# PHX Course: From Data to Dashboards: Building Excel skills to support health program decisions

**Date/time:** July 20, 2020 to August \*\*\*, 2020; asynchronous/online

## Faculty

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# Course Rationale:

More than ever before, managers need to make sound decisions based on data. Robust dashboards are important tools in this process. Build your Excel “toolbox” by learning and applying useful formulas, graphing and dashboarding techniques, and data analysis in a wide range of real-world case study examples, such as enrollment and utilization analysis, estimation of revenues and expenses, and performance dashboards to monitor and evaluate health interventions.

# Goal:

To develop skills in using Excel and in dashboard design to support management decisions in health programs. After taking this course, students will be able to design and build Excel dashboards to perform such tasks as estimating coverage of health services in a given catchment area; future revenues and expenses; analyzing costs and utilization of services; predicting how organizational performance will be affected by management decisions or policy choices; and other programmatic and policy decisions.

**Overall Objectives:**

1. Discuss the advantages and disadvantages of Excel and other spreadsheet software packages as a management tool;
2. List the different types of graphs that are most appropriate for visual displays of varying data types;
3. Identify best practices for creating dashboards and their component elements;
4. List characteristics and components of good dashboard design;
5. Critique a dashboard;
6. Describe the management uses and policy applications for dashboards;
7. Use advanced Excel features, including range names, data validation, lookup functions; conditional formatting; AutoFilter, pivot tables, statistical functions, data forms (lists); creating charts and dashboards; and others;
8. Apply a systematic process for creating a dashboard, including specifying purpose and audience for the dashboard, developing structure, and applying best-practice standards for layout, clarity, efficiency and sustainability in design;
9. Analyze outputs from other dashboards and draw interpretations for decision-making.

# Overview:

The course starts with a discussion of **reports and dashboards** and ways in which they can be useful for health program and policy decisions. In each session, we will review publicly-available dashboards to see real examples at work and to assess how well the dashboards achieve their stated goals.

Following the overview, students work for the next three or four weeks with case studies or existing spreadsheets or reports, to learn dashboard design and Excel skills. Each class focuses on selected spreadsheet functions as they apply to a particular aspect of analysis and building a dashboard (e.g., pivot tables, data validation, conditional formatting, etc.). Students then have time to work through a case study or practical exercise.

Finally, in the latter weeks of the course students begin a project to design their own dashboard using Excel.

# Teaching Methods

Different people have different learning styles, and the class has been tailored accordingly. Each week, you will have assigned readings and Kaltura recordings to watch. Case studies and real data sets are used to provide opportunities for discussion and analytical exercises. Each session will cover one or more Excel functions or features that are used as the “building blocks” of a dashboard. These elements will be combined into the final dashboard that each student will produce.

# Texts and Other Materials:

* REQUIRED Alexander, Michael. 2016. *Excel Dashboards and Reports for Dummies, 3rd Edition.* Hoboken, NJ: John Wiley & Sons, Inc. (ISBN 978-1-119-07676-6)
	+ OPTIONAL Winston, Wayne L. 2011. *Microsoft Excel 2010: Data Analysis and Business Modeling.* Redmond, WA: Microsoft Press. (ISBN 978-0-7356-4336-9)
	+ OPTIONAL for further reading: Powell, Stephen G. and Kenneth R. Baker. 2007. *Management Science: The Art of Modeling with Spreadsheets.* Second Edition. Boston: John Wiley & Sons, Inc. (on reserve)

# Course Requirements and Student Evaluation:

Student evaluation during the course will be based on problem sets, knowledge checks, class participation (in weekly check-ins and/or discussion area if not able to make the weekly check-in), and the final project. Assignments will be evaluated based on accuracy of answers, as well as appropriate format.

