

# Time and Motion Study Tool: Ambulatory Practice (TMS-AP)

Version 1.0

Partners Healthcare  
Agency for Healthcare Research and Quality  
National Resource Center for Health Information Technology



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# 1. Introduction

## 1.1 Overview

The Time and Motion Study – Ambulatory Practice (TMS-AP) Tool v1.0 was developed at Partners HealthCare, based on work done at the Regenstrief Institute<sup>1</sup>. It is designed to assess the impact ambulatory care interventions have on workflow and workload. It is a Microsoft® Access 2000 database that can be run on any computer with Microsoft® Access 2000 or 2003 installed, and it has been run on tablet PCs to facilitate portability of the application.

This User's Quick Guide will provide an overview of how to use the application. Customizing the application to capture different information is beyond the scope of this document, but familiarity with Microsoft Access should allow users to tailor the application for different studies. All references to database tables in this document have been *italicized*. Please refer to a recent article in the Journal of Biomedical Informatics for further information and an example of this application's use<sup>2</sup>.

## 1.2 Time and Motion Study Considerations

A full discussion of time and motion studies is beyond the scope of this User's Guide, but a brief discussion is useful. Prior to beginning such a study, it is important to have a clear idea of the research question that will be answered, outcomes that will be measured and stakeholders that will be involved. This will allow researchers to build a task list specific to the workflow of users being evaluated. These tasks should be visible to observer without prompting and grouped into categories to facilitate analysis. From this task list, researchers can develop a data collection form that standardizes data capturing and minimizes observer errors. This data collection form will drive any customization required for this time and motion tool. The task list and analysis categories included in TMS-AP were designed to evaluate the impact of electronic health records on ambulatory physicians.

When deploying the tool, it is important to keep in mind several issues common to many research methodologies. Because time and motion studies require passive observation, observer training and pilot observations should be conducted, in addition to training on the data collection tool itself. Consent should be obtained from clinicians and patients. Care should be taken in creating an appropriate study design that accounts for issues such as randomization if possible and ensures appropriate statistical power of the study.

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<sup>1</sup> Overhage JM, Perkins S, Tierney WM, McDonald CJ. Controlled trial of direct physician order entry: effects on physicians' time utilization in ambulatory primary care internal medicine practices.

J Am Med Inform Assoc. 2001 Jul-Aug;8(4):361-71.

<sup>2</sup> Lisa Pizziferri, Anne F. Kittler, Lynn A. Volk, Melissa M. Honour, Sameer Gupta, Samuel Wang, Tiffany Wang, Margaret Lippincott, Qi Li and David W. Bates, Primary care physician time utilization before and after implementation of an electronic health record: A time-motion study, Journal of Biomedical Informatics, Volume 38, Issue 3, Human-Centered Computing in Health Information Systems. Part 2: Evaluation, June 2005, Pages 176-188.

Finally, potential confounding factors should be considered and isolated if possible. Such factors include observation factors (e.g., observer biases or the time of day), clinician factors (e.g., years in practice or computer literacy), and environmental factors (e.g., the number of patients or computer setup in the clinic).

### 1.3 Overview of Data Fields

The application was designed to study physician activities in the outpatient setting. It stores information about several entities in the study: institutions (*Institutions*), clinics (*TblClinics*) and physicians (*TblPhysicianInfo*). The application has a fixed set of activities that may be studied. Each activity has a major category which describes the activity at a high level, and minor category which specifies details of that activity. The major activities are listed below; please refer to the *ActivityTable* in the database for a full list of major and minor activities. Modifications to these activities should be relatively straightforward for users comfortable with Microsoft Access.

**Table 1: Major Activities**

<b>ActivityTable</b>
<b>MajorCategory</b>
Computer - Read
Computer - Looking For
Computer - Writing
Paper - Read
Paper - Looking For
Paper - Writing
Procedures
Personal
Talking
Walking
Phone
Start
Finish

Using these data fields, one or more observers (*TblObservers*) can record observations (*Observations*). These observations describe the activities of a particular physician over a specific period of time. Each moment in time should reflect only one activity per physician.

## 2. Using the Application

### 2.1 Initial Database Setup

When the application is opened, the data entry screen will automatically pop up. This screen is intended to allow an observer to enter in the information specific for that observation period. Before such observations can take place, a few tables in the database need to be populated with general information about the study.

