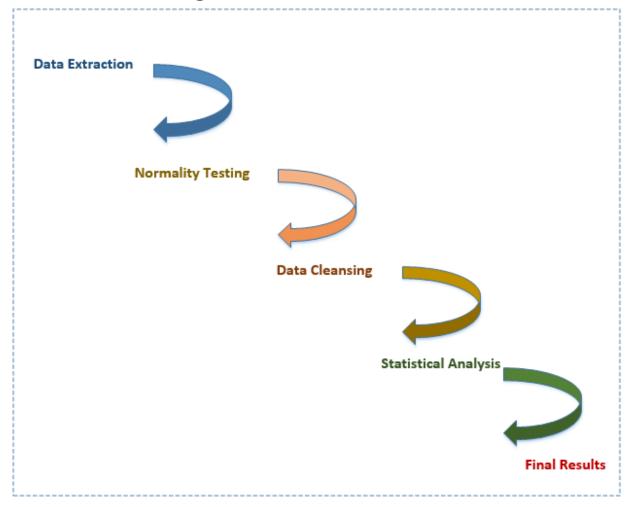uest access VINCI data. DART request included patients who were enrolled in the study from July 1st 2009 through December 31st 2014.

After the DART request was approved, data required to analyze MOVE participation were extracted from VINCI into MS SQL server. These data were then imported into SAS dataset to perform statistical analysis.

Instruments

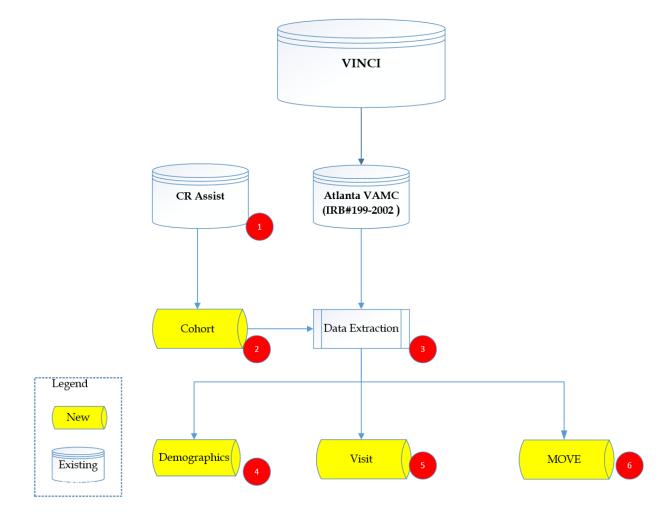The informatics solution was created in five steps. These steps were namely Data

Extraction, Normality Testing, Data Cleansing, Statistical Analysis and Final Results.

High Level Process Flow

Data Extraction

Normality Testing

Data Cleansing

Statistical Analysis

Final Results

Data Extraction

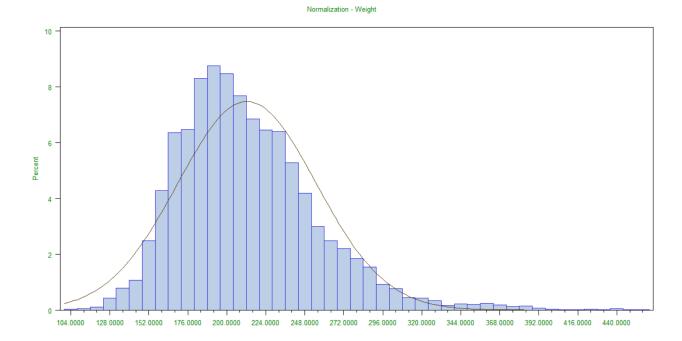**Data Extraction Process to Analyze MOVE! Participation**

Annotation

1. Using CR Assist, create a 'COHORT' dataset with Patient ID, which contains all research patients who completed the screening study (IRB#199-2002).

2. Using 'COHORT' dataset, extract all matching patients from Atlanta VAMC (IRB#199-2002) database beginning July 2009 through December 2014.

3. Of the patients selected, create 3 entities (data set) namely, VISIT, DEMOGRAPHICS and MOVE.

4. DEMOGRAPHICS dataset include, Patient ID, Last name, First name, SSN, Age, Sex, and Race/Ethnicity. In accordance with HIPPA regulations, real SSN will be requested to be scrambled for each patient. Refer 'Data Structure' section for details on DEMOGRAPHICS dataset.

5. VISIT dataset included , Patient ID, Date of Visit, Name of Visit, Site of Primary Care, Weight, Height A1c, 0 Hr Glucose, 2 Hr Glucose , ICD Code (include diabetes 250.xx , 790.xx) , Metformin dosage , Sulfonylureas-dosage and Insulin dosage.

