**Executive Summary**

The model described in the following report simulates the operational proceedings of a diagnostic clinic for American Veterans. This clinic is comprised of several rooms and doctors, each of which has a specific role in the diagnostic process. More specifically, veterans will require a multitude of diagnostic based questionnaires (DBQs) to be completed, which require varying lengths of appointments and varying specialties of doctors and of equipment. The overarching purpose of the model is to determine whether or not a clinic with a certain number of rooms and a certain combination of staff will be able completely address a given number of cases[[1]](#footnote-1) over the course of a given day, and if so, how efficiently the clinic will operate.

**Inputs**

There are two Excel sheets of input to the model.

The sheet “UI Input” is printed below, and primarily concerns itself with the breakdown of cases and the examination time necessary to address each diagnostic. Cells that should be edited to vary the inputs are highlighted in green; all other cells are either descriptive, formulaic, or preset[[2]](#footnote-2).

* Row 3 consists of a breakdown into the most general of case types – general medicine, neurological or psychiatric specialist, and audio specialist. In this image, 65% of cases would fall into general medicine.
* Cells I9 through Q9 represent all possible types of DBQs – a 20 minute general medicine DBQ, a 30 minute general medicine DBQ, etc.
* Cells G11 and G16 represent, respectively, the length of the check-in and check-out processes to the clinic.
* Cells F12 and F15 represent the percentages of the examination time that, respectively, are work to be completed by a medical assistant and a specialist (nurse practitioner, audiologist, psychiatrist, or neurologist). However, a fair amount of the medical assistant work can be completed prior to the visit of the patient (without the patient in attendance). The model operates on the fact that medical assistants can complete this “pre-visit” work a day prior to seeing the patient, in times during which they are otherwise not occupied. Cells F13 and F14 respectively represent the amount of medical assistant work that is completed prior to visit and during visit.
* Cells D19 through D21 represent the percentages of overall general medicine cases that fall into three different subtypes – Type 1, Type 2, and Type 3 – of general medicine cases. In this particular input set, 40% of 65% (which is 26%) of cases are Type 1 general medicine cases. Cells D24 through D29 represent the same idea for audiologist and neurologist/psychiatrist cases.

The next sheet of inputs (“Inputs”) specifies variables which are more specific to a particular run through the model. Once again, cells that should be edited to vary the inputs are highlighted in green.

* Cells B7 through B10 represent the number of each type of room in the clinic. Face-to-face medical assistant examinations occur in the triage rooms, nurse practioners and neurologists work in the general examination rooms, the psychiatrist works in the psychiatry room, and the audiologist works in the audiology room.
* Cells B13 through C17 represent ranges of doctors through which the model will iterate. In the example sheet of inputs, the model would try all combinations of between 3 and 4 medical assistants, 2 and 3 nurse practioners, 1 and 2 audiologists, 1 and 2 neurologists, and 1 and 2 psychiatrists, and determine which one leads to a clinical operation that addresses all DBQs and furthermore minimizes the doctor cost to the clinic[[3]](#footnote-3). In the example sheet of inputs, all doctors have an equivalent cost of 1, in which case the model is simply minimizing the time during which the doctor is in the clinic but not seeing a patient.
* Cell B28 represents the length of a day in minutes.
* Cell B29 represents the frequency of veteran appointments. If there is a 30 minute appointment interval, the day begins at 8:00, and a veteran’s first appointment is at 8:25, for instance, the veteran will have his or her appointment scheduled at 8:00.
* Cell B30 represents the number of cases in a day.
* Cell B31 represents the length of the sanitation period - a period during which the room is sanitized post-examination.

**Outputs**

* Whether the particular set of inputs yielded a viable clinic model is indicated on the “Remaining DBQs” sheet of the excel document. If the inputs lead to an unfeasible clinic, the DBQs that were not resolved are printed out on the sheet as well (if the run is successful, all entries would be 0 to indicate that no DBQs remain). One could immediately view whether or not a run was successful by viewing the program output (see operational instructions).
* Histogram of “Start Wait Times” – the time which elapses between a veteran’s arrival to the clinic and his or her first face to face examination with medical personnel.
* Histogram of “In Out Times” – the time which elapses between a veteran’s arrival to and exit from the clinic.
* Histogram of “Lobby Times” – the total time during which the veteran is in the clinic but not seeing medical personnel.
* Time plot of “Patient Experience” – a solid dot or dash indicates that a patient is occupied at a particular time. Each y value corresponds to a particular patient, as denoted in the legend of the plot.
* Time plot of “Doctor Utilization” – a solid dot or dash indicates that a doctor is occupied at a particular time. Each y value corresponds to a particular doctor, as denoted in the legend of the plot.
* Time plot of “Room Utilization” – a solid dot or dash indicates that a room is occupied at a particular time. Each y value corresponds to a particular room, as denoted in the legend of the plot.
* Time plot of “Lobby Occupancy” – the plot displays the number of veterans in the lobby at each time in the day.

**Assumptions**

* Face-to-face medical assistant examinations must be completed prior to to specialist examinations.
* Once a veteran begins his or her first face-to-face medical assistant examination, that veteran will get through all medical assistant examinations before returning to the lobby.
* The first doctor to see a patient will check in that patient.
* The doctor that addresses the final DBQ of a patient will check that patient out immediately following that final DBQ.
* Medical assistants complete pre-visit work for the following day when they have downtime. All of the pre-visit work must be competed in order to yield a successful run of the model.
* Specialists are booked in order of cost and volume. As audiologists experience very little volume, they have the highest scheduling priority with the motivation that they finish as quickly as possible. Following audiologists are psychiatrists, neurologists, and nurse practioners (the necessary medical assistant examinations are completed in all cases).

**Operational Instructions**

1. A “case” represents a particular veteran, and consequently, each “case” has its own set of DBQs to be completed. [↑](#footnote-ref-1)
2. The breakdown of DBQs for a particular case type (e.g. general medicine type 1) is an instance of a preset input. Editing those values must require direct modification of the program. [↑](#footnote-ref-2)
3. Calculated by multiplying the cost of each type of doctor (cells D13 through D17) by the time span between a doctor’s first appointment and the end of the last appointment. [↑](#footnote-ref-3)