DETERMINING STATISTICAL SIGNIFICANCE FOR OMS DATA:
STEP-BY-STEP GUIDE
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This document is part of several training modules created to assist in the interpretation and use of the Maryland Behavioral Health Administration Outcomes Measurement System (OMS) data. This module provides step-by-step instructions for using the OMS Statistical Significance Excel Workbooks. These Workbooks enable users to statistically compare OMS data between a variety of system levels (e.g., State, Local Behavioral Health Authority (LBHA), Agency, etc.).

For readers who might be unfamiliar with statistical analysis and terminology, the module entitled "Introduction to Data and Data Analysis" is recommended prior to using the Workbooks. Those individuals interested in a more detailed description of OMS analytic strategies may be interested in the training module, "How OMS Items Are Analyzed".

The following information is included in this document:

   I.   A description of the OMS Statistical Significance Workbooks, including what they can be used for and their limitations,

   II.   An overview of the statistics used in the spreadsheets, and

   III.   Instructions for completing the worksheets within the Workbooks.

CHI-SQUARE TEST LIMITATIONS

One of the statistical tests used in the Workbooks is a Chi-square test. A Chi-square test may not work if the sample size for a given item is small or if there is a small number of individuals providing a certain response to that item (for example, a small number of "Yes" or "No" responses). For counties and programs serving small numbers of consumers, it is possible that the Chi-square test will therefore not work with some or all of their OMS data because the basic criteria for conducting the test cannot be met. Unfortunately, there is no exact "cut off" that can be used to determine ahead of time whether or not the Chi-square will work, although a general rule of thumb is that any response category with 5 or less may prevent the test from working. In addition, it is possible that, even if all response categories are over 5, the calculation of the Chi-square may not be supported. See Appendix A for additional detail.

I. Description of the Statistical Significance Workbooks

The OMS Datamart is designed to allow users to make comparisons between two groups – for example, between their agency and the State/LBHA, or between agencies or multiple site locations. By toggling between levels of comparison in the Datamart, differences between groups are easily recognizable.

Two questions that many users then have are "How do I know if the differences I identify are significant differences?" and "How do I know if the changes over time are significant?" The OMS Statistical Significance Workbooks are designed to assist providers and LBHA administrators in answering just such questions.

> **SUMMARY**
>
> **The OMS Statistical Significance Workbooks are easy to use analysis tools that enable the user to conduct statistical tests of OMS Datamart data and estimate the magnitude of differences in the data.**

There are four OMS Workbooks:

1. Adult Point InTime (PIT) - OMS Statistical Significance Workbook
2. Adult Change Over Time (COT) - OMS Statistical Significance Workbook
3. Child-Adolescent Point In Time (PIT) - OMS Statistical Significance Workbook
4. Child-Adolescent Change Over Time (COT) - OMS Statistical Significance Workbook

Please note that the term **"workbook"** refers to the Excel document as a whole whereas the term **"worksheet"** refers to the individual tabs within the workbooks. Each OMS Statistical Significance Workbook has several worksheets within it (one for each OMS item). The workbooks are "locked" to prevent accidental changes to the formulas embedded in them; however, users will be able to enter information into the relevant cells in order to perform the analyses.

II. Statistics Used in the OMS Statistical Significance Workbooks

The OMS Statistical Significance Workbooks include two statistical techniques: Chi-square tests and effect size calculation.

"**Chi-square**" tests are used for testing categorical (e.g., yes/no,not at all/a little bit/somewhat/quite a bit/very much, or strongly/agree/neutral/disagree/strongly) questions, which includes most of the OMS items. The Chi-square test indicates if patterns of responses between two groups are different. However, the test does not indicate which group is bigger or

smaller, doing better or worse, more or less satisfied, etc. In order to figure that out, the user will have to visually compare the numbers in the two tables.

"Effect sizes" are used to provide context to outcome measures with continuous data. In the OMS, this includes the BASIS-24®, Youth Short Symptom Index, and the MARS 5 (Maryland Assessment of Recovery Scale). **"Effect sizes"** are used to compare groups of data to determine how much change has occurred within a group. An advantage of effect sizes is that they go beyond simple questions of "is there a difference" and give answers such as "the groups differ by X amount." Effect sizes in the social sciences tend to be in the small to medium range (.20 to .79).