6. MOVE dataset include, Patient ID, Date of Visit, Name of Visit, Site of Primary Care, Date when patient referred, enrolled in MOVE program and Date when patient participated in MOVE program. Refer 'Data Structure Sections' for details on MOVE dataset.
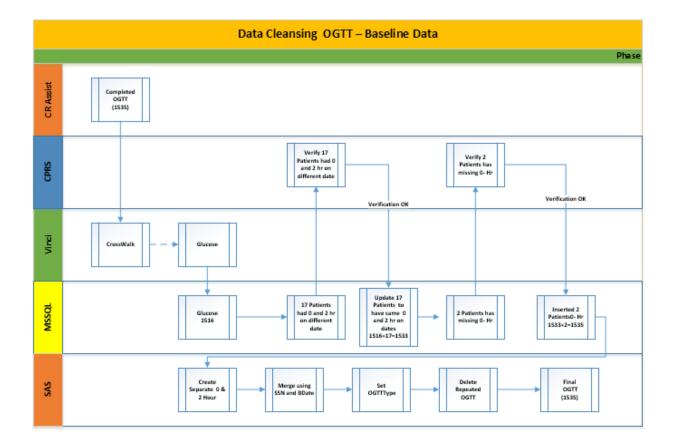
Normality Testing

1,535 Records

OGTT table contains baseline information. This table hold information such as Patient ID, Date of OGTT, Zero Hour Glucose, Two Hour Glucose and OGTT Type. OGTT Type had 4 possible types namely Normal, Low risk Pre-diabetic, High risk Pre-diabetic and diabetic. The normality of data were tested using SAS Univariate function. This process helped to identify all outliers for the baseline data.

Normalization - Weight
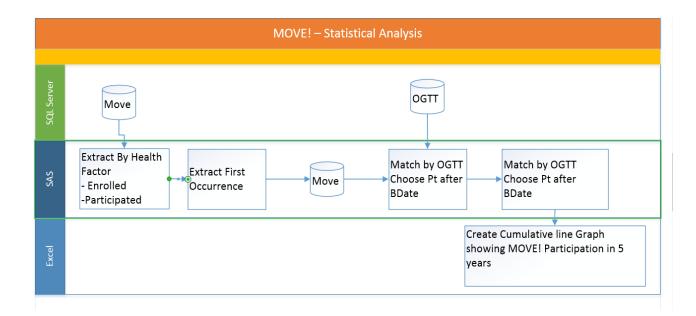
Data Cleansing

Cleansing of the data was the critical step in creating the informatics solution. Patient

information in CR Assist was considered as system of records. Total 1535 patients were

identified from CR Assist. Patient data extracted from VINCI must match the patient

information from CR Assist. SAS process was created to determine if the data from

VINCI matched data from CR Assist. The results of this process showed discrepancy

between number of records in VINCI and CR Assist. The number of records from VINCI

were 1516. However 1535 records existed in CR Assist. In order to identify the

discrepancy another SAS program was created. The results of this SAS process showed

the discrepancy was due to missing zero hour or missing two hour data. These data were

extracted from CR Assist and manually added to the OGTT and Move table. The SAS

process also exposed duplicate records in OGTT table. These duplicate records were

deleted OGTT and Move table

As a part of clean-up process, all the patients whose zero hour glucose were less than 50

mg/dl and more than 300 mg/dl were excluded from baseline. Similarly all the patients

whose two hour glucose were less than 50 mg/dl and more than 500 mg/dl were excluded

from baseline. This data cleansing process eliminated some records from OGTT table.

After running the clean-up process records from VINCI matched records from CR Assist.

Statistical Analysis

In order to determine whether the primary care providers referred patients to 'MOVE!'

Program multiple SAS programs were created. These programs used OGTT table and

MOVE table. The MOVE table consisted of the first date a patient was enrolled in

MOVE! Program. This table also contained MOVE participation for 5 year period.

Using data from OGTT table and MOVE table SAS program determined how many

patients were referred to move program. These counts were then exported to Excel and

create 5 year graph.

Final Results

This thesis was trying to find answer to the following research question.

Will primary care providers refer patients to 'MOVE' Program once patients were identified with prediabetes?

•Null Hypothesis: Higher percent of participants with prediabetes will be referred to

'MOVE' program.

