SECTION 1

Introduction to Tableau

CHAPTER 1

Introduction

A Book Designed for Healthcare Professionals

Designed specifically for healthcare professionals by the healthcare, data-visualization, and report-design experts at HealthDataViz, this book is intended to introduce and describe in detail the features that Tableau Desktop 8.2 provides for analyzing healthcare data and creating dashboards and reports.

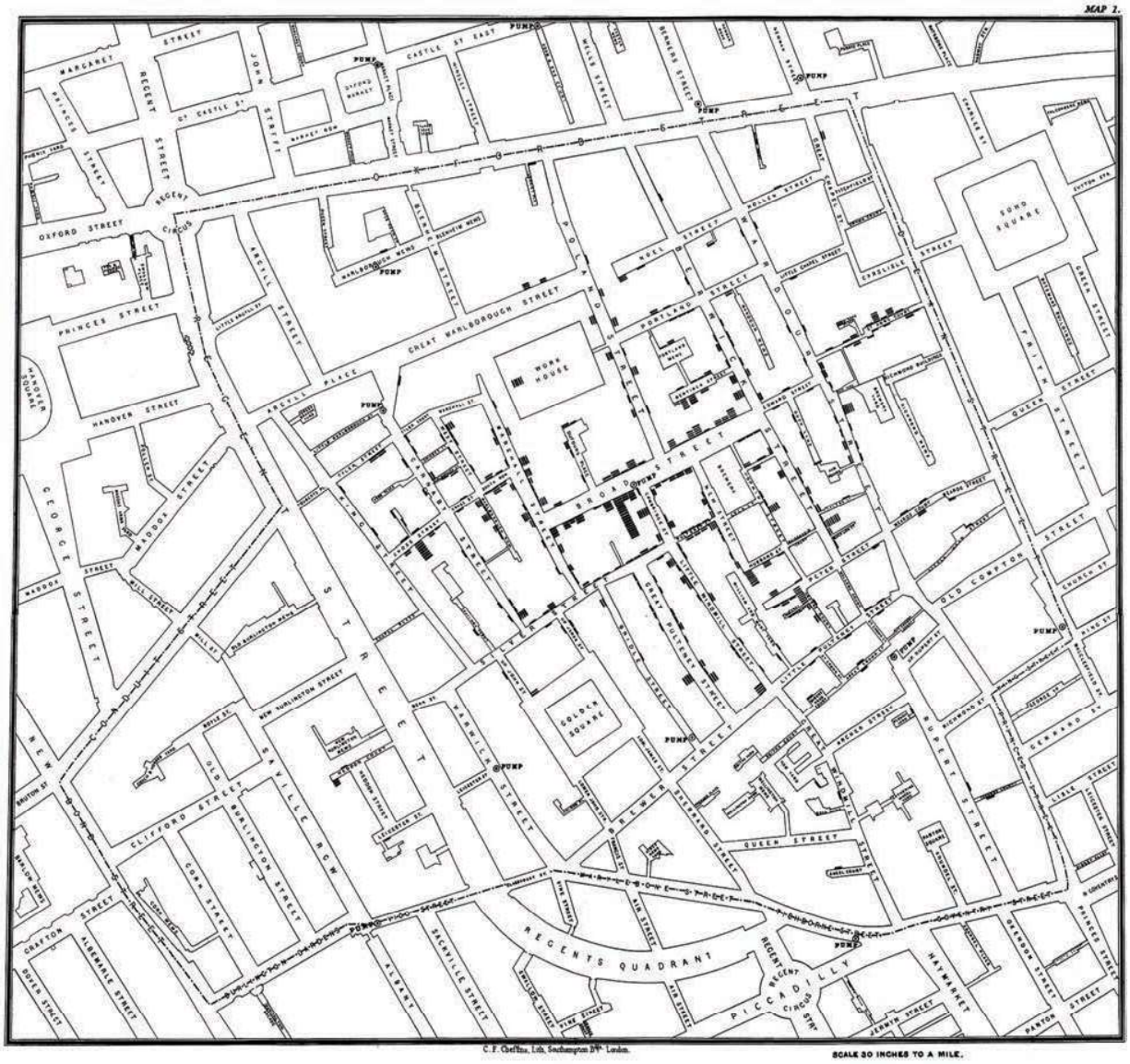
Throughout this book we have used (real, but suitably de-identified) healthcare data from a wide range of sources (public health, hospital, clinical) to demonstrate Tableau's functionality in concrete, practical ways that are immediately useful for real-world application by healthcare professionals.

Before presenting and explaining all of this book's useful and innovative features, let's take a moment to consider several significant visualizations that have helped to improve care and inform recent trends in making modern healthcare systems stronger and more effective.

