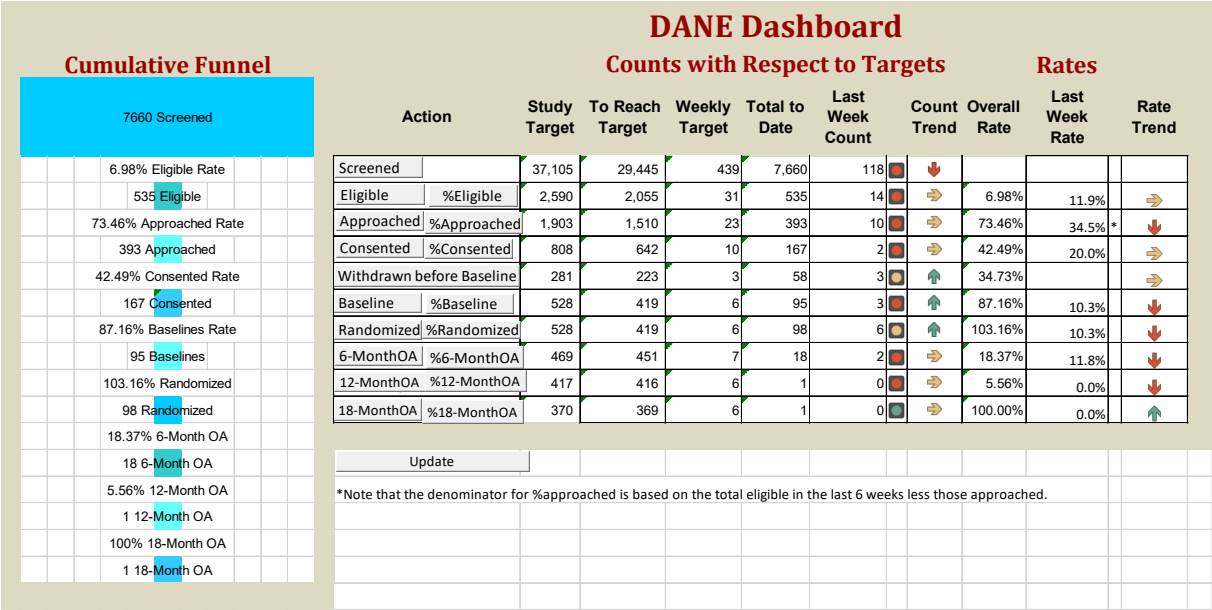


Documentation for the DANE Dashboard

This Excel workbook contains a dashboard and control charts for the DANE study.

The Main Dashboard

The main dashboard worksheet is shown below:



The cumulative funnel shows how the numbers of patients decline through the various stages in the screening and consent process.

The **Action** column of the worksheet contains descriptions of the stages of the process. The **Study Target** column currently contains the number of patients needed to reach a study goal of 528 participants at the Baseline level based on the rates and cumulative rates at each stage given in the **Rate** and **Cum. Rate** columns. These values can change as the rates change. The **To Reach Target** column contains the number of patients who must be processed in the future at each stage required to reach the goal of 528 Baselines. These values also change as the rates change and as more patients are processed. The **Weekly Target** column gives the number in **To Reach Target** divided by the number of weeks remaining. The **Total to Date** column tells the total number of patients processed at each stage to the end of the most recent full week. The study weeks start on Sunday. The **Last Week Count** column tells the number processed at each stage for the last full week.




Except for the Withdrawn row, the **Count Status** column contains a stoplight that is:

- **Green** if the **Last Week Count** is within 10% of target value,
- **Yellow** if the **Last Week Count** value is between 70% and 90% of target value,
- **Red** if the last value is less than 70% of target value.

This column contains a formula for the difference between the current month and the target value. It is conditionally formatted according to the rule for stoplight colors. The withdrawn




column gives a **green** light if there are no withdrawals, a **yellow** light for less than target but more than none, and a **red** light for more than target in the most recent week. (These are not just withdrawals before baseline. To separate out by stage would require additional logic.)