Perhaps the most important caveat is that while the OMS Statistical Significance Workbooks can indicate if there are significant differences in the data, they cannot tell what these differences mean. Sometimes clinically meaningful details are not captured by statistical tests, whereas in other situations statistical tests highlight mathematical details that carry minor (or no) clinical importance. Further, statistics can be affected by many factors. It remains the user's responsibility to appropriately use statistical tests and interpret them in context with other relevant information.

SUMMARY

➢ **There are four OMS Statistical Significance Workbooks (Child PIT, Child COT, Adult PIT, Adult COT).**

➢ **Chi-square analyses are conducted on categorical data, which includes most OMS items.**

➢ **Effect sizes are used to provide context to outcome measures. In OMS, they are used for the BASIS-24®, Youth Short Symptom Index, and the MARS 5 scale.**

➢ **The OMS Workbooks can only indicate if there are mathematical differences in the data. Interpreting the clinical meaning of the results is up to the user.**

III.   Using the Datamart and the OMS Statistical Significance Workbooks

1. You will need a functional personal computer with internet access and the following installed software:

   a. A web browser
   b. Microsoft Excel

2. You will also need a copy of the appropriate Excel OMS Statistical Significance Workbook (i.e., Adult PIT, Adult COT, Child and Adolescent PIT, Child and Adolescent COT). These are available on the OMS Datamart Welcome Page under the "Additional OMS Resources" tab or on the Beacon Health Options website.

SUMMARY

To use the OMS Workbooks, you will need:

➤ **a computer with internet access and a web browser,**

➤ **Microsoft Excel, and**

➤ **a copy of the appropriate Excel OMS Statistical Significance Workbook**

<u>Opening the OMS Datamart</u>

- **To access State, county, and Local Behavioral Health Authority (LBHA) level data, go to the "Public" Datamart available at: http://maryland.beaconhealthoptions.com/services/OMS_Welcome.html** (no login is required for the Public Datamart)

- **To access agency or location site level provider data, go to the "Connected" Datamart available through the Beacon Health Options ProviderConnect (service providers, including Local Addiction Authorities providing services) or IntelligenceConnect (LBHAs) system and login.**

1. On the Datamart Welcome Page, select desired analysis parameters (i.e., Services Received (i.e., All, MH, SRD, Both); Adult or Child/Adolescent; Most Recent Interview Only (PIT) or Initial Interview Compared to Most Recent (COT) data; and time frame (i.e.,fiscal or calendar year). When you select fiscal or calendar year, a dropdown box will appear asking you to select which year you would like to view.
2. Click "View Results".
3. If desired, change the filters at the top of the Datamart (i.e., Statewide/specific jurisdiction/agency, age, gender, race, and time in treatment).
4. For the "Connected" side of the Datamart, click to select agency and location. Then click on the blue slide out tab to the left of the list to close the slider and results will appear.
5. Click the yellow life domain tabs at the top to find your OMS question of interest (e.g., living situation, employment, etc.).

<u>Tips on Using the Workbooks</u>

The Workbooks are designed to be relatively easy to use. Helpful hints:

1. The graph on each worksheet can be viewed in its entirety by scrolling down the page.
2. When printing the page, select the "fit to one page" option.
3. Each Workbook has an "Intro" tab which includes a link to the Datamart.
4. Each Workbook also has a tab for each OMS item at the bottom of the screen. If these tabs do not appear on your screen, consult Excel Help (question mark in the upper right hand corner of the screen) for assistance in configuring your computer.

<u>Step-by-step directions for Chi-square analyses (all OMS items except Psychiatric Symptoms)</u>

