Random Patient Clinical Data Simulator

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Abstract

Access to real patient data is important for teaching purposes and research. However, due to law this data is protected and can only be used by people who have permission to access it.

Acknowledgements

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Chapter 1

Introduction

Simulation of data can be a huge benefit for teaching and research purposes. In order to achieve data that can be used for that purpose real statics will have to be used with generated patients in order to create this data as real data cannot be used due to law protecting people's privacy.

1.1 Objectives

The main objective of this project is to develop a "random patient data" which then can be used for training, research and teaching purposes. The user will have access to information about various conditions based on Scottish statistics.

The application will allow users to filter through that information in order to analyse the data about these conditions. While filtering through these statistics appropriate graphs are going to be generated to aid ease of reading the data.

The application is going to be web-based so that it can be accessed anywhere and on any type of device. Therefore, the user should be able to access the application on various electronic devices that have internet access.

Sources that have been gathered to produce this application are going to be available to the user. If they would like to find out more information about these conditions or data used to generate these statistics.

1.2 Outcome

1.3 Report Structure

The report is broken down into "#" different chapters where each chapter focuses on different development stage of the application. The first chapters focus on background research and the problem to be solved by the application. Followed by chapters focused on detailed analysis of design of the application, how implementation process has been executed, what issues have been encountered during the development of the application. The what were the results of testing stage and evaluation of the application. There report will come to an end with a summary and last comments before the final conclusion.

1.4 Marking Scheme

The marking scheme for this project is going to be "Experimentation-based with Significant Software Development" this is because before developing the application a lot of research will have to be done beforehand to gather all the requirements in order to generate usable data for the application.

Chapter 2

Background Research

The aim of this chapter is to describe in detail what research has been done in order to prepare for development of "RPCDS". This section will talk about benefits of simulation in relation to teaching to research and from where and what statistics were gathered for project.

2.1 Simulation

Simulation based learning in a health education environment has some advantages over other teaching methods used in that field depending on context, topic and method. By creating this application, students who are studying to be a health professional can practice analysing patient data and statistics which can result in additional gains in knowledge, critical thinking ability, satisfaction or confidence based on studies.

2.2 Community Health Index (CHI) Number

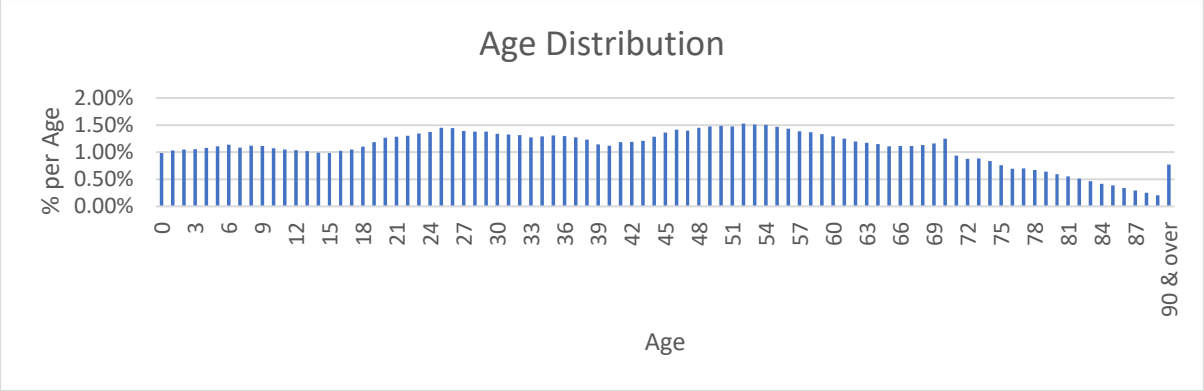
The CHI number is a population register used in Scotland for healthcare purposes. The CHI Number uniquely identifies a person on the index. This number is 10 digit long. The first 6 digits are persons Date of Birth (DDMMYY) followed by 2 random digits. The 9th digit is representing the persons sex which assigns an even number for females and an odd number for males. The final digit is a check digit.

2.3 Statistics gathering

Statistics for this project were gathered from official sources for the data to be valid. The statistics were gathered in a format which showed how many people were affected by the condition in different age groups based on gender. Some statistics include signs and symptoms (S&S) that do not necessarily have a confirmed diagnosis, classified according to body system.