### Grading:

Grading for the PHX course is Pass/Fail. Each part of the course will be evaluated as follows:

*Problem Sets* (25%)

*Knowledge Checks* (25%)

*Final Project* (40%)

Students will apply the steps of dashboard design to create their own working Excel dashboard. Students will all use the same data set (tracking a disease outbreak); set goals for the dashboard; define specifications for features and functionality; create and test the dashboard using formulas, formatting, and other design features; and document their dashboard. Ample time is allowed in later weeks to ensure that students have sufficient time to work on their dashboards. The dashboards will be evaluated against an evaluation framework which will be distributed. Students will have an opportunity to present their dashboards at the final weekly check-in.

*Class Participation (10%)*

While this class is entirely online, there will still be opportunities to participate during the weekly check-ins and/or discussion area topics. Grading in this area will be based on the instructor's assessment of the student’s work effort.

|  |  |
| --- | --- |
| **Points/ session** | **Preparation and Participation** |
| 2 | Student demonstrates that s/he has read the material and understands key concepts. All required homeworks and/or knowledge checks are completed. |
| 1 | No evidence of preparation or inactive participant; or excused absence from class (students will be allowed one excused absence from class if permission is sought ahead of time). Homeworks and/or quizzes are not all completed. |
| 0 | Unexcused absence from class. (Students will be allowed one excused absence from class if permission is sought ahead of time.) |

Be prepared to save work to a flash drive, drop box, or e-mail to yourself.

**Boston University School of Public Health**

## *Information regarding Academic Honesty*

Academic honesty is essential for students to attain the competencies the University and School expect of graduates, and any action by a student that subverts these goals seriously undermines the integrity of the educational programs at the School. Students at the Boston University School of Public Health are expected to adhere to the highest standards of academic honesty.

Academic misconduct is any intentional act or omission by a student which misrepresents his or her academic achievements, or attempts to misrepresent these achievements. While not an exhaustive list, the following acts constitute academic misconduct:

* Cheating on examinations**.** The use or attempted use of any unauthorized books, notes or other materials in order to enhance the student’s performance in the examination, copying or attempting to copy from another student’s examination, permitting another student to copy from an examination or otherwise assisting another student during an examination, or any other violation of the examination’s stated or commonly understood ground rules.
* Plagiarism. Any representation of the work of another person as one’s own constitutes plagiarism. This includes copying or substantially restating the work of another person in any written or oral work without citing the source, or collaborating with another person in an academic endeavor without acknowledging that person’s contribution.
* Submitting the same work in more than one course without the consent of all the instructors
* Misrepresentation or falsification of data
* Allowing another student to represent your work as his or her own
* Violating the rules of an examination or assignment

Charges of academic misconduct will be brought to the attention of the Associate Dean for Education, who will review all such cases and decide upon the appropriate action. A student who is found guilty of academic misconduct may be subject to disciplinary action, up to and including dismissal from the School.

**Excel Skills Covered in Course**

This is a list of some of the skills and functionality in Excel which you will learn in this course, organized approximately by Session where the skill will be introduced. Other skills may be added, depending on time and interest of students.

|  |  |
| --- | --- |
| Session 1 | * Auto Filter
* Text functions: LEFT, MID, RIGHT, CONCATENATE, LEN, FIND
* Excel Table feature
* IF
* Range names
* Which chart?
* Chart basics (time permitting)
 |
| Session 2 | * COUNT, COUNTA, COUNTBLANK, counting text only, COUNTIF(S), SUM, SUMIF(S)
* Lookup functions
* Remove Duplicates
* Conditional formatting
 |
| Session 3 | * Pivot tables (including how to create a calculated field)
* Pivot charts
* Slicer
* Timeline
 |
| Session 4 | * Data validation
* Sparklines (Excel 2010 and up only)
* Statistical functions: AVERAGE (mean), MEDIAN, MODE, MIN, MAX, STDEV (standard deviation), QUARTILE
* Histograms
* Box-and-whisker plots
 |
| Session 5 | * INDEX and MATCH
* OFFSET
* INDIRECT
* Reading in data from an external source
 |
| Session 6 | * Error checking
* Auditing
* Macros--mini-programs that you can use to automate repetitive tasks
 |
| Possible Supplemental Topics | * Mapping
* Other topics of interest?
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**Session 1: Course Overview; Text Functions, Range Names, Comparisons, and Chart Basics** (week of July 20-26)