The *ActivityTable* table contains information about specific activities that physicians may engage in during the course of the observation. Because of its relationship to other tables and the complexity of maintaining such relationships, modification of *ActivityTable* is beyond the scope of this document.

The *Institutions* table contains a list of all institutions that are part of the study. An institution may contain several clinics. As an example, a study may involve two institutions: University Hospital A and University Hospital B. University Hospital A might have a Westside Clinic, an Eastside Clinic and a Women's Health Clinic. The *Institutions* table will need to be populated with a complete listing of all participating institutions.

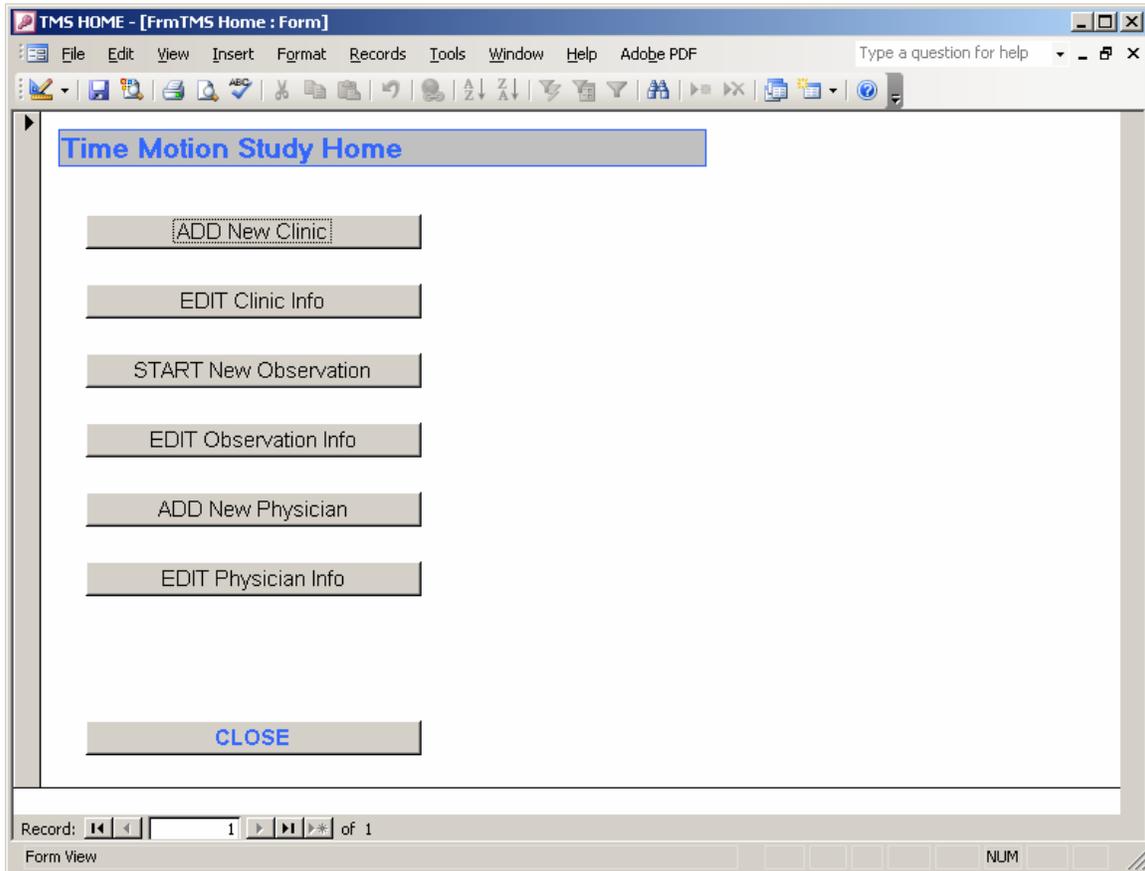
The *TblObsTypeKey* table contains a list of classes of observations. Its intended use is to distinguish observations related to the control group versus the intervention group in a randomized control trial, a pre-implementation versus post-intervention observation in a pre-post study, or similar groups depending on the study design. This table will need to be populated in accordance to the study design.

The *TblObserver* table contains a list of all observers who will enter data for the study. This should be populated before distributing the application to the observers.

A special note regarding the *Observations* table: This table needs at least one record in order for the data collection form to work properly. The application as distributed contains a "seed" record. Please **do not delete** this record.

A special note regarding the data entry screen: Although the following instructions suggest saving information before closing the screen, in most cases the application will update information as soon as data is typed in. Therefore, closing a screen will not delete any information that has been entered. If data has been entered and a user wishes to undo that entry, the record should be modified using the data editing functions.