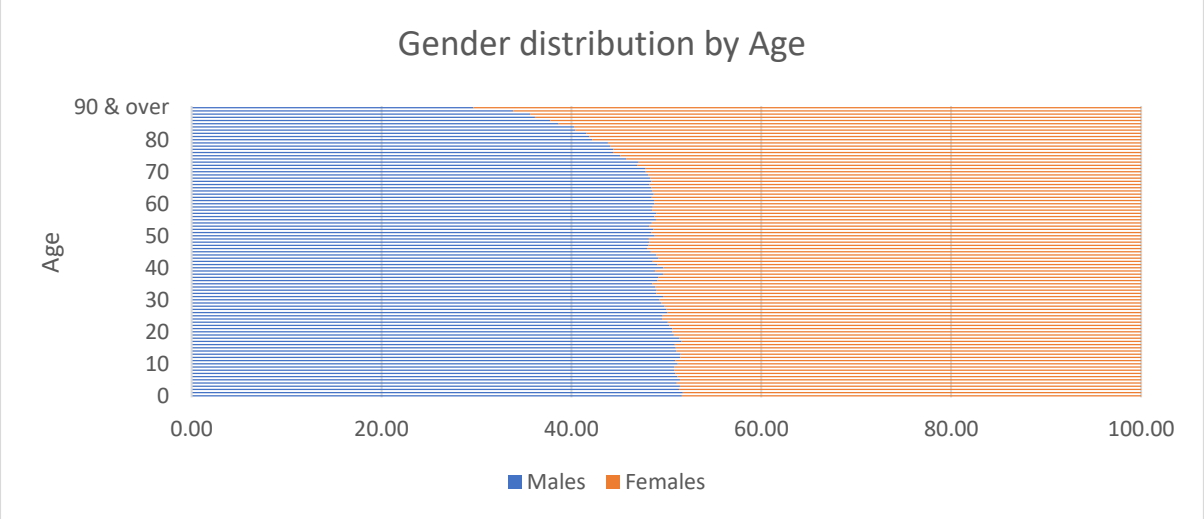
2.3.1 Age Distribution

For the software to be useable it will have to have realistic statistics about how the age is distributed in Scotland. This is because conditions to individuals are going to be assigned by their age and gender. Below is a graph included which shows the percentage of age is distributed in Scotland based on Mid-2017 population estimates Scotland.



2.3.2 Gender Distribution

To get accurate results in this project gender will have to be distributed accordingly. This is because if all age groups are split into 50% males and 50% females then wrong data will be outputted. In the graph below it is shown the percentage of males and females at different ages.

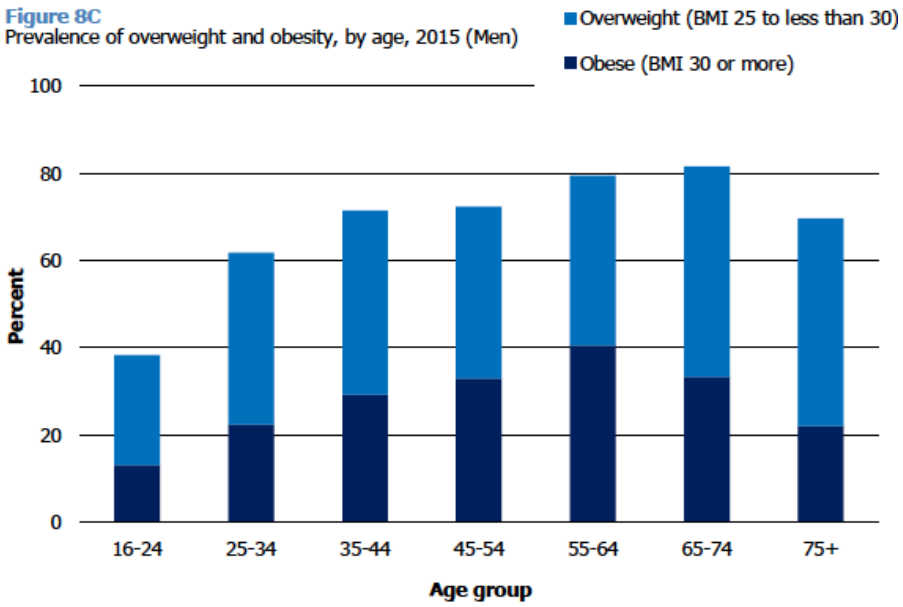


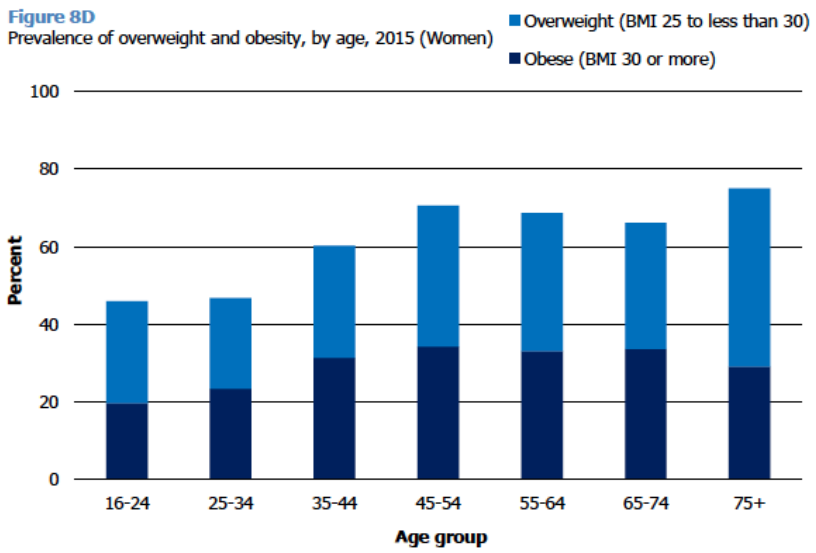
2.3.3 Body Mass Index (BMI) Distribution

BMI is a widely accepted measure that allows for differences in weight based on persons height. This measure is important since people with higher BMI tend to be more affected by conditions such as Diabetes and Hypertension. Below is a BMI table for adults who are age 16 or higher.