Visualizing Healthcare

Even before modern-day vision research validated the direct and powerful relationship between the way information is presented and the way we see and understand it, pioneering healthcare statisticians and caregivers like John Snow (1813-1858) and Florence Nightingale (1820-1910) understood that visual display could be a highly effective method for grasping and communicating the messages buried in data.

No one who has ever taken an epidemiology course can forget Dr. John Snow's classic work, "On the Mode of Communication of Cholera." By mapping the London street addresses of residents who had become sick (and in many cases died) and the location of the city water pumps, Snow was able to visually communicate the relationship between pathogen-tainted water and the people who contracted the disease. Most people who had fallen ill, it turned out, lived near the Broad Street pump. Snow persuaded the town council to remove the pump's handle, and the outbreak abated.

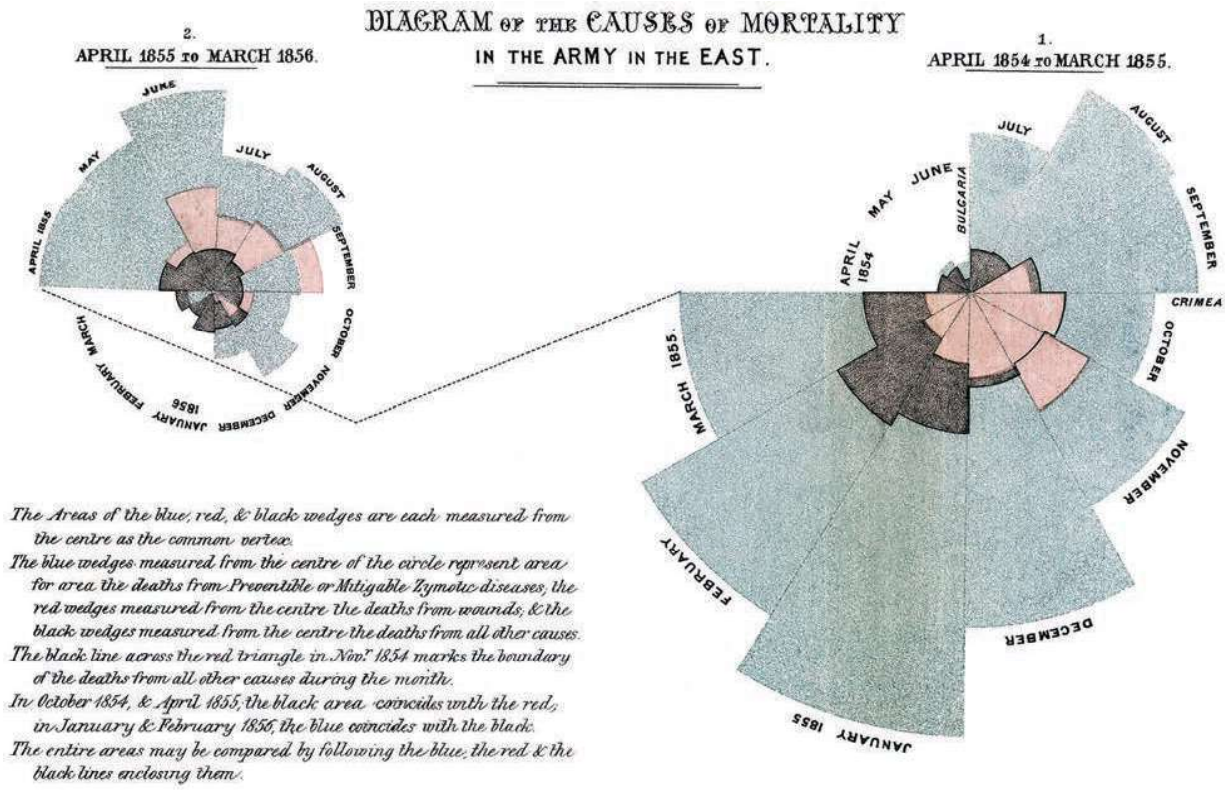


(Image in the public domain.)

In 1868, British nurse Florence Nightingale—distressed by the alarmingly high mortality rates in the Crimean War—began to compile statistics on causes of death. Her analysis revealed that of the 900,000 soldiers who died during the war—more than half of 1,650,000 combatants from all countries involved—most had succumbed to preventable diseases arising from unsanitary conditions in the hospitals where they were treated, and not as a direct result of their battlefield wounds. Nightingale recognized the buried message: better hygiene could have saved—and could still save—thousands of lives.