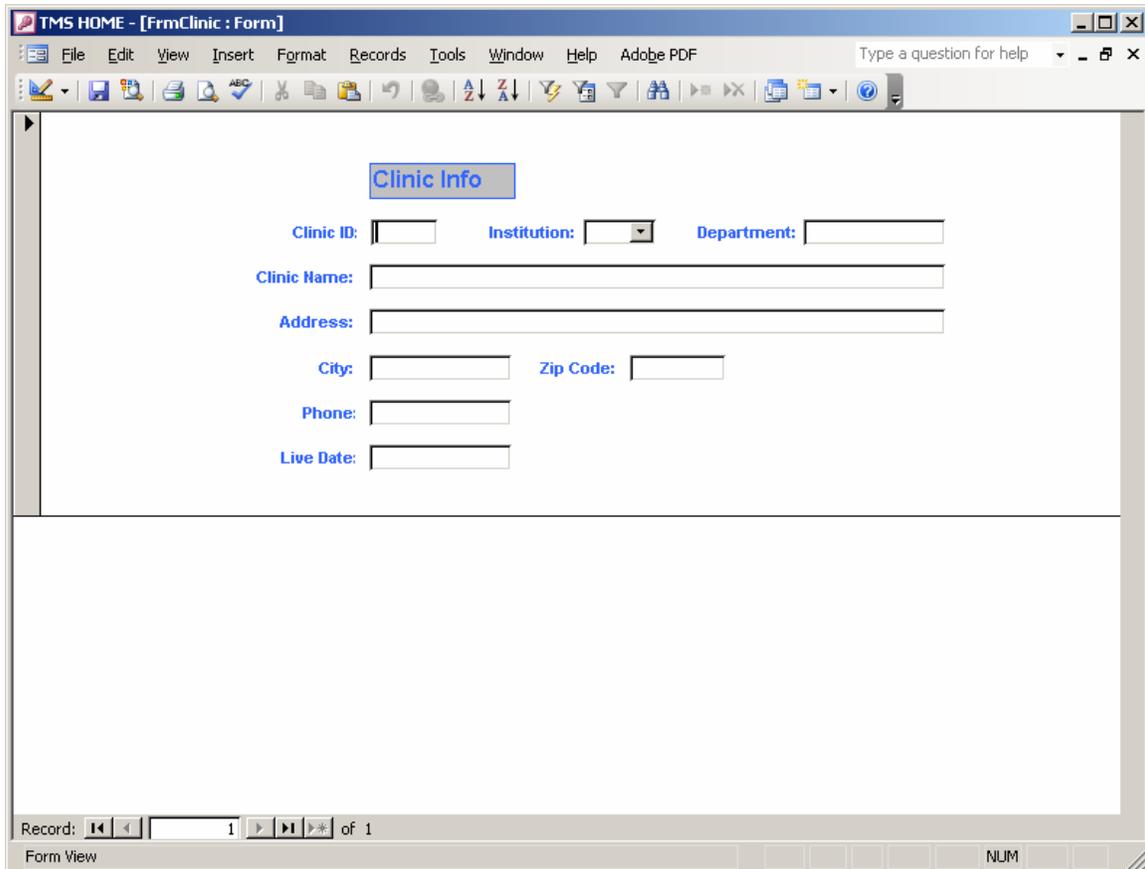
## 2.2 Opening Data Entry Screen



This screen should pop up whenever the application is launched. It provides easy access to the high level data entry tasks: adding and editing information for clinics, physicians and observations.

## 2.3 Add Clinic

New clinic information can be added using this screen.



The screenshot shows a Microsoft Access form titled "TMS HOME - [FrmClinic : Form]". The form has a menu bar with "File", "Edit", "View", "Insert", "Format", "Records", "Tools", "Window", "Help", and "Adobe PDF". Below the menu bar is a toolbar with various icons. The main area of the form is titled "Clinic Info" and contains the following fields:

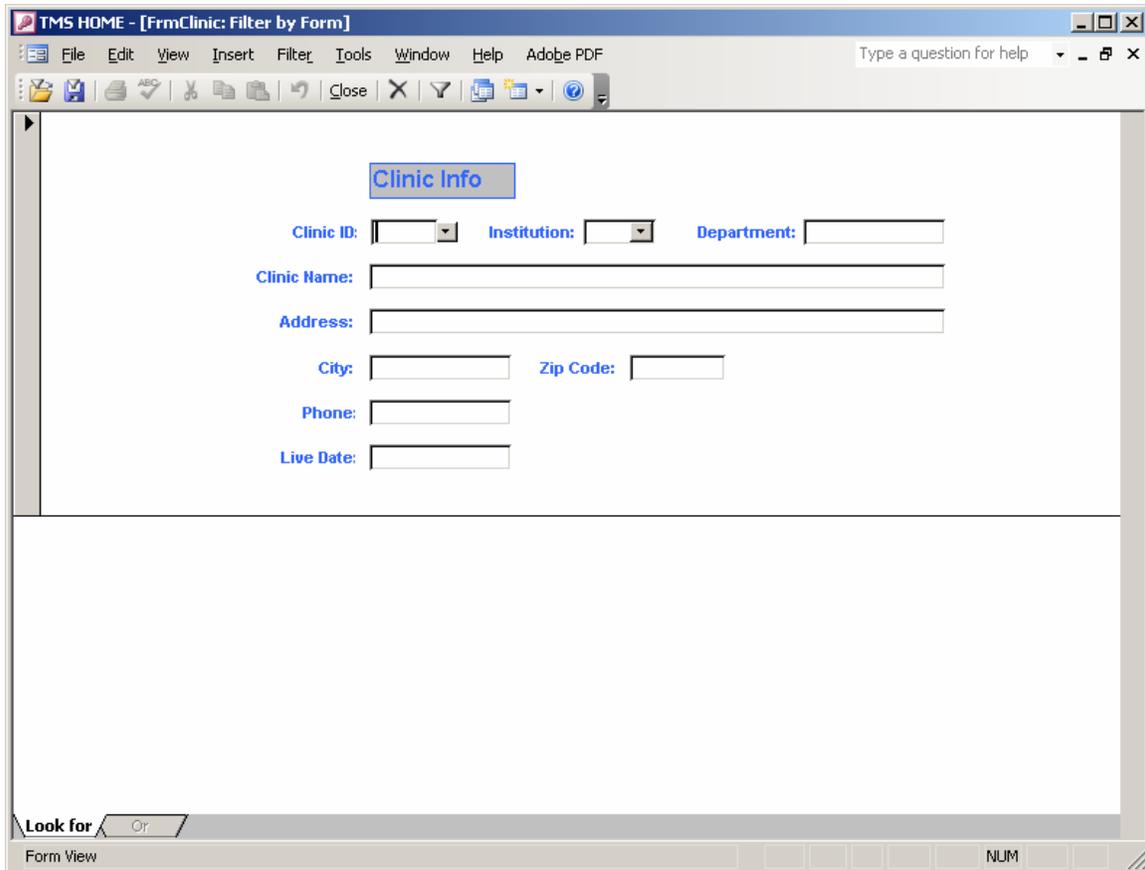
- Clinic ID:
- Institution:
- Department:
- Clinic Name:
- Address:
- City:
- Zip Code:
- Phone:
- Live Date:

At the bottom of the form, there is a record navigation bar showing "Record: 1 of 1" and a "Form View" button. The status bar at the bottom right shows "NUM".

The "Clinic ID" is the key for this table, so it must be a unique number. Although in the ideal all fields should be completed, the "Clinic ID" is the only required field for this form. The "Institution" field associates this clinic with an institution. It is best to use the drop-down box to choose an institution rather than typing name, in order to ensure that the association between the clinic and institution will be properly maintained. Click on the floppy disc shaped "Save" icon in the Access menu bar to save the entered clinic information.

## 2.4 Edit Clinic

Existing clinic information can be edited using this screen.



The screenshot shows a software window titled "TMS HOME - [FrmClinic: Filter by Form]". The window has a menu bar with "File", "Edit", "View", "Insert", "Filter", "Tools", "Window", and "Help". Below the menu bar is a toolbar with various icons. The main content area contains a form titled "Clinic Info" with the following fields:

- Clinic ID:
- Institution:
- Department:
- Clinic Name:
- Address:
- City:
- Zip Code:
- Phone:
- Live Date:

At the bottom of the window, there is a "Look for" section with a radio button for "Or" selected. The status bar at the bottom left says "Form View" and the bottom right says "NUM".

The first step is to identify the clinic for which information will be edited.