**Readings and Preparation:**

* Read Stephen Few’s article, “Dashboard Confusion,” found at this link: <http://www.perceptualedge.com/articles/ie/dashboard_confusion.pdf>. You will find his definition of a dashboard on the middle of page 3 of the article, condensed to a single sentence.
* Skim Stephen Few’s article, “Eenie, Meenie, Minie, Moe: Selecting the Right Graph for Your Message,” found at this link: <http://www.perceptualedge.com/articles/ie/the_right_graph.pdf>
* Skim the WHO Bulletin article “Adaptation and implementation of local maternity dashboards in a Zimbabwean hospital to drive clinical improvement,” focusing primarily on Box 1 (Clinical Indicators) and Figure 1 (example of dashboard display), found at this link: <http://www.who.int/bulletin/volumes/92/2/13-124347/en/>. Note that a better image of the maternity dashboard display can be found on the final page of the PDF file at this link: <http://www.who.int/bulletin/online_first/13-124347.pdf?ua=1>
* Watch the Session 1 Kaltura recordings
* If you need additional reinforcement on the Excel functions, see Microsoft Excel 2010: Data Analysis and Business Modeling, by Wayne Winston (ISBN 978-0-7356-4336-9), Chapters 6 (Text Functions) 12 (IF Statements), and 2 (Range Names).
* Come to class prepared to discuss what is and isn’t a dashboard, and why
* Skim the Introduction and read Chapters 1, 2, and 15 of Excel Dashboards and Reports for Dummies, 3rd Edition, by Michael Alexander (ISBN 978-1-119-07676-6).

#### Purpose:

This session provides an overview of course objectives and content, as well as an introduction to our course data set. The session starts with review of syllabus, including grading and deadlines, group project information, etc. The discussion focuses on the first few chapters of the Alexander book, including defining dashboards, preparing to create a dashboard, and best-practice design principles. We will also review a brief article on different types of graphs and when to use them. Finally, we will practice the first set of Excel building blocks on a real data set.

#### Objective:

1. Describe the elements of a dashboard and how they differ from other reports;
2. Discuss the advantages and disadvantages of Excel and other spreadsheet software packages as a management tool;
3. List characteristics and components of good dashboard design;
4. Identify the most appropriate graphs to use for different types of data;
5. Apply skills learned to the course data set.

#### Activities:

* Review of syllabus
* Short discussion of dashboards versus reports, following Chapter 1 of Alexander
* Review of Few articles
* Introduction to course data set and discussion of what we might want to glean from the data
* Demonstration of Excel features using the course data set
	+ Auto filter
	+ Text functions
	+ Excel Table feature
	+ IF statements
	+ Date math
	+ Range names

#### Graded Component(s):

* Knowledge checks

**Session 2: Querying and Summarizing Data; Conditional Formatting for Emphasis** (week of July 27-August 2)

**Readings and Preparation:**

* Watch Session 2 Kaltura recordings
* Read Alexander: Chapters 3 and 5 (Dressing Up Your Data Tables; Formatting Your Way to Visualizations).
* OPTIONAL Read Winston: Chapter 20 (COUNTIF, COUNTIFS, COUNT, COUNTA, COUNTBLANK); Chapter 21 (SUMIF, AVERAGEIF, SUMIFS, AVERAGEIFS); and Chapter 3 (Lookup Functions)
	+ OPTIONAL Exercises to try BEFORE CLASS: Ch. 20: Problems 1-4

#### Purpose:

In this session, students gain experience in querying and summarizing data. When building a dashboard, the data are often not in the format needed. The Excel functions and features that we will cover today have many practical applications: COUNT, COUNTIF(S), COUNTA, SUMIF(S), VLOOKUP and other lookups, and Remove Duplicates. In addition, we will review applications of conditional formatting to highlight certain dashboard metrics. We will also begin to discuss the final group project.