1. Open the appropriate Excel "OMS Statistical Significance Workbook" based upon the desired analysis. (Note: If you get a message saying "The workbook is locked for entry," click on "Read Only". You will then be able to use the Workbook.)
2. At the bottom of the Workbook there are a series of tabs, each of which corresponds to a question in the Datamart (these are the worksheets). Select the tab for the desired analysis. A pre-populated page with the selected question and its number, age group (Adult or Child) and type of analysis (PIT or COT) will appear.
3. <u>Now you will enter your data into the Workbook.</u>
4. Your cursor will automatically go to the first orange cell. Fill in three orange cells with the service type (i.e., All, MH, SRD, or Both), the timeframe (i.e., fiscal year or calendar year), and any filters you have selected (i.e., age , gender, race, time in treatment) for the analysis. These items will then automatically appear as labels under the graph.
   a. You might want to consider using abbreviated words due to limited space for the boxes under the graph (i.e., "SRD" instead of Substance-Related Disorders or "FY17" instead of Fiscal Year 2017)
5. Fill in the two green cells underneath the labels "Group 1" and "Group 2" and enter the names of the two groups you are comparing (e.g., State, LBHA, another agency, location site, etc.). You will need to move your cursor to the second green cell in order to enter the name of Group 2.
6. Looking at your first selected group in the Datamart, find the frequency count (i.e., "# of Clients") for the item.
7. Enter the number of clients that responded to each category into the first column of yellow shaded cells.
8. **Pay close attention to the order of the response options and categories, making sure to enter the correct data into the cells.**
9. As you enter data into the yellow cells, the Chi-square test begins to calculate. You may see a variety of messages in the red shaded space labeled "Interpretation." **Ignore these messages, because your Chi-square result will be inaccurate until you have completely finished entering data into the two columns of yellow cells.**
10. You are now ready to enter data from the Datamart for the group you would like to use as a comparison (e.g., State, LBHA, another agency, location site, etc.).
    a. Remember that if you are comparing agency or location level data to the State or LBHA, you will need to pull the agency/location data from the Connected Datamart and the State or LBHA data from the Public Datamart.
    b. Make sure you select identical data filters at the top of the Datamart for your comparison group as you selected for your initial group. The Datamart will have returned to its default settings if you switched between Public and Connected versions or returned to the Welcome Page.
11. Click on the bottom tab in the Datamart corresponding with your analysis question, and locate the "# of Clients" information for that question, as you did previously.
12. Enter the information for the comparison group in the second column of yellow shaded cells on the OMS Statistical Significance Workbook worksheet.

13. Once you have entered data in **ALL** of the yellow cells in **BOTH** columns, look to the red shaded cells labeled "Interpretation."

14. **There are several possible result messages that may display in the red shaded "Interpretation" cells:**

    a. *"Distributions differ at the .01 level"* – means that the groups are statistically significantly different from one another and that you can have 99% confidence that the results were not due to chance.

    b. *"Distributions differ at the .05 level"* – means that the groups are statistically significantly different from one another and that you can have 95% confidence that the results were not due to chance.

    c. *"No difference between distributions"* – means that the two groups were not statistically different from one another.

    d. *"Data distribution will not support Chi-square calculation"* – means that the data distributions include values which violate the principles for Chi-square calculation. Therefore, the basic criteria for the test are not met. See Appendix A for more details.

    e. *"Chi-square cannot be calculated if a row total is zero"* – means that the Chi-square test has not yet been conducted due to incomplete data entry or because a row total is zero. If data entry is incomplete, finish entering the data to get a final result. Or, if the data has zeros in a row, then the Chi-square cannot be conducted because the basic criteria for the test are not met. See Appendix A for more details.

SUMMARY

➢ **You will only enter information in cells that are highlighted in orange, green and yellow.**
- **Orange cells =** time frame for analysis (fiscal or calendar year), type of service (All, MH, SRD, or Both) AND filters (age, gender, race, time in treatment)
- **Green cells =** enter the names of the two groups you are comparing (for example, "My Agency" and "Statewide").
- **Yellow =** the data itself (numbers and percentages).

➢ **All other cells have been locked and protected to prevent unwanted changes to the formulas and formatting of the worksheets.**

➢ **After completely entering data in both columns of yellow cells, the "Interpretation" box will provide you with the Chi-square result:**
- *"Distributions differ at the .01 level"*
- *"Distributions differ at the .05 level"*
- *"No difference between distributions"*
- *"Data distribution will not support Chi-square calculation"*
- *"Chi-square cannot be calculated if a row total is zero"*

Step-by-step directions for effect size calculations

The effect size is <u>only</u> used for the BASIS-24®, the Youth Short Symptom Index, and the MARS 5 scale.The effect size calculation worksheets are only available in the Change Over Time (COT) Workbooks.

It is important to note that the effect size calculation worksheets produce information for one group at a time (e.g. only one LBHA, only one agency or agency location). The comparison being made is between that group's initial score and their most recent score.