BMI (kg/m ^{2})	Description
Less than 18.5	Underweight
18.5 to less than 25	Normal
25 to less than 30	Overweight, excluding obese
30 to less than 40	Obese, excluding morbidly obese
40+	Morbidly obese

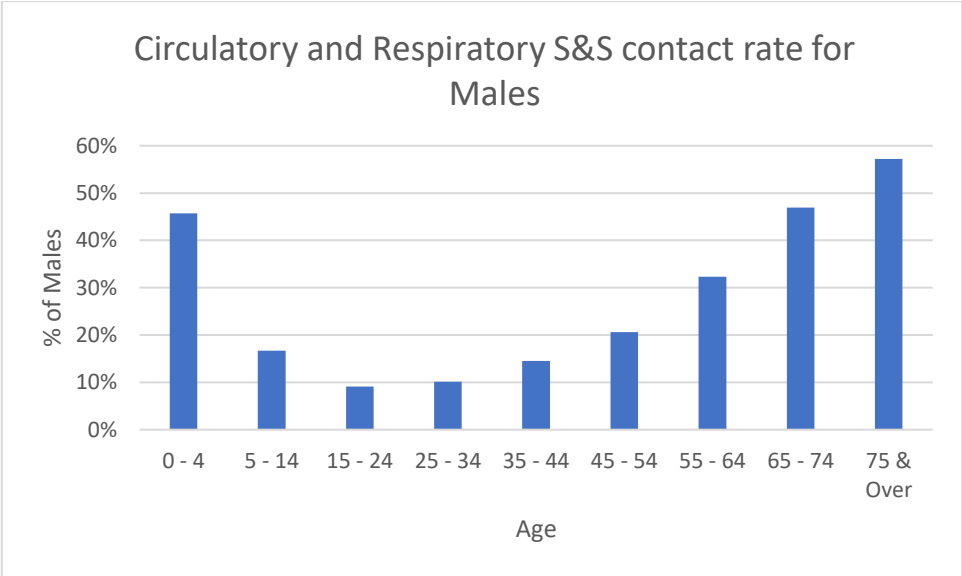
Since people with an age lower than 16 are classified differently people who are younger than that will not have a BMI measure in the system. Below are charts which show peoples BMI based on age and gender. For people with a BMI that have lower than 25 will have a BMI which is either normal BMI or underweight BMI will have a random BMI generated between 15 and 25.