#### Objective:

1. Discuss ways in which raw data might need to be transformed or summarized in order to be used in a dashboard
2. Discuss creation of our first dashboard components on the membership data
3. Use Excel features, including COUNT, COUNTIF(S), COUNTA, COUNTBLANK, SUM, SUMIF(S), lookup functions, and conditional formatting

#### Activities:

* Discussion of questions from Kaltura recordings and first week’s knowledge checks
* Brief discussion of course data set: what and how we will report on our dashboard
	+ Discussion and hands-on work: Applying functions we've learned so far to answer questions about our data set
* Review final project assignment (due at the end of week 6, August 29, 2020; extensions may be given if need be): Build Your Own Dashboard (see separate description and data file)

#### Graded Component(s):

* Knowledge checks
* **Problem Set (PS) 1,** due ***before the Session 3 weekly check-in:*** Suriname hospital statistics.
	+ Please name your file as follows: **YourLastName\_PS1.xlsx**

**Session 3: Pivot Tables and Pivot Charts; Data Modeling** (week of August 3-9)

#### Readings and Preparation:

* Watch Session 3 Kaltura recordings
* Read Alexander: Chapter 6 (The Pivotal Pivot Table) and Chapter 12 (Adding Interactivity with Pivot Slicers)
* OPTIONAL Read Winston, Chapter 43 (Using PivotTables and Slicers to Describe Data).
	+ OPTIONAL Exercise to try BEFORE CLASS: Ch. 43, Problem 4.

#### Purpose:

In this session, students are introduced to more advanced features of Excel, including pivot tables and pivot charts. In addition, students begin to think more in-depth about data modeling and the final project.

#### Objective:

1. Using the class data set, gain practice with pivot tables and charts;
2. Using course data set, link membership and claims data and begin to add value and context by describing the data and looking for patterns
3. Explain the purpose of their own dashboard
4. Describe the audience or user community for their own dashboard
5. Specify the features and functionality for their own dashboard, applying best-practice standards for layout, clarity, efficiency and sustainability in design
6. Set a schedule for building the dashboard

**Activities:**

* Discussion of questions from Kaltura recordings and second week’s knowledge checks
* Discussion of questions from Problem Set 1 (which was submitted before class)
* Hands-on work: pivot tables and charts
* Discussion: data models
* Walk through final project assignment

#### Graded Component(s):

* Knowledge checks

**Session 4: Data Validation, Sparklines, and Statistical Functions** (week of August 10-16)

#### Readings and Preparation:

* Watch Session 4 Kaltura recordings
* Alexander, review Ch. 2 section on Data Validation (pp. 38-39); read Ch. 4 (Sparking Inspiration with Sparklines), and skim Ch. 7 (Charts That Show Trending)
* OPTIONAL Winston, Ch. 40 (Validating Data); Ch. 41 (Summarizing Data by Using Histograms); Ch. 42, Summarizing Data by Using Descriptive Statistics*.*

#### Purpose:

In this session, students are introduced to more advanced features of Excel, including data validation and statistical functions, as well as how data validation can be combined with other features to ease data entry and prevent errors. Students are also introduced to sparklines.