To begin, open the Datamart in the same way as described previously, select analysis parameters, and assign filters as desired. Then:

1. For Adult COT click the Psychiatric Symptoms or Recovery & Functioning (Page 1) tabs. For Child COT click Psychiatric Symptoms or Functioning (Page 2) tabs. Both are seen at the top of the Datamart.
2. Open the appropriate OMS Statistical Significance Workbook (either Child COT or Adult COT).
3. Click on the Psychiatric Symptoms, Recovery, or Resilience tabs at the bottom of the Excel worksheet.
4. Enter data into the orange (service type, timeframe and filters), blue (State, LBHA, agency, location) and yellow (data) shaded cells.
5. For any BASIS-24®, Youth Short Symptom Index overall scale or subscales, or the MARS 5 (Maryland Assessment of Recovery Scale), you will see two numbers: one for the average score of that scale at the initial OMS interview, and another for the average score for that scale on the most recent OMS interview.
6. Copy those two numbers into the appropriate yellow shaded cells of the OMS Statistical Significance Workbook.
7. Information to complete the cells labeled "Standard Deviation" is found in the last <u>four tabs</u> of the each COT Workbooks:
   a. In the Adult COT Workbook,
      i. To obtain information for providers, use the tab labeled "Psych Symptoms SD-Providers" or "Recovery SD-Providers."
      ii. To obtain information for counties or statewide, use the tab labeled "Psych Symptoms SD-Jurisdictions" or "Recovery SD-Jurisdictions."
   b. In the Child and Adolescent COT Workbook
      i. To obtain information for providers, use the tab labeled "Psych Symptoms SD-Providers" or "Resilience SD-Providers."
      ii. To obtain information for counties or statewide, use the tab labeled, "Psych Symptoms SD-Jurisdictions" or "Resilience SD-Jurisdictions."
   c. Find your agency/county by name.
   d. Find the number for your agency/county that corresponds with the scale item you are interested in.
   e. Insert that number in the yellow shaded cells under the header "Standard Deviation" on the Excel worksheet.

8. You should now see effect size values next to the scale in which you are interested. Effect sizes estimate the magnitude of the change between the two groups. They usually fall within the small to medium range in the social sciences.

9. There are conventions used in the social sciences to interpret effect sizes. They are:
    a. Effects in the range of .20- 49 are considered small.
    b. Effects in the range of .50-.79 are considered medium.
    c. Effects in the range of .80 and higher are considered large.

SUMMARY

➢ **The effect size is used for the:**
   o **Symptom scales (BASIS-24® and Youth Short Symptom Index)**
   o **Recovery and resilience scale (MARS 5; Maryland Assessment of Recovery Scale)**

➢ **It is only available in the COT workbooks.**

➢ **The OMS Workbooks calculate effect sizes for one group at a time, comparing their initial to their most recent scores.**

➢ **The standard deviations needed to enter all required data in the worksheets are available within a separate worksheet in the Workbook.**

➢ **Effect sizes in the social sciences are generally small to medium.**

Appendix A. Chi-Square Test Limitations

There may be instances when the Chi-square test cannot be used with OMS data. Some users of the OMS Statistical Significance Workbooks may get an Interpretation message of "*Data distribution will not support Chi-square calculation*" or *"Chi-square cannot be calculated if a row total is zero."* Upon receiving these messages, the user should first doublecheck to make sure that all of the data has been entered correctly and completely. The message may be appearing due to incomplete or incorrect data.

If the message continues to appear after doublechecking the data, the following explanation may help users understand why the Chi-square test could not be conducted with their data.

The Chi-square test is used to determine if the patterns of results between the two groups are mathematically different from one another. It does this by creating an "expected" pattern of results. The expected pattern of results is what one would expect to see if there were no significant differences between the two groups. By comparing the real or "observed" OMS data with this "expected" data, the test then indicates if the groups are statistically different from one another.

Like any statistical test, the Chi-square has certain criteria that must be met in order for the test to be conducted. For Chi-square tests, small numbers in either the observed or expected data may prevent the test from running and therefore the test is "not supported."

This can be understandably frustrating to users who have somewhat small samples, because one cannot always determine ahead of time if the test will run or not. That is because the "expected" part of the comparison is something that occurs during the test and is calculated behind the scenes. Unfortunately, there is no exact "cut off" that can be used to determine ahead of time whether or not the Chi-square will work, although a general rule of thumb is that any response category with 5 or less may prevent the test from working. In addition, it is possible that, even if all response categories are over 5, the calculation of the Chi-square may not be supported.

It is also important to note that just because a Chi-square test will not work for one OMS item it does not mean that the Chi-square test will not work for other OMS items. It is dependent on the pattern of results for any given item in relation to the group to which it is being compared.