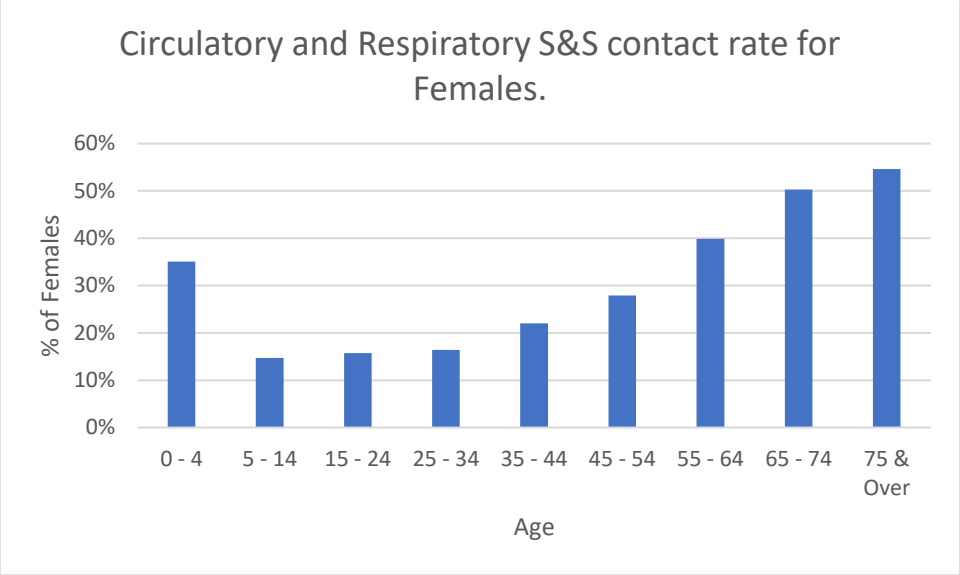




2.3.4 Circulatory and Respiratory S&S

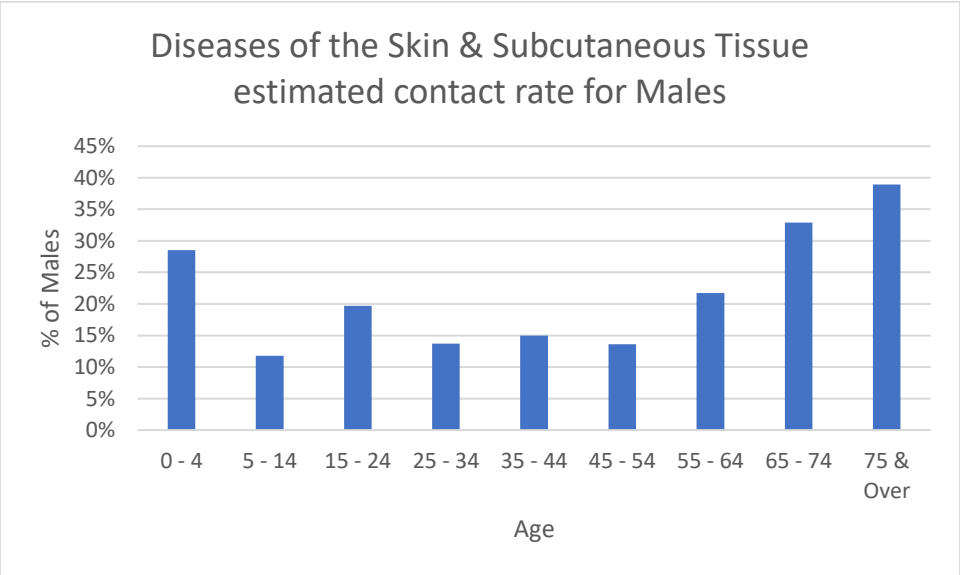
Circulatory and Respiratory [5] condition is one most common condition that affects people in Scotland. Below are graphs which show the percentage of males and females that are affected by this condition based on age for a population of a thousand based on Information Services Division Scotland statistics.

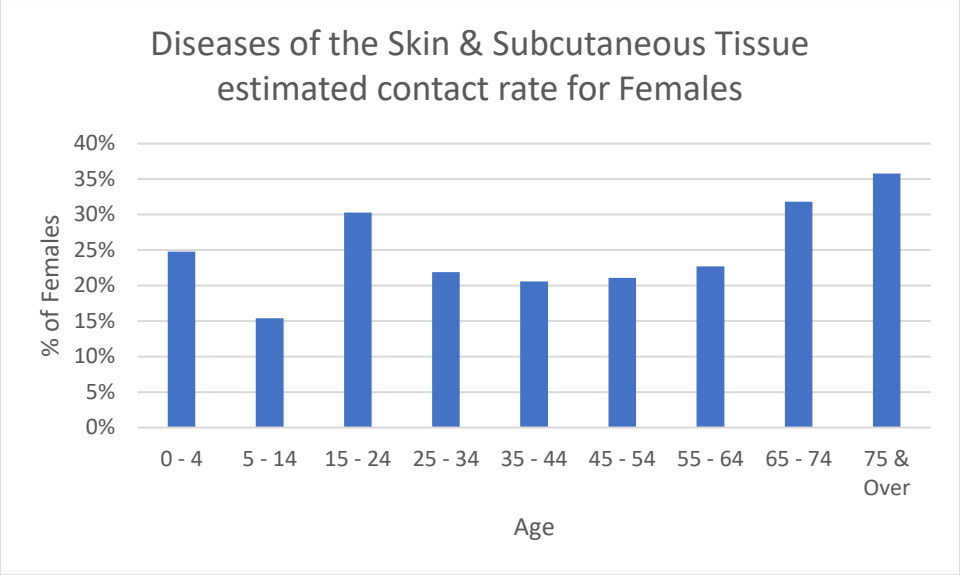




2.3.5 Diseases of the Skin & Subcutaneous Tissue

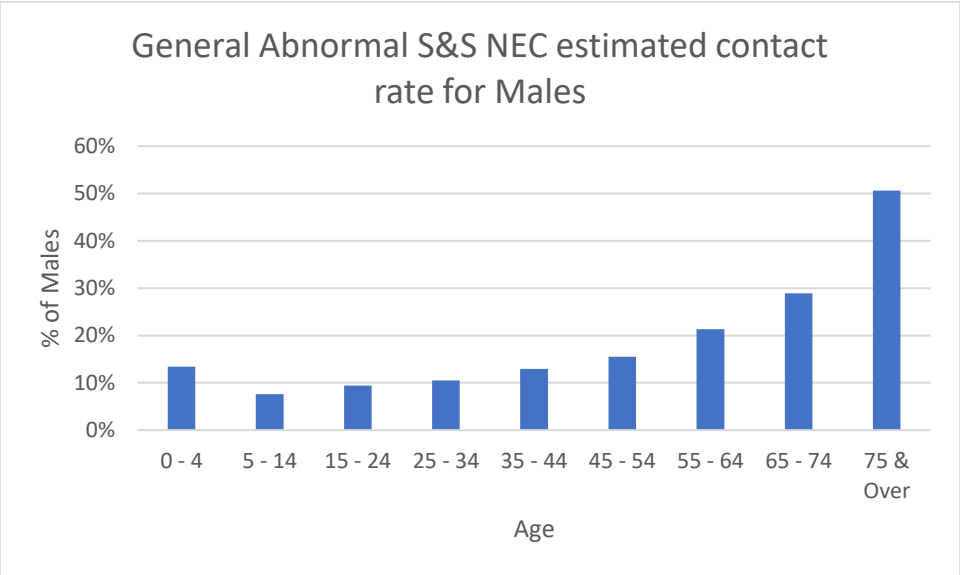
Diseases of the Skin & Subcutaneous Tissue [5] condition is one most common condition that affects people in Scotland. Below are graphs which show the percentage of males and females that are affected by this condition based on age for a population of a thousand based on Information Services Division Scotland statistics.