The **Count Trend** column compares the average count of the last four weeks to the **Weekly Average** count. The symbols are:

-  If the average of the last 4 weeks is 2 standard deviations or more above overall mean.
-  If the average of last 4 weeks is within 2 standard deviations of overall mean.
-  If the average of last 4 weeks is 2 standard deviations or more below overall mean.

The **Overall Rate** column is the number of patients at the current stage divided by the number at the preceding stage. The **Last Week Rate** column contains the rate for the most recent full week in the date respectively. These metrics are taken from the related control charts and the cells contain formulas linking them to the appropriate control chart cells.

The **Rate Trend** column compares the average rate of the last four weeks to the **Weekly Average** rate. The symbols are:

-  If the average of the last 4 weeks is 2 standard deviations or more above overall rate.
-  If the average of last 4 weeks is within 2 standard deviations of overall rate.
-  If the average of last 4 weeks is 2 standard deviations or more below overall rate.

The gray buttons in the **Action** column are navigation buttons to take the user to the control charts for weekly counts and rates for each action. Control charts are time series plots to allow the user to visualize the data over time with statistical guidance to identify patterns of variation.

The Dashboard worksheet contains several hidden columns for values used in calculations. These can be unhidden by selecting columns in the dashboard, right clicking, and then left clicking on unhide at the bottom of the dropdown menu. The trend calculations are on the GraphicData worksheet.