1. Click on any of the fields to activate a drop-down menu.
2. Choose a value to pull up the record with that value. It is important to use the drop-down menu to ensure that a proper match will be found.
3. Click the funnel-shaped "Apply Filter" icon in the Access menu bar to bring up the selected clinic.

Please note, selecting multiple values on one screen acts as a Boolean "AND," and will only pull up records that contain all of the selected values. It is simplest to enter only one field in this form and then apply the filter. To apply a Boolean "OR" search, click on the "OR" tab at the bottom of the screen, and enter the new information separately.

The screenshot shows a Microsoft Access form window titled "TMS HOME - [FrmClinic : Form]". The form is in "Form View" and displays a "Clinic Info" section. The fields are: Clinic ID (10), Institution (dropdown), Department (dropdown), Clinic Name (Outpatient Clinic), Address (101 Main Street), City (Anywhere), Zip Code (dropdown), Phone (empty), and Live Date (empty). The status bar at the bottom shows "Record: 2 of 2 (Filtered)" and "Form View".

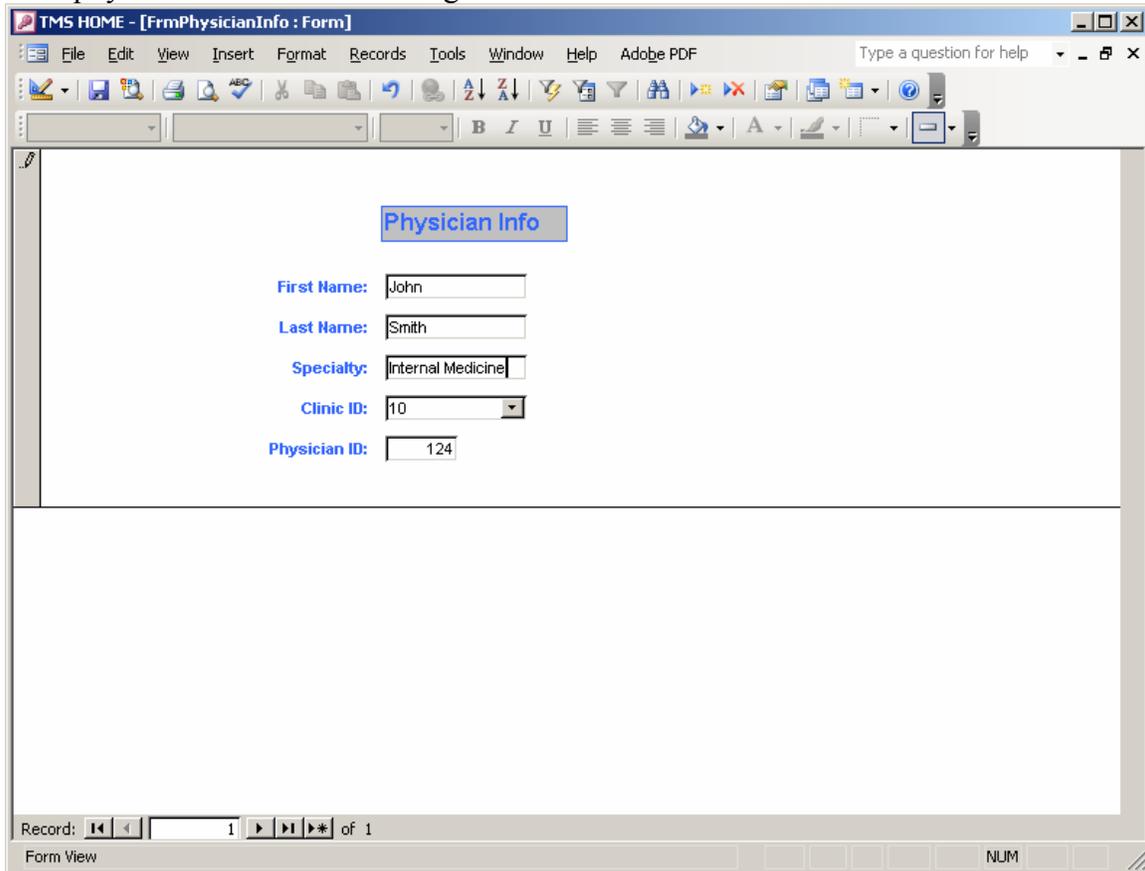
The second step is to edit the clinic information.

1. Select the clinic for which information will be edited. If multiple matching clinics were found, you can flip through the options using the arrow buttons at the bottom of the screen.
2. Select the field to edit, and type in the new information.
3. Click on the floppy disc shaped "Save" icon on the Access menu bar to save the changes.