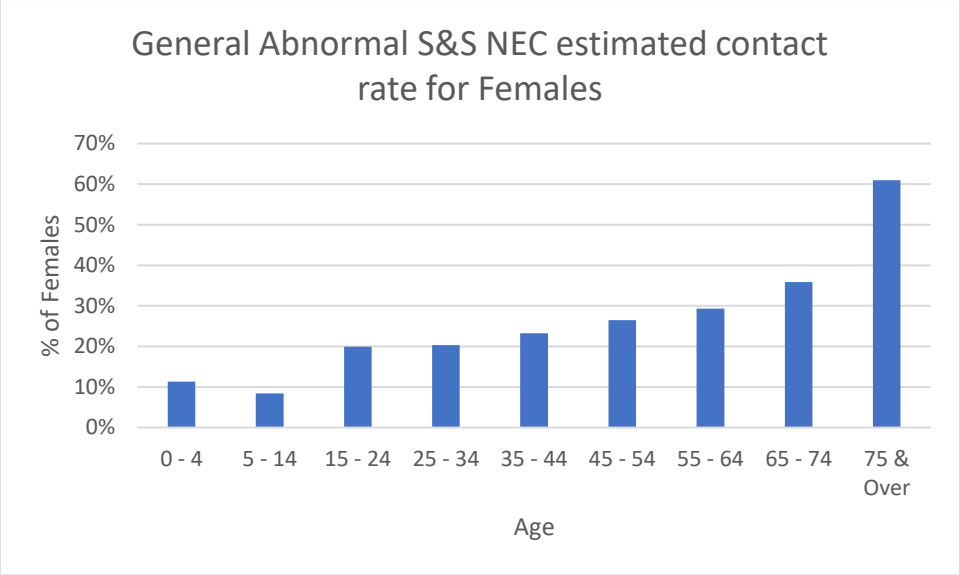




2.3.6 General Abnormal S&S NEC

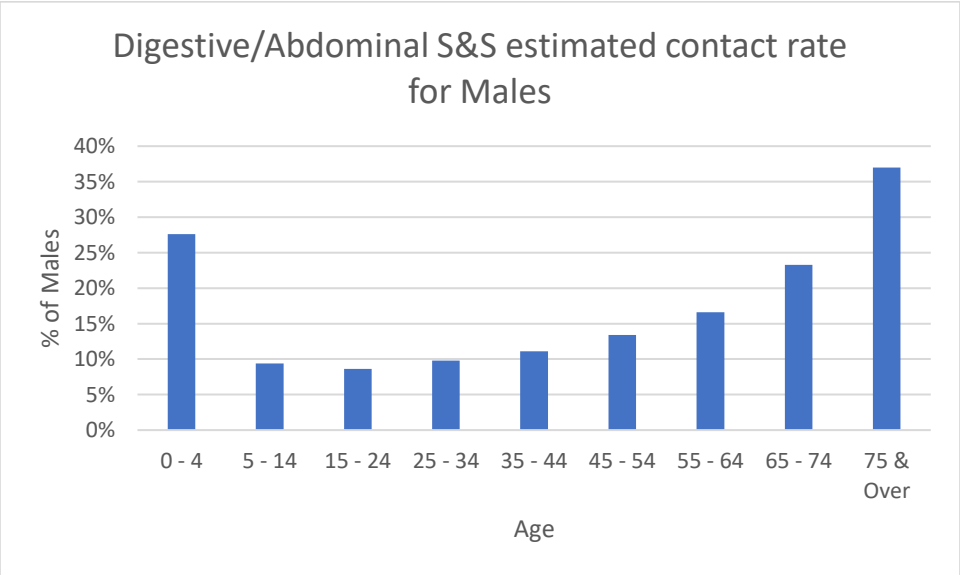
General Abnormal [5] condition is one most common condition that affects people in Scotland. Below are graphs which show the percentage of males and females that are affected by this condition based on age for a population of a thousand based on Information Services Division Scotland statistics.