Control Chart Worksheets

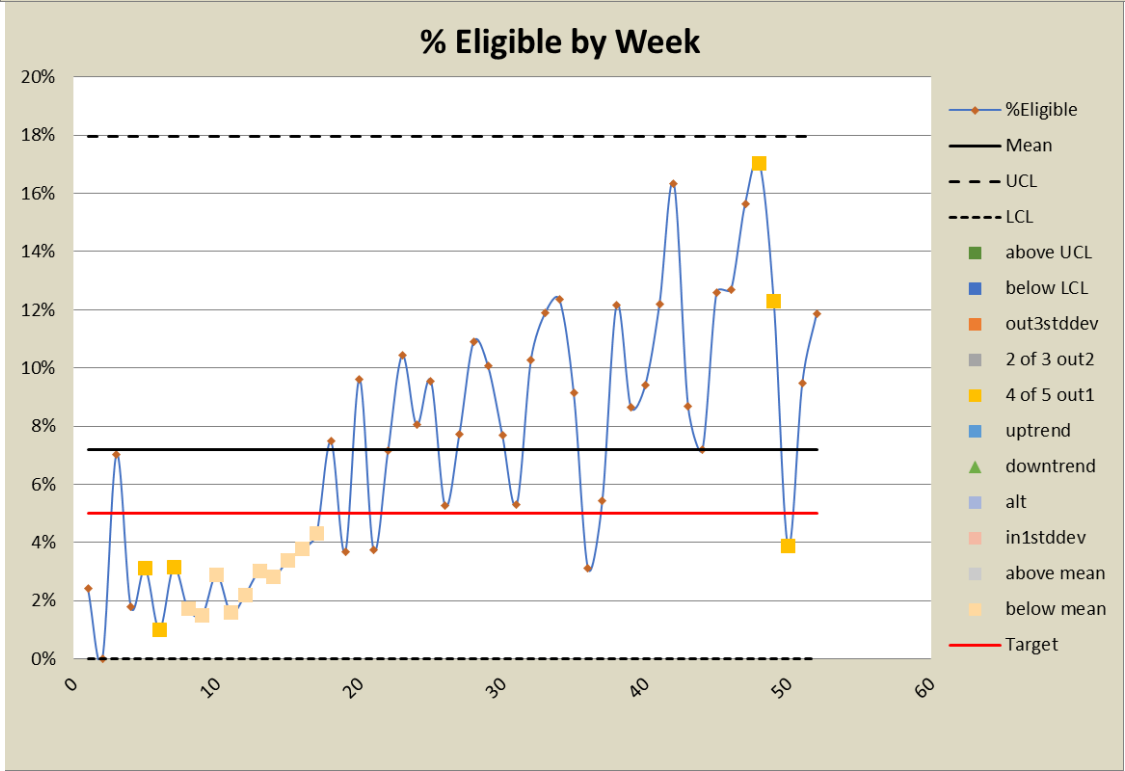
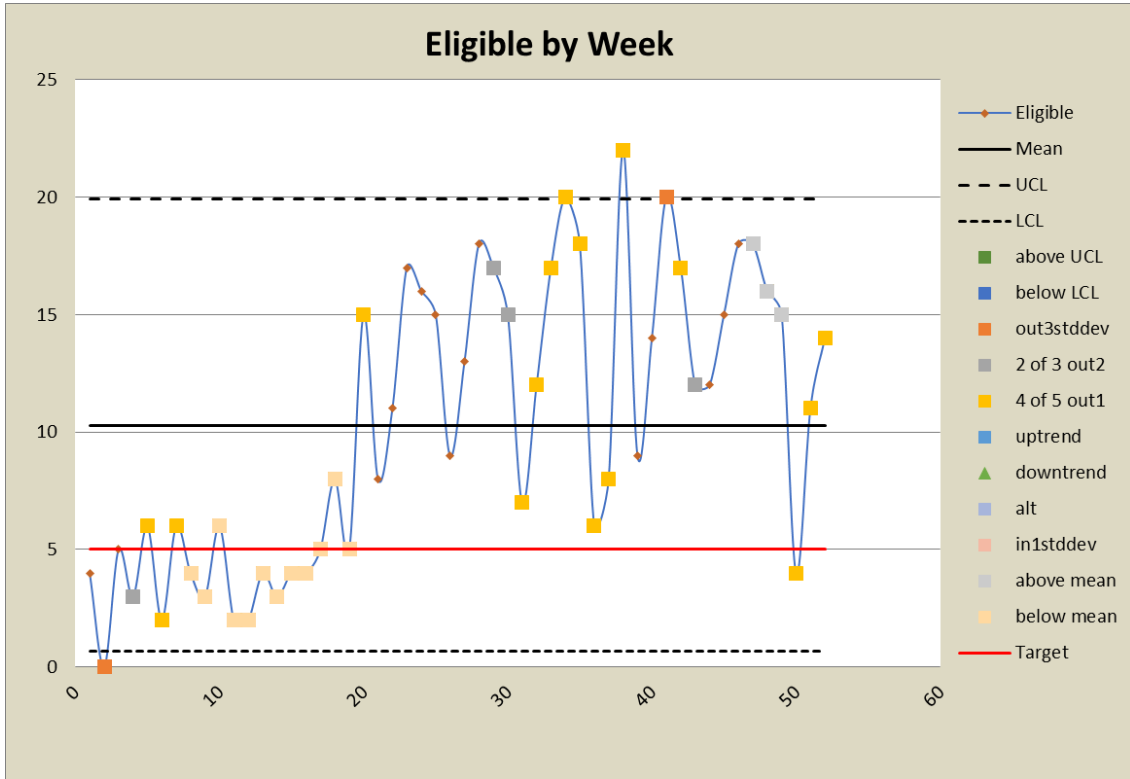
This workbook contains a control chart worksheet for each **Action** count and for each **Action** rate except for which a rate exists (rate does not exist for Screened because there is no preceding stage). These are accessible using the navigation buttons in the Action column or by paging across the tabs at the bottom of the worksheet.

A control chart is a time plot of data from a process for the purpose discerning whether the process is stable, with variation only coming from sources common to the process, or not stable, with variation coming from identifiable causes. Control charts are used to identify patterns of variation that are statistically significant so the user does not react to variation that is not statistically significant.

Four types of control charts are commonly used depending on the type of data:

- \bar{x} -charts plotting means and s -charts plotting standard deviation for continuous data,
- p -charts plotting proportions, and
- c -charts plotting count data.