Take care not to change the "Clinic ID" field unless absolutely necessary, since this is the key used by the database for this record.

## 2.5 Add Physician

New physicians can be added using this screen.



The screenshot shows a software window titled "TMS HOME - [FrmPhysicianInfo : Form]". The window has a menu bar with "File", "Edit", "View", "Insert", "Format", "Records", "Tools", "Window", "Help", and "Adobe PDF". Below the menu bar is a toolbar with various icons. The main area of the window contains a form titled "Physician Info" with the following fields:

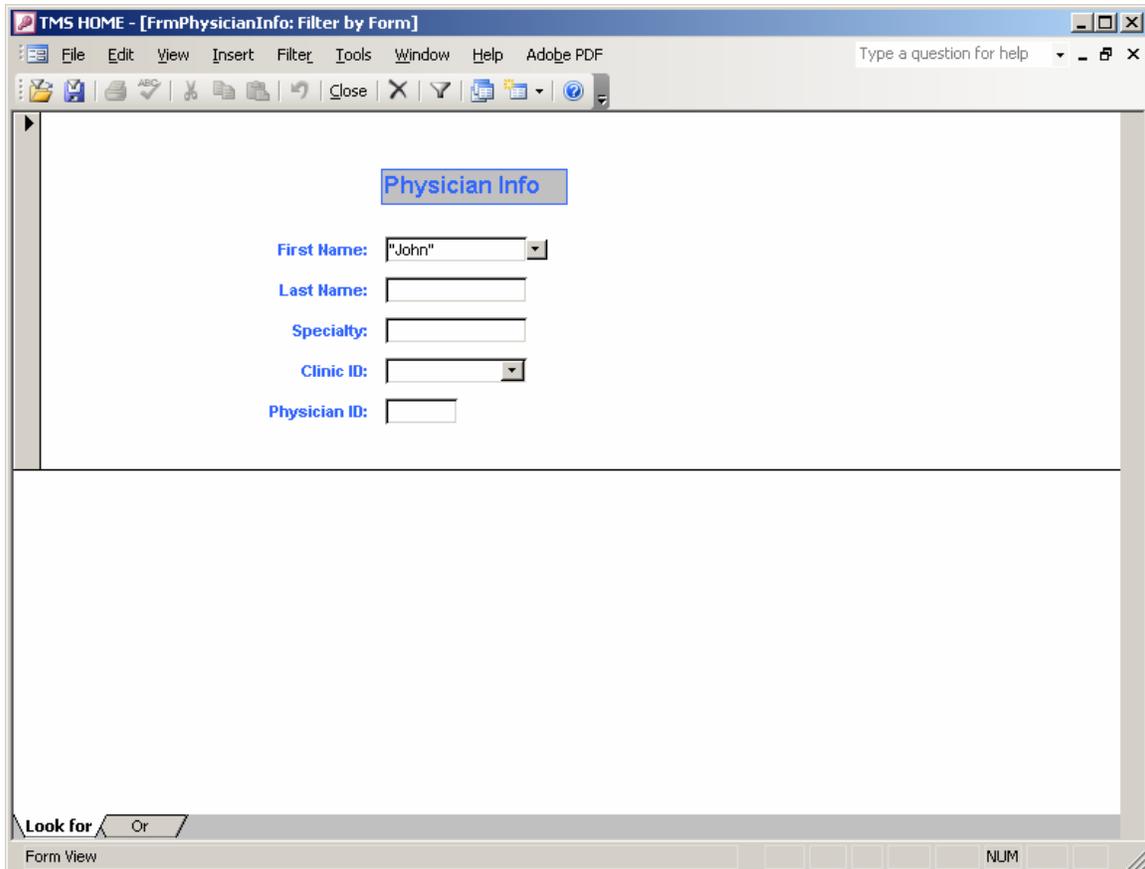
- First Name:** Textbox containing "John"
- Last Name:** Textbox containing "Smith"
- Specialty:** Dropdown menu showing "Internal Medicine"
- Clinic ID:** Dropdown menu showing "10"
- Physician ID:** Textbox containing "124"

At the bottom of the window, there is a status bar with "Record: 1 of 1" and "Form View" on the left, and "NUM" on the right.

Click on the textboxes and enter the physician information. The "Physician ID" is an auto-generated number by the application and should not be changed. Click on the floppy disc shaped "Save" icon on the Access menu bar to save the information.