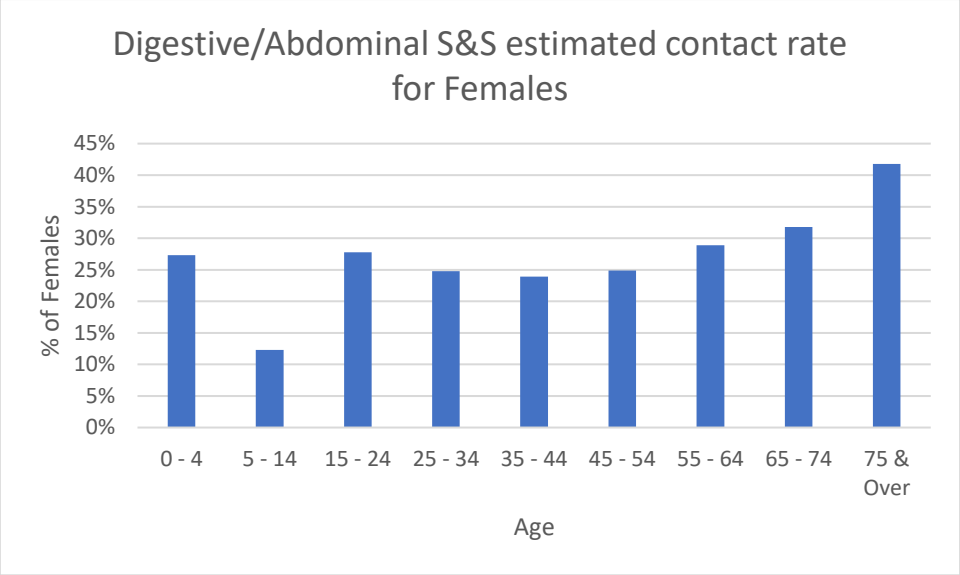




2.3.7 Digestive/Abdominal S&S

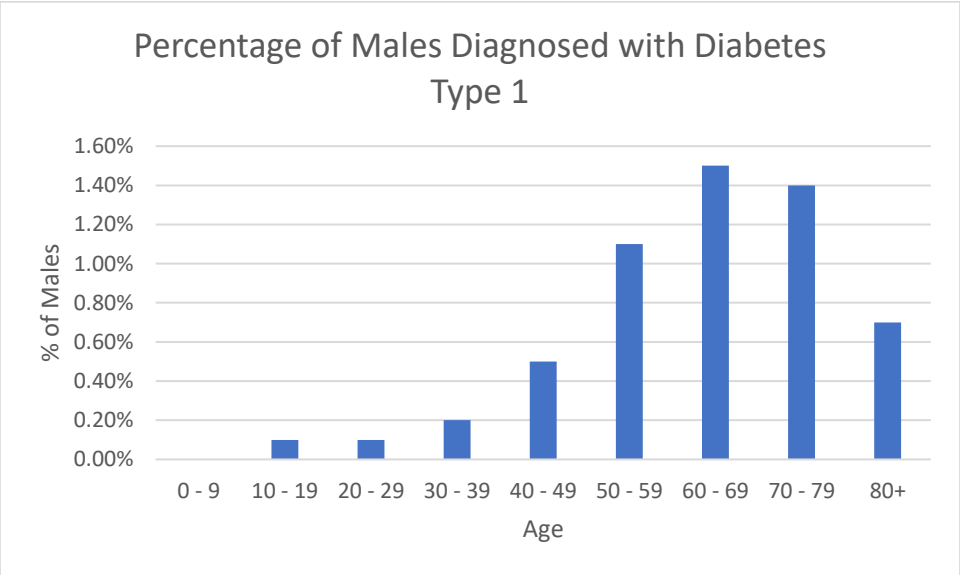
Digestive/Abdominal [5] condition is one most common condition that affects people in Scotland. Below are graphs which show the percentage of males and females that are affected by this condition based on age for a population of a thousand based on Information Services Division Scotland statistics.

