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

**Date/time:** January 9, 2023 to February 19, 2023; 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, simple 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; and
10. Write a one-page summary of the final dashboard to highlight key features and findings.

# 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 during the week to work through a case study or practical exercise.

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

# Teaching Methods

All lessons are pre-recorded, with knowledge checks at the end of each video to test students’ understanding of the material (ungraded component). 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 the students produce. There is also an optional weekly check-in on Zoom, which will be recorded for anyone who wants to review it or who was unable to attend the live Zoom session.

Different people have different learning styles, and we have tailored the class accordingly. Each week, you will have assigned readings and video recordings to watch, including hands-on practice using the class data set. There is further hands-on practice with those specific skills using case studies and/or existing dashboards. Two problem sets and a final project allow students to practice and hone their skills further.

# Texts and Other Materials:

* 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, quizzes, class participation (defined as participating in the graph-of-the-week and other discussion questions), and the final project. Assignments will be evaluated based on accuracy of answers, as well as appropriate format.

### Grading:

For the PHX course, grading is on a pass/fail basis. Students email assignments to the professor, who provides feedback. If students have questions prior to the completion of the assignment, the professor is happy to review work in progress.

*Problem Sets* (25% each, or 50% total)

*Final Project* (40%)

Students will apply the steps of dashboard design to create their own working Excel dashboard. Students will use the provided data set (tracking a COVID 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. The dashboards will be evaluated against an evaluation framework which will be distributed.

*Class Participation (10%)*

Class preparation and participation are important parts of this course. While the weekly check-ins are optional, we do encourage all students to participate in the asynchronous online discussions.

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 week where the skill will be introduced. Other skills may be added, depending on time and interest of students.

|  |  |
| --- | --- |
| Week 1 | * Auto Filter
* Text functions: LEFT, MID, RIGHT, CONCATENATE, LEN, FIND
* Excel Table feature
* IF statements (to test for one criterion)
* Nested IF statements (to test for multiple criteria)
* Range names
* Which chart?
* Graph of the week: Part-to-whole comparisons (bars vs. pies; “Save the Pies for Dessert”?)
 |
| Week 2 | * COUNT and its variants, SUM, COUNTIF(S), SUMIF(S)
* Lookup functions
* Remove Duplicates
* Conditional formatting
* Graph of the week: Time series data
 |
| Week 3 | * Pivot tables
* Pivot charts
* Exploring your data set
* Slicer
* Timeline
* Graph of the week: Ranking
 |
| Week 4 | * Data validation
* Sparklines (Excel 2010 and up only)
* Statistical functions
* Histograms
* Box-and-whisker plots
* Graph of the week: Distributions
 |
| Week 5 | * INDEX and MATCH
* OFFSET
* INDIRECT (optional)
* Reading in data from an external source
 |
| Week 6 | * Error checking
* Auditing
* Recording simple macros in Excel
 |
| Possible Supplemental Topics | * Mapping
* Other topics of interest?
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**Week 1: Course Overview; Text Functions, Range Names, Comparisons, and Chart Basics**

(week of January 9, 2023)

#### 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.

**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 video 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).
* **Be prepared** to discuss what is and isn’t a dashboard, and why (in the course portal)
* **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).

#### Graded Component(s):

* None (students will begin working on Problem set 1 in Week 2)

**Week 2: Querying and Summarizing Data; Conditional Formatting for Emphasis**

(week of January 16, 2023)

#### 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 this week 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.

#### 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, COUNTA, SUMIF, lookup functions, and conditional formatting

**Readings and Preparation:**

* Watch Session 2 video recordings
* Read Alexander: Chapters 3 and 5 (Dressing Up Your Data Tables; Formatting Your Way to Visualizations).
* If you didn’t get to it before the first class, please skim the Introduction and chapters 1, 2, and 15 of Alexander
* 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: Ch. 20: Problems 1-4

#### Graded Component(s):

* Begin work on **Problem Set (PS) 1,** due to the professor (via email) ***before the end of Week 3:*** Suriname hospital statistics.
	+ Please name your file as follows: **YourLastName\_PS1.xlsx**

**Week 3: Pivot Tables and Pivot Charts; Slicer, Timeline**

(week of January 23, 2023)

#### 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. Gain more practice in exploring a data set using pivot tables
4. Start thinking about the final project (see instructions linked under Week Six). You will be learning more as the course progresses, but be prepared to answer the following:
	1. Explain the purpose of their own dashboard
	2. Describe the audience or user community for their own dashboard
	3. Specify the features and functionality for their own dashboard, applying best-practice standards for layout, clarity, efficiency and sustainability in design

#### Readings and Preparation:

* Watch Session 3 video 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: Ch. 43, Problem 4.

#### Graded Component(s):

* Problem set 1 due by end of week (January 29, 2023).

**Week 4: Data Validation, Sparklines, and Statistical Functions**

(week of January 30, 2023)

#### 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, as well as a variety of statistical functions used to describe data.

#### Objectives:

#### Readings and Preparation:

* Watch Session 4 video 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*.*

#### Graded Component(s):

* Begin work on **Problem Set (PS) 2,** due to professor via email ***by the end of Week 5:*** Suriname dashboard.
	+ Scan or photograph a **paper copy (hand-drawn sketch**, NOT a photo/Excel printout) to submit along with your Excel file
	+ Email the image of the sketch and the Excel version, named as follows: **YourLastName\_PS2.xlsx**

**Week 5: More advanced functionality (INDEX and MATCH; OFFSET; INDIRECT; reading in external data sets)**

(Week of February 6, 2023)

#### Purpose:

In this session, students learn more advanced Excel functionality: using INDEX and MATCH in lieu of VLOOKUP; ways that OFFSET and INDIRECT can be used; and how to read an external data set into Excel.

#### Objectives:

1. Use advanced functionality in Excel, including INDEX and MATCH, as well as OFFSET (INDIRECT is optional)
2. Learn how to read in external data sets and use stored connections to speed up the process for repetitive tasks (e.g., reading in updated versions of a report every week)

#### Readings and Preparation:

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

#### Graded Component(s):

* Problem set 2 to be emailed to professor by the end of week 5 (an image of the dashboard sketch as well as the Excel file), February 12, 2023

#### 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).
* OPTIONAL: Depending on your approach to you project, you may find Chapters 6 and 7 of Powell and Baker useful. Chapter 6, “Analysis Using Spreadsheets,” p. 123-137 and Chapter 7, “Data Analysis for Modeling,” pages 140 to 150. For those local to Boston, a copy of the book is on reserve at the BUMC library (instructional building).

**Week 6: Error-Checking and Auditing; Simple Macros**

(Week of February 13, 2023)

#### Purpose:

In this session, students gain skills in reviewing their work, troubleshooting issues with their or someone else’s Excel workbook, etc. Students also gain practice in recording simple macros. Students continue work on final projects.

#### Objectives:

1. Review a spreadsheet and check for errors; use auditing tools to facilitate the process
2. Learn how macros work in Excel: record a simple macro by recording keystrokes

#### Activities:

* Continue work on final project and submit by end of week (due by February 19, 2023).

**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/>