## 2.6 Edit Physician

Existing physician information can be edited using this screen.



The screenshot shows a software window titled "TMS HOME - [FrmPhysicianInfo: Filter by Form]". The window has a menu bar with "File", "Edit", "View", "Insert", "Filter", "Tools", "Window", "Help", and "Adobe PDF". Below the menu bar is a toolbar with various icons. The main content area contains a form titled "Physician Info" with the following fields:

- First Name:** A dropdown menu with "John" selected.
- Last Name:** A text input field.
- Specialty:** A text input field.
- Clinic ID:** A dropdown menu.
- Physician ID:** A text input field.

At the bottom of the form, there is a "Look for" section with a radio button for "Or" selected. The status bar at the bottom of the window shows "Form View" and "NUM".

The first step is to identify the physician for whom information will be edited.

1. Click on any of the fields to activate a drop-down menu.
2. Choose a value to pull up the record with that value. It is important to use the drop-down menu to ensure that a proper match will be found.
3. Click the funnel-shaped "Apply Filter" command in the Access menu bar to bring up the selected clinic.

Please note, selecting multiple values on one screen acts as a Boolean "AND," and will only pull up records that contain all of the selected values. It is simplest to enter only one field in this form and then apply the filter. To apply a Boolean "OR" search, click on the "OR" tab at the bottom of the screen, and enter the new information separately.

The screenshot shows a Microsoft Access form window titled "TMS HOME - [FrmPhysicianInfo : Form]". The form contains the following fields:

- Physician Info** (Section Header)
- First Name:** Text box containing "John"
- Last Name:** Text box containing "Smith"
- Specialty:** Text box containing "Internal Medicine"
- Clinic ID:** Dropdown menu showing "10"
- Physician ID:** Text box containing "124"

At the bottom of the form, there is a status bar showing "Record: 1 of 1 (Filtered)" and "Form View".

The second step is to edit the physician information.

1. Select the physician for which information will be edited. If multiple matching physicians were found, you can flip through the options using the arrow buttons at the bottom of the screen.
2. Select the field to edit, and type in the new information.
3. Click on the floppy disc shaped "Save" icon on the Access menu bar to save the changes.

Take care not to change the "Physician ID" field unless absolutely necessary, since this is the key used by the database for this record.

## 2.7 Start Observation

New observations can be added using this screen.

The screenshot shows a software window titled "TMS HOME - [FrmObservationInfo : Form]". The window contains a form with the following fields and controls:

- Observation #:** Text box containing "1".
- Date:** Empty text box.
- Physician:** Drop-down menu showing "Jane Doe".
- Observation Type:** Drop-down menu showing "CONTROL".
- Sessions:** Empty text box.
- Patients Observed:** Empty text box.
- Total Patients Seen:** Empty text box.
- Comment:** Large empty text area.
- Observer:** Drop-down menu showing "JS".

At the bottom of the form area, there are two buttons: "OPEN Entry Form." and "SAVE / CLOSE".

The window's menu bar includes: File, Edit, View, Insert, Format, Records, Tools, Window, Help, Adobe PDF. The status bar at the bottom indicates "Record: 1 of 1" and "Form View".

The observer completes this screen every time an observation session is started. The "Observation #" is the key for this table, so it must be a unique number. It should be automatically populated when the form opens and should not be changed. The "Date" should reflect the date of the observation. The "Physician," "Observation Type" and "Observer" values should be selected using their respective drop-down menus to ensure proper matching in the database. "Sessions" was used to code how many half day sessions were observed that day. "Patients Observed" should reflect how many patients the observer saw while using the data collection application. "Total Patients Seen" should reflect how many patients were seen by the Physician. This number may be greater than the number seen by the Observer for a variety of reasons, such as refusal by the patient. Any additional comments can be recorded. Click on the floppy disc shaped "Save" icon in the Access menu bar to save the clinic. Click on the "OPEN Entry Form" button to record physician activities.

## 2.8 Record Activities

A series of physician activities can be recorded using this screen.