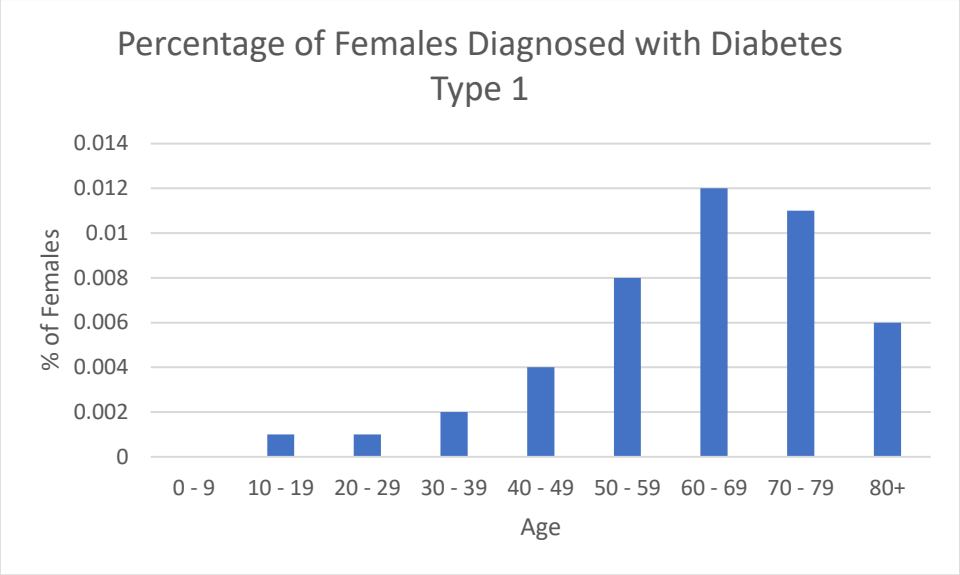




2.3.8 Diabetes Type 1

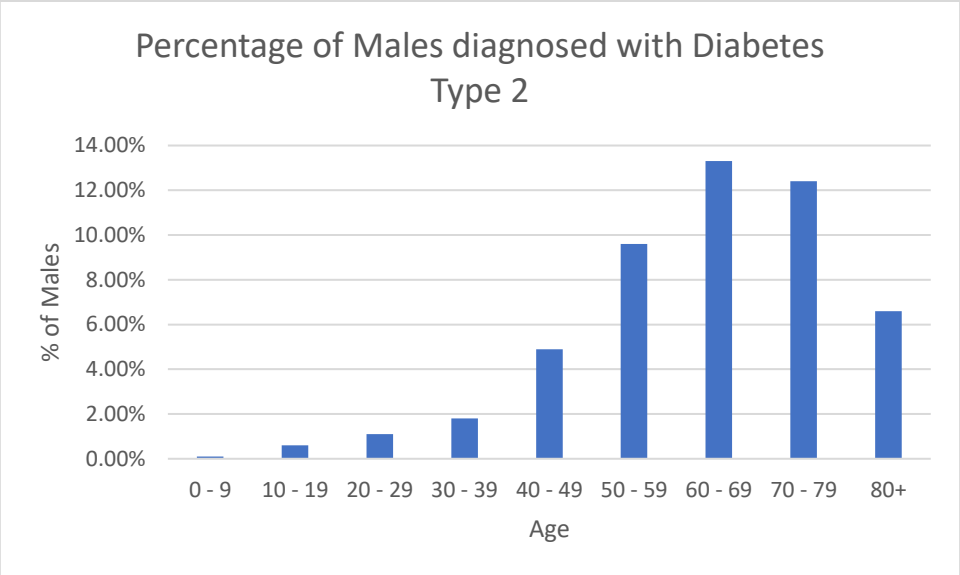
Diabetes is a popular condition in todays society. However, Diabetes Type 1 [6] is less common than Diabetes Type 2. Below are graphs which show the percentage of males and females that are affected by this condition based on age for a population of a thousand based on statistics from Diabetes UK.

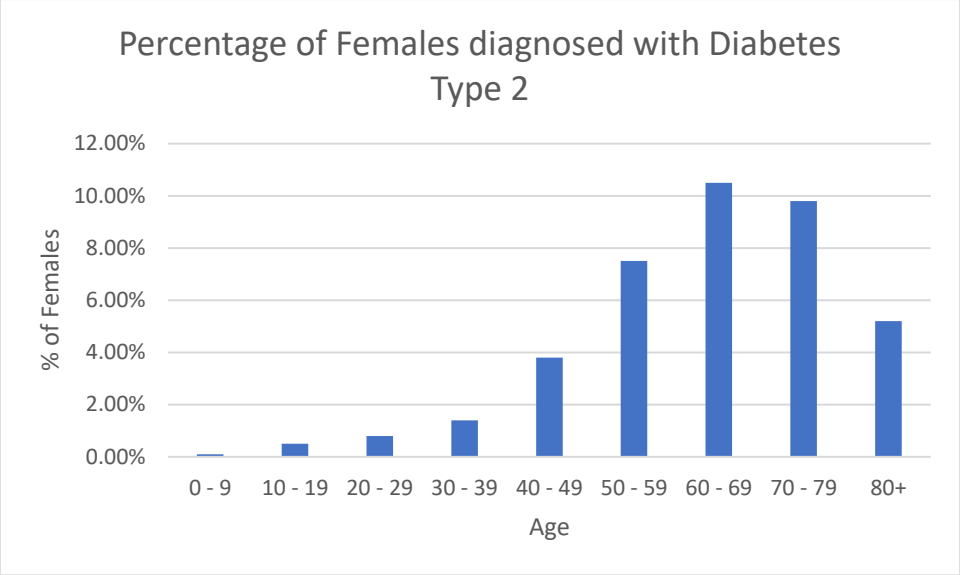




2.3.9 Diabetes Type 2

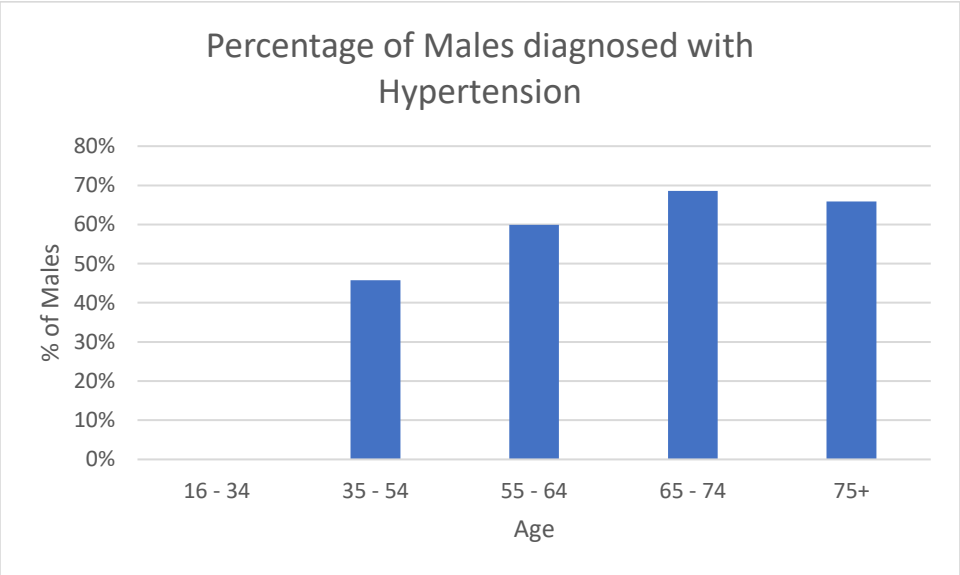
Diabetes Type 2 is more common than Diabetes Type 1 [6] because an obese person has a higher chance of being affected by this condition. Below are graphs which show the percentage of males and females that are affected by this condition based on age for a population of a thousand.