This Excel workbook currently contains only c -charts for counts and p -charts for rates because all of the data for this project is discrete. Sample charts are shown in the following figures.



The data and logic for the control charts are in columns A through AD starting at row 38 with column headings for all metrics. The first column contains weeks, used in the horizontal axis on the chart. The second column contains data referenced from a pivot table or calculation worksheet. The remaining columns through column Q are used to indicate which values are nonrandom based on the Western Electric and Nelson signal processing rules. Columns R through AD are the calculations on which the signal processing rules are based.

Cells A32:G35 contain data used in calculations for graphics on the main dashboard page.

The user can set the control limits in terms of the number of standard deviations in cell M2.

Cells L4:M9 contain the calculations for mean, standard deviation, and the control limits which are calculated from data in column B starting with row 39, and used in columns C through E starting in row 39.

Cells L11:T21 contain output from the signal processing rules and are currently not being used but could be used in the future.

A process is considered stable if there are no statistically significant variations. The following rules, which are a combination of the Western Electric and Nelson signal processing rules, are statistically significant conditions having probabilities less than 5%. If any of these conditions are met, the process is not stable.

1 point outside of control limits (usually 2 or 3 standard deviations)
1 point outside 3 standard deviations
2 of 3 consecutive points outside 2 standard deviations
4 of 5 consecutive points out 1 standard deviation
5 or more points consecutive points trending upward
5 or more points consecutive points trending downward
14 or more points alternating up and down
15 consecutive points within 1 standard deviation
8 or more consecutive points above mean
8 or more consecutive points below mean

The logic for these rules is in cells R39:AD69 and L11:P22 of the control chart worksheets. The logic to display the points on the charts with large colored symbols is in F39:P69. The target values are in Q39:Q69.

If a process is stable and achieving target performance, then no corrections or changes to the process are needed or desired. Moreover, changing a stable process that is meeting target performance can lead to instability and poor performance. Another benefit of process stability is that data from the process can be used to predict the future performance of the process.

If the chart indicates that the monitored process is not stable – which means that identifiable causes of variation are present, analysis of the control chart can help determine the sources of variation. The identification of these causes can be used to improve the process.

A process that is stable but not achieving target performance, needs to be improved through a deliberate effort to understand the causes of current performance and fundamentally improve the process.

Signal processing rules determine statistically significant variations, but not all statistically significant variations are trends. To find trends in the data, the signal processing rules were modified for the Methodist OR dashboard. These rules are still in the DANE control charts but are NOT used. The unused rules to determine trend are:

Improve	Decline
Last point 3 standard deviations below mean or lower	Last point 3 standard deviations above mean or higher
Last 2 out of 3 points 2 standard deviations below mean or lower	Last 2 out of 3 points 2 standard deviations above mean or higher
Last 4 out of 5 points 1 standard deviation below mean or lower	Last 4 out of 5 points 1 standard deviation above mean or higher
Last 6 points below mean	Last 6 points above mean
Last 6 points going down	Last 6 points going up
Last 3 points going down with last point 2 standard deviations below mean or lower	Last 3 points going up with last point 2 standard deviations above mean or higher
Last 4 points going down with last point 1 standard deviations below mean or lower	Last 4 points going up with last point 1 standard deviations above mean or higher
Last 5 points going down with last point below mean or lower	Last 5 points going up with last point above mean or higher

The logic for the trends uses some of the signal processing logic. Additional logic for trends is in cells AF39:AM69 and Q11:T20 for the yearly control charts.

Hiding the rows and columns containing most of the logic would make these worksheets more user friendly for the casual user, but currently, no rows and columns are hidden because hiding them can cause the update macro (described below) to fail.