The screenshot shows the TMS HOME - [EntryForm] application window. The window title is "TMS HOME - [EntryForm]". The menu bar includes File, Edit, View, Insert, Format, Records, Tools, Window, Help, and Adobe PDF. The toolbar contains various icons for file operations and editing. The main content area is divided into several sections for recording activities: "Computer - Read", "Computer - Looking for", "Computer - Writing", "Procedures", "Talking", "Paper - Read", "Paper - Looking For", "Paper - Writing", "Personal", "Walking", "Phone", and "Waiting". Each section contains a list of radio buttons for selecting an activity. The "Computer - Looking for" section has "Chart" selected. At the top, there are fields for ID (15538), Date (8/16/2006), Time (6:27:34 PM), and a "Now" button. There is also a "Comment" field with the number "11". On the right side, there is an "Observation #" field with the number "1" and a "CLOSE" button. At the bottom, there is an "Add New Record" button and a "START" button (radio button) and a "FINISH" button (radio button). The status bar at the bottom shows "Record: 3 of 3" and "Form View".

To start the session:

1. Update the time by clicking on the "Now" button
2. Click the "Start" radio button
3. Click the "Add New Record" button record this information

Every time a physician changes an activity, the change should be recorded:

1. Click the "Now" button the moment the physician begins a new activity to update the precise time
2. Click on the corresponding radio button to record the specific activity. Only one activity is permitted for any moment in time.
3. Enter any relevant comments in the "Comments" textbox.
4. Click the "Add New Record" button to record this activity

Note: Each activity is logged to the data table when the "Add New Record" button is clicked. This gives the observer a moment to judge the activity taking place. If a task radio button is clicked in error, the observer can simply click the correct one until the "Add New Record" button is selected.

To end the session:

1. Update the time by clicking on the “Now” button
2. Click the “Finish” radio button
3. Click the “Add New Record” button record this information
4. Click on the “Close” button

## 2.9 Edit Observation

Existing physician information can be edited using this screen.

The screenshot shows a software window titled "TMS HOME - [FrmObservationInfo: Filter by Form]". The window has a menu bar with "File", "Edit", "View", "Insert", "Filter", "Tools", "Window", "Help", and "Adobe PDF". A search bar on the right contains the text "Type a question for help". The main content area is titled "Observation Info" and contains the following fields:

- Observation #: 1
- Date: [text box]
- Physician: [dropdown menu]
- Observation Type: [dropdown menu]
- Sessions: [text box]
- Patients Observed: [text box]
- Total Patients Seen: [text box]
- Comment: [text area]
- Observer: [dropdown menu]

At the bottom of the form area are two buttons: "OPEN Entry Form" and "SAVE / CLOSE". Below the main form area is a footer bar with "Look for" and "Or" tabs, "Form View" on the left, and "NUM" on the right.

The first step is to identify the observation for which information will be edited.

1. Click on any of the fields to activate a drop-down menu.
2. Choose a value to pull up the record with that value. It is important to use the drop-down menu to ensure that a proper match will be found.
3. Click the funnel-shaped "Apply Filter" command in the Access menu bar to bring up the selected clinic.

Please note, selecting multiple values on one screen acts as a Boolean "AND," and will only pull up records that contain all of the selected values. It is simplest to enter only one field in this form and then apply the filter. To apply a Boolean "OR" search, click on the "OR" tab at the bottom of the screen, and enter the new information separately.

The screenshot shows a software window titled "TMS HOME - [FrmObservationInfo : Form]". The window has a menu bar with "File", "Edit", "View", "Insert", "Format", "Records", "Tools", "Window", and "Help". Below the menu bar is a toolbar with various icons. The main area of the window contains a form titled "Observation Info". The form has the following fields and controls:

- Observation #:** A text box containing the number "1".
- Date:** An empty text box.
- Physician:** A dropdown menu showing "Jane Doe".
- Observation Type:** A dropdown menu showing "CONTROL".
- Sessions:** An empty text box.
- Patients Observed:** An empty text box.
- Total Patients Seen:** An empty text box.
- Comment:** A large empty text area.
- Observer:** A dropdown menu showing "JS".

At the bottom of the form area, there are two buttons: "OPEN Entry Form" and "SAVE / CLOSE". Below the form area is a status bar that reads "Record: 1 of 1 (Filtered)". To the right of the status bar is a table with three columns: "Number of Patients Observed Only", "FLTR", and "NUM".

The second step is to edit the physician information.

1. Select the observation for which information will be edited. If multiple matching observations were found, you can flip through the options using the arrow buttons at the bottom of the screen.
2. Select the field to edit, and type in the new information.
3. Click on the floppy disc shaped "Save" icon on the Access menu bar to save the changes.

Take care not to change the "Observation #" field unless absolutely necessary, since this is the key used by the database for this record.