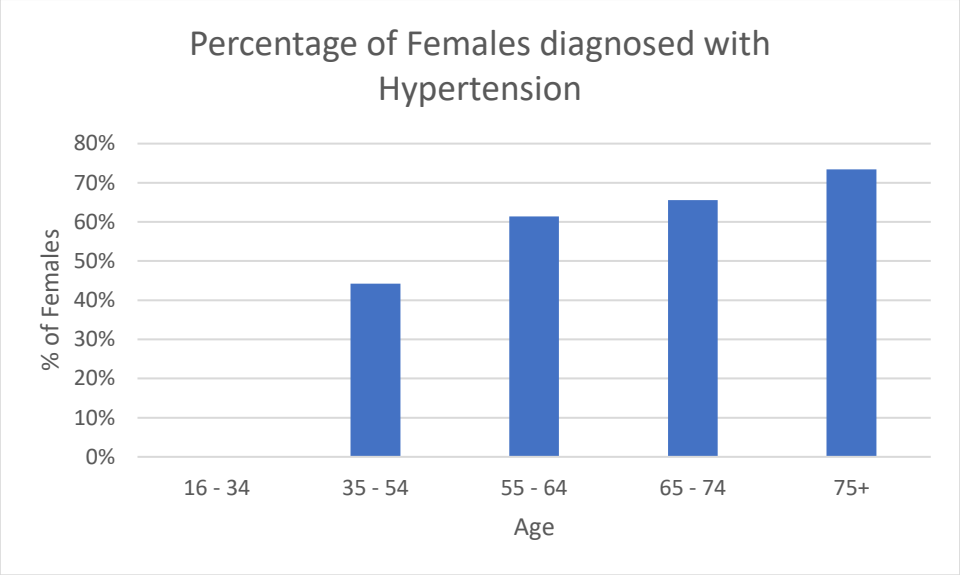




2.3.10 Hypertension

Hypertension [7] condition is one most common condition that affects mainly affects people who are older than 30 years old in Scotland. Below are graphs which show the percentage of males and females that are affected by this condition based on age for a population of a thousand based on ScotPHO statistics.




Percentage of Females diagnosed with Hypertension
80%
70%
60%
50%
40%
30%
20%
10%
0%
% of Females
16 - 34
35 - 54
55 - 64
65 - 74
75+
Age

Chapter 3

Problem Description and Specification

The aim of this chapter is to describe in detail what the problem is and how it is going to be approached. This will include a complete list of functional and non-functional requirements to be met by the software and how these requirements were identified and approached.

3.1 Problem Description

The challenge in Random Patient Clinical Data Simulator will consist of creating a population which will have an age, gender, BMI[1] and conditions based on statistics gathered for the project. Each of the statistics have a number of people that are a certain age, gender, BMI and conditions. These number will have to be converted into percentages to help assign these statistics to the simulated data. These percentages which help generate data will also have to have include an error rate which will make the statistics vary each time the data is simulated. Each person will also require a valid postcode which is in Scotland. Each person will have to have a unique CHI Number[2] where the format will have to be the same for each person. The simulated data will be displayed using appropriate graphs based on the condition chosen by the user.

3.2 For who is this software designed for?

This software is going to be designed for researchers and health professionals who want to improve their analytical skills.

3.3 Functional Requirements

The software will have to:

- Create a database which is unique to a user.
- Let the database to be retrieved to the user that has been simulated previously.
- Simulate data based on statistics gathered.
- Assign postcodes to records in the database that are valid postcodes in Scotland.
- Create a unique CHI Number for each record in the database with appropriate format.
- Display the records stored in the database.
- Display graphical statistics based on each condition to the user.
- Store the name of the database for each user.

3.4 Non-Functional Requirements

The software will have to:

- Have an easy to use user interface so that they user can access simulated data quickly.
- Contain a user interface that support various screen sizes.

[1] Body Mass Index

[2] Community Health Index Number

- Load a database automatically that has been previously user used device.

3.4 Approach to Solving the Problem

Chapter 4

Software Description and Specification

The aim of this chapter is to describe how the application was designed. This will include what software development process was chosen, how was the structure of the database was created for the application and how the graphical user interface was designed.

4.1 Software Architecture

4.2 Database Design

4.3 Graphical User Interface Design

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Appendix A

Appendix B

Appendix C