#### Objectives:

1. Using the class data set, gain practice with setting up various types of data validation
2. Review the different types of sparklines, when and how to add them, and how to modify the format
3. Learn/review several statistical functions
4. Learn how to create histograms and box-and-whisker plots

#### Activities:

* Case study to practice data validation; refresher on VLOOKUP
* Practice on creating sparklines
* Show data distributions graphically with histograms and box-and-whisker plots
* Continuing work on dashboards for final projects

#### Graded Component(s):

* Knowledge checks
* **Problem Set (PS) 2,** due ***before the start of Session 5:*** Suriname dashboard.
	+ Scan and upload a **paper copy (hand-drawn sketch**, NOT a printout of a dashboard created in Excel), as well as the Excel version of the dashboard
	+ Upload the Excel version, named as follows: **YourLastName\_PS2.xlsx**

**Session 5: INDEX/MATCH; Reading data from an external source; OFFSET/INDIRECT** (week of August 17-23)

#### Readings and Preparation:

* Alexander, Ch. 9 (Displaying Performance Against a Target)
* OPTIONAL Powell and Baker, Chapter 5, “Spreadsheet Engineering,” pages 95-116 (on reserve in BU library).
* OPTIONAL Winston, Ch. 22 (OFFSET), Ch. 23 (INDIRECT), Ch. 4 (INDEX), and Ch. 5 (MATCH).

#### Purpose:

In this session, students learn more advanced Excel features. Ample time is also given for students to continue work on their dashboards. Focus is on importing data, entering formulas, and creating graphs and other visualizations. The instructor provides advice and (virtual) hands-on assistance as needed. Students also will practice analyzing and interpreting dashboard output.

#### Objectives:

1. Build and test a dashboard using Excel
2. Use advanced functionality in Excel, including OFFSET, INDIRECT, INDEX, and MATCH
3. Analyze outputs from an existing dashboard
4. Draw interpretations for decision-making

#### Activities:

* Review any questions from Problem Set 2
* Check in with students on final assignment progress
* Questions regarding new functionality (OFFSET, INDIRECT, INDEX, and MATCH)

#### Graded Component(s):

* Knowledge checks

**Session 6: Testing, Error-Checking, and Documentation; Macros** (week of August 24-30)

#### Readings and Preparation:

* Review of Alexander Ch. 2 (Building a Super Model)
* OPTIONAL Winston, Ch. 16 (The Auditing Tool)
* OPTIONAL Powell and Baker, review section 5.5 on Testing a Workbook (on reserve).

#### Purpose:

In this session, students continue to work on their dashboards. The instructor provides advice and (virtual) hands-on assistance as needed. Focus is on completing dashboard testing, and creating documentation and a user guide. Students also begin to prepare their presentations (scheduled for final weekly check-in).

#### Objectives:

1. Test and document a dashboard using Excel
2. Use advanced functionality in Excel
3. Plan a presentation of the final project dashboard

#### Activities:

* Work on dashboards
* Simple macro practice: formatting periodic reports
* Demo of more advanced macro

**Note:** The final dashboard and one-page summary are due by Saturday, August 29, 2020. Extensions may be given if needed.

**Additional Resources:**

If you feel that you need to brush up on some of your Excel skills, please refer to the following resources. The purpose of these tasks is to ensure that as a class, all of us have a sound understanding of Excel formulas, basic functions, how to move around the worksheet, and use many of its features, etc., so that we may venture into the world of creating dashboards and models with strength. This is especially important if you don't have solid Excel experience.

Excel is a really powerful tool and learning its features comes with use. Even for those that can use Excel well, there are often tricks, options and features that we can add to our repertoire. The orienting activities will help you learn and fill in gaps, as much as they may review some of the old things you may already know.

***List of Tasks to Complete, as Needed:***

We will point you to a couple different websites to read about or watch videos on Excel.