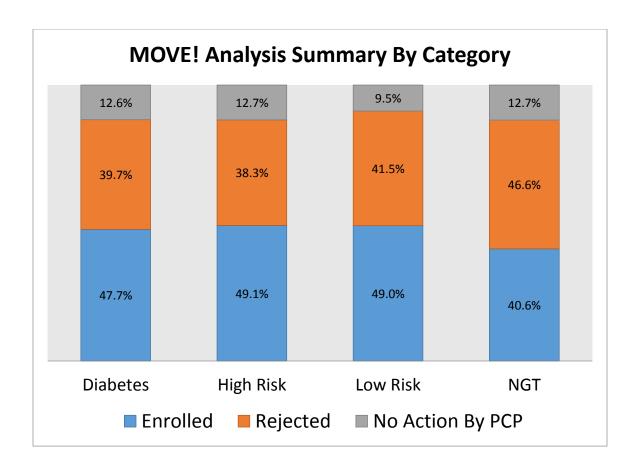|					
Oral Glucose Tolerance Test (OGTT) Screening Data					
	All	NGT	Low Risk Prediabetes	High Risk Prediabetes	Diabetes
N	1535	746	306	332	151
%	100.0 %	48.6 %	19.9%	21.6%	9.8%

The above table shows baseline data. Out of 1535 patients, 48.6% of patients were

normal, 19.9% were low risk prediabetes patients, 21.6 % were high prediabetes and

9.8% were diabetes patients.

The informatics solution created two types of analysis. First analysis was a high level

summary analysis and second analysis was by category.

MOVE! Analysis Summary		
	%	Count
Patient Enroll	44.8%	688
Patient Reject	43.1%	662
No Action By PCP	12.1%	185

The above table shows high level summary. According to this analysis 44.8% patients

were enrolled in MOVE! Program. 43.1 % patients rejected participating in MOVE!

Program. PCP did not take any action for 12.1% patients.

MOVE! Analysis Summary By Category				
	Diabetes	High Risk	Low Risk	NGT
Enrolled	47.7%	49.1%	49.0%	40.6%
Rejected	39.7%	38.3%	41.5%	46.6%
No Action By PCP	12.6%	12.7%	9.5%	12.7%

MOVE! Analysis Summary By Category

Category	No Action By PCP	Rejected	Enrolled
Diabetes	12.6%	39.7%	47.7%
High Risk	12.7%	38.3%	49.1%
Low Risk	9.5%	41.5%	49.0%
NGT	12.7%	46.6%	40.6%

Legend: ■ Enrolled ■ Rejected ■ No Action By PCP

The above graph shows MOVE! Analysis by category. The categories included Diabetes, High risk Prediabetes, Low risk Prediabetes and Normal.

Diabetic: 47.7 % of diabetic patients, enrolled in MOVE program. 39.7 % of patients rejected to enroll in MOVE program. PCP did not take any actions for 12.6 % of patients

High-Risk Prediabetes: 49.1 % of high risk patients enrolled in MOVE Program. 41.5 % rejected to participate in MOVE program. PCP did not take any actions for 9.5 % of patients

Low-Risk Prediabetes: 49.0 % of low risk patients enrolled in MOVE Program. 38.3 % rejected to participate in MOVE program. PCP did not take any actions for 12.7 % of patients

Normal: 40.6 % of normal patients enrolled in MOVE Program. 46.6 % rejected to participate in MOVE program. PCP did not take any actions for 12.6 % of patients

The above diagram shows graphical representation of reasons for why patients did not participate in 'MOVE!' program. Health Factor table contained unstructured data for patients who participated in MOVE program and those who did not participate in MOVE! Program. This unstructured data were extracted and   word cloud was generated using free online tool. https://www.jasondavies.com/wordcloud/#.

Conclusion

Based on the analysis higher percentage of high risk and low risk prediabetes patients were referred by PCP to enroll in MOVE! Program. ***Hence the Null Hypothesis was proved to be true.***

Limitations and Delimitations

"Screening for Diabetes and Prediabetes Study" had limitations and delimitations.

Limitations

1. It was possible that the study had missed some diagnoses. For instance, many Atlanta VA patients might have received care outside Atlanta; VA. The details about these diagnoses were not captured in VINCI.

2. The analysis did not exclude confounding factors; as a result there was a slight possibility for the results were skewed. For instance, weight change in patient could be due to sickens, medications such as steroid, inability to participate in MOVE program etc. These factors were not excluded during the analysis

3. Lastly the analysis did not exclude type 1 diabetes.

Delimitations

Even though large study population existed in national Veterans Care, this study

population included only 1535 voluntary patients from Atlanta VA

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https://www.jasondavies.com/wordcloud/#.