Navigating the Workbook

The DANE Dashboard workbook contains six types of sheets with the type indicated by the color of the tab at the bottom:

- Dashboard – Red tab
- Data sheets – Blue tabs
- Control Charts - Tan tabs
- Dashboard data and calculations – Gray tabs
- Pivot tables – Pink tabs
- Calculations for control charts – Green tabs

The user can move easily among the Dashboard and Control Charts using the navigation buttons as described in the preceding sections. To access the other worksheets, the user can scroll through the tabs at the bottom of the worksheets.

This workbook contains three data sheets:

- Screening Data – from the report Screened(Leslie) in the DANE Screening database
- Refuse Data – from the report RefusedWdate(Leslie) in the DANE Screening database
- Consent Data – from the report Consented(Leslie) in the DANE Outcomes and Intervention database

The data can be copied from each report by clicking at the start of the first ID, holding the shift key, scrolling to the bottom and all the way to the right and clicking on the last cell. Once copied, it can be pasted by clicking on the first cell to the far left under the heading line and pasting values. This will not paste over the Screen week or Refuse week columns in the Screening Data and Refuse data sheets respectively. The update macro (described in a later section) will copy the function to calculate week to the end of the Screen week and Refuse week columns. The Consent Data sheet is referenced directly from the Consent Data Calculations worksheet which is updated by the update macro.

The workbook has four Dashboard data and calculations worksheets:

- Signal Process Switches – Allows user to set bounds on signal processing rules that are currently not used in the DANE Dashboard context.
- GraphicData – Contains calculations for trends on Dashboard worksheet.
- Study targets – Columns A and B contain calculations for attrition following baseline. The rest of the sheet has an unused draft of a possible more user-friendly dashboard.
- Start Date – Contains start of study date and today so that the difference can be calculated and the current week, weeks remaining, and last complete week can be calculated. It also contains the minimum number of days between so that the number available at various stages can be calculated for finding rates.

The dashboard contains several pivot tables:

- Screened by week pivot – Based on Screening Data worksheet.
- Eligible by week pivot – Based on Screening Data worksheet.
- Enrolled by week pivot – Based on Screening Data worksheet.
- Refuse pivot – Based on Refuse Data worksheet.
- Consent by week pivot – Based on Consent Data Calculations worksheet which is in turn based on Consent Data worksheet.
- Withdrawn by week pivot – Based on Consent Data Calculations worksheet which is in turn based on Consent Data worksheet.
- Visit by week pivot – Based on Consent Data Calculations worksheet which is in turn based on Consent Data worksheet.

- Randomized by week pivot – Based on Consent Data Calculations worksheet which is in turn based on Consent Data worksheet.
- Pivot – Based on the Organized Data worksheet which is in turn based on Consent Data Calculations worksheet.

Calculation sheets are sometimes on separate worksheets from the pivot tables in the event of the need to add categories to the pivot tables and because some calculation sheets use data from more than one pivot table. The calculation sheets are:

- %Eligible by week calculations
- Consent data calculations
- Visit by week calc
- Randomized by week calc
- Organized Data
- Data from Query
- Available for Baseline
- Available for Random
- Available for 6-mo
- Available for 12-mo
- Available for 12-mo

Some of the calculation sheets use MATCH and INDEX functions to organize the data week by week, filling in gaps with #N/A so the data can be referenced directly by control charts. Control charts for rates require more complex calculations to determine how many patients are available for each stage. The **%Approached** is based on the number eligible less the number approached for the last 6 weeks. These calculations are on the Consent by week pivot worksheet. The **Available for Baseline, Available for Random, Available for 6-mo, Available for 12-mo, and Available for 12-mo** worksheets contain large matrices with complex logic to determine which patients qualify for the stage on a week-by-week basis. The column sums are in row 2 of each of these sheets. These rows are searched using INDEX functions for the calculations on the **Visit by week calc** and **Randomized by week calc** worksheets. The fact that a changing row must be searched to put the data in a column adds complexity.

Hiding all the worksheets except the Dashboard and Control Charts would make this much more user friendly to the casual user but currently, no worksheets are hidden because hiding worksheets can cause the update macro (described below) to fail.