**PART ONE:** Work through the following basic Excel training at the following Web site:

The Microsoft Support/Training has articles and videos for various versions of Excel (2010, 2013, and 2016). **Suggestions below are based on the Excel 2013 articles and videos unless otherwise noted.**

<https://support.office.com/en-us/article/Excel-training-9bc05390-e94c-46af-a5b3-d7c22f6990bb?ui=en-US&rs=en-US&ad=US>

**1. GET FAMILIAR WITH EXCEL**

| **Name of Training Module** | **Description** |
| --- | --- |
| Make the Switch to Excel 2013*(Helpful for those who know earlier versions of Excel.)* | The layout of the new design, what has changed since earlier versions, etc. |
| Create your first Excel 2013 workbook *(Basics for those new to Excel.)* | How to create a workbook, enter and edit text and numbers, and add rows or columns |
| Understand and Use Cell References; Basic Math in Excel | How to enter simple formulas into worksheets, and how to make formulas update their results automatically |
| Excel 2010 Keyboard Shortcuts I: CTRL key shortcuts*(Very useful keyboard shortcuts for common tasks and navigating quickly around your workbook—Excel 2010 training)* | How to create a new workbook, save your work, and more useful tips using keyboard shortcuts rather than the mouse or touch pad |

**2. CREATE CHARTS IN EXCEL**

| **Name of Training Module** | **Description** |
| --- | --- |
| Create a chart | How to create a chart that suits your data and make changes to a chart after you create it |

**PART TWO:** The same Microsoft site has lots of guidance on working with Excel.

<https://support.office.com/en-us/excel>

Please review (read deeply if you are unfamiliar; skim through if you are more familiar) the following topics and subsections:

II) Formula and name basics

* Get started/Create a simple formula
* Formulas/Detect errors in formulas
* Formulas/Define and use names in formulas
* Formulas/Create a formula by using a function
* Formulas/Switch between relative, absolute, and mixed references

III) Logical Functions - see: <https://support.office.com/en-US/article/Logical-functions-reference-E093C192-278B-43F6-8C3A-B6CE299931F5>

**PART THREE**: Nine (9) YouTube Videos to augment the above:

<http://office.microsoft.com/en-us/excel-help/learn-the-basics-of-excel-formulas-with-excelisfun-videos-on-youtube-HA102335414.aspx?CTT=1>

**Links to various Web sites:**

<http://www.perceptualedge.com/articles/misc/Graph_Selection_Matrix.pdf>: a one-page handout to compare graph types and when to use them

<http://www.perceptualedge.com/articles/ie/the_right_graph.pdf>

<http://www.perceptualedge.com/articles/dmreview/intelligent_dashboard.pdf>: shows winning entry in DM Review’s 2005 dashboard competition (wine sales)

School District Dashboard (link to a screenshot of a dashboard):
<http://dashboardspy.wordpress.com/2006/06/02/school-district-dashboard-screenshot-dashboards-for-student-and-school-performance/>

United States Education Dashboard:

<http://dashboard.ed.gov/about.aspx>

Top Patient Prescription Claims:

[http://www.visualizefree.com/app?op=vs&SingleMode=true&identifier=1^128^\_\_NULL\_\_^ielFgfze&title=Prescription%20Data](http://www.visualizefree.com/app?op=vs&SingleMode=true&identifier=1%5e128%5e__NULL__%5eielFgfze&title=Prescription%20Data)

KPI Dashboard Example (third from top):

<http://www.inetsoft.com/products/dashboard_examples/>

City Hospital Group:

<http://demo.visualmining.com/projects/HealthcareVertical/index.jsp>

Dundas Hospital Healthcare Dashboard:

<https://samples.dundas.com/Dashboard/9321740d-007a-45fb-98e3-b1b3be54595b?e=false&vo=viewonly>

IT Dashboard:

<https://www.itdashboard.gov/drupal/>

World Bank databank:

<http://databank.worldbank.org/ddp/editReport?REQUEST_SOURCE=search&CNO=2&country=USA&series=&period>=

Corporater:

<https://corporater.com/en/business-solutions/kpis-and-dashboards/>

California Opioid Overdose Surveillance Dashboard:

<https://discovery.cdph.ca.gov/CDIC/ODdash/>

Coalition for the Homeless Houston dashboards:

<http://www.homelesshouston.org/continuum-of-care/dashboards-2/>