If we commercialize this product, the workbook could be structured more efficiently. This draft was created with the goal of creating a minimally viable product as quickly as possible, so it is structured according to the first way each problem was solved. As is often the case with problem solving, the first solution is not always the most efficient or the most versatile and the path through a series of problems is not always the most efficient. The Update macro described below could also be rewritten and restructured much more efficiently using a series of functions and subroutines.

Visual Basic Macros

The workbook containing the dashboard has three types of Visual Basic macros:

- Navigation among worksheets,
- Updating the dashboard and control charts with new data, and
- Conditional formatting.

Visual Basic macros can be accessed through the Visual Basic icon in Code section of the Developer tab in Excel.

The macros for navigating among worksheets begin with the letters *goto*. These can be called by clicking on buttons in the Action column on the dashboard to take the user to the control charts. Each control chart has a button that calls a macro to return the user to the dashboard.

The **Update** macro allows the user to copy data from the REDCap database and paste it onto data sheets in the DANE Dashboard workbook, click a button on the main dashboard worksheet and all the pivot tables, calculation worksheets, control charts, and main dashboard update in a few seconds. The Update macro is long and complex because there are many pivot tables, calculation worksheets, and control chart worksheets to update. The Visual Basic function `.formular1c1` used to update the MATCH and INDEX functions on the calculation sheets requires calculations of where data are offset on multiple sheets. This means any uses of `.formular1c1` have to be carefully updated in the code anytime edits to the workbook are made that could move rows and columns.

If we commercialize this product, the Update macro could be much shorter by creating one function for each type of sheet that could be called by passing the sheet names.

Updating the Workbook

To update the DANE Dashboard workbook:

1. Open a blank Excel workbook into which to paste the REDCap data so that extra blank lines are not introduced.
2. Go to the DANE screening database:
 - a. Go to Leslie's reports and select Screened(Leslie).
 - b. Where it says Displaying record at the top of the report, select ALL.
 - c. Click at the top left of the first cell with data. Be careful not to select the record id or name.
 - d. Scroll to the bottom. Hold the shift key and click in the bottom right cell. All cells with data should be highlighted.
 - e. Right click. On the dropdown menu, select copy.
 - f. Go to the blank workbook and paste values in cell A1 of the first worksheet.
 - g. Label the worksheet Screened.
 - h. Open a new blank worksheet in this Excel workbook.
 - i. Go to Leslie's reports and select RefusedWdate(Leslie).
 - j. Select all data, copy and paste into the new blank worksheet as you did for the screening data. Label this worksheet Refused.

3. Go to the DANE Outcomes and Intervention database
 - a. Go to Leslie's reports and select Consented(Leslie).
 - b. Open new blank worksheet in the Excel workbook.
 - c. Select all data, copy and paste the consented into the new blank worksheet as you did for the screening and refused data. Label this worksheet Consented.
 - d. Save this excel workbook for later use if desired.
4. Open the DANE Dashboard Workbook and save a copy with the date of the data download in the name.
 - a. Select all the screening data from the new workbook, being careful not to select any extra blank lines at the top. The data should be in columns A through G. Be careful to select all the data through column G and not select column H. Go to the Screening Data worksheet in the DANE Dashboard workbook. Click on cell A2 in the Screening Data sheet of the DANE Dashboard workbook and paste the screening data from the new workbook into Screening Data worksheet on the DANE Dashboard. Do not copy over column G.
 - b. Repeat this process copying the new Refused data from the new workbook and pasting into the Refuse Data worksheet of the DANE Dashboard workbook.
 - c. Repeat this process copying the new Consented data from the new workbook and pasting into the Consent Data worksheet of the DANE Dashboard workbook.
5. Go to the main Dashboard worksheet of the DANE Dashboard workbook. Click on the Update button. The update macro will update everything in the workbook and return the user to the main Dashboard worksheet. Save this version of the workbook.

Warning: Do not attempt to paste a file with fewer lines or weeks than the current version.