As impressive as her statistics were, Nightingale worried that the tables she presented to Queen Victoria would seem tedious, even incomprehensible, and feared that members of

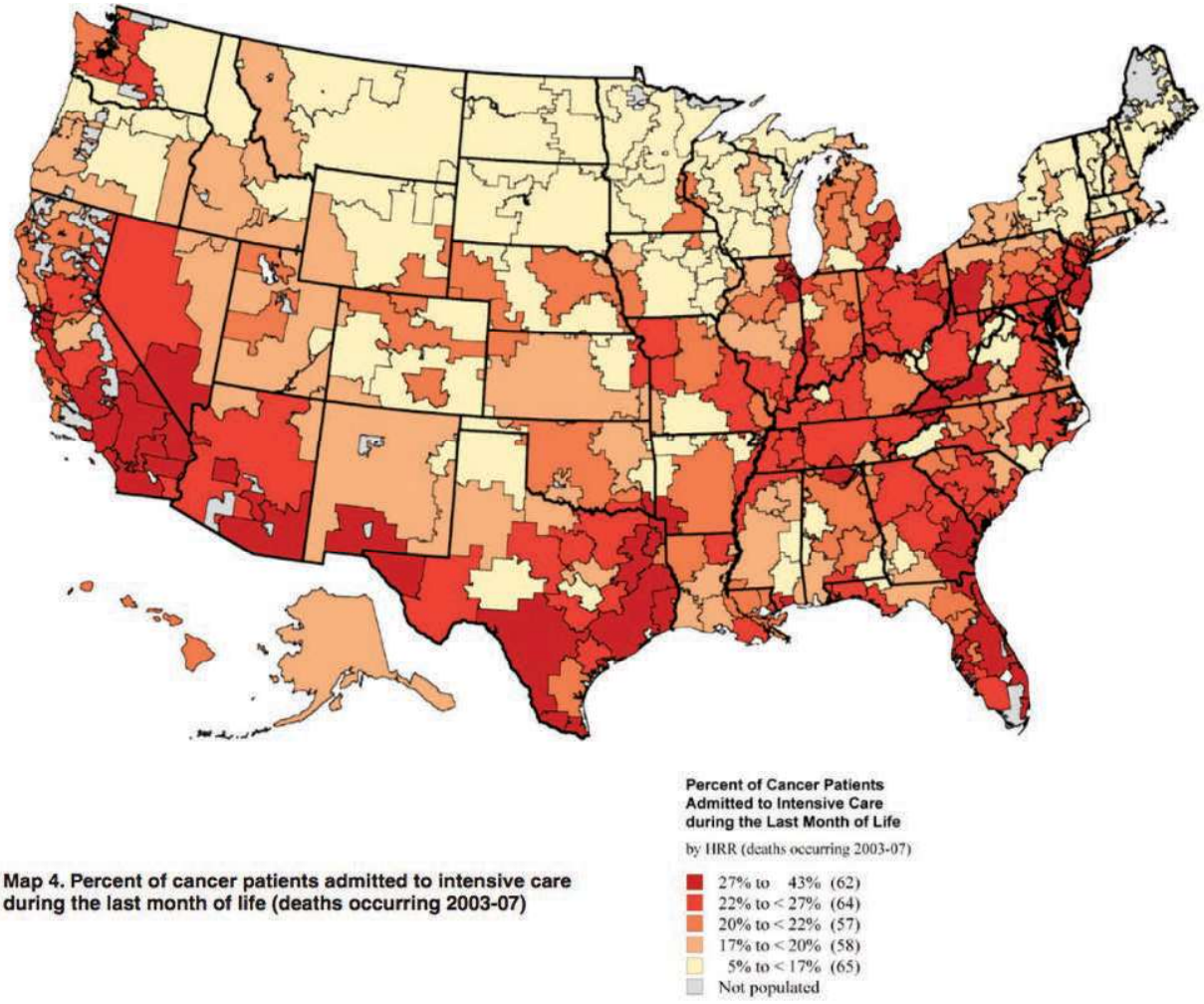
the British Parliament were unlikely to be swayed by numbers lying flat on a page. So Nightingale devised clever ways of presenting the information in charts.



(Image in the public domain.)

In the now-famous "Diagram of the Causes of Mortality in the Army in the East," each month is represented as a twelfth of a circle, and months with more deaths are shown with longer wedges, so that the area of each wedge represents the total number of deaths. Preventable deaths are blue, deaths due to wounds are red, and deaths from all other causes are black. Over the months after March 1855, when members of the Sanitary Commission began repairing, cleaning, and otherwise improving the conditions in the field hospitals, the blue wedges shrank dramatically. Showing wonderful insight into the power of displaying the data in this way, Nightingale said her graph was designed "to affect thro' the Eyes what we fail to convey to the public through their word-proof ears."

More recent efforts by healthcare researchers like those led by Dr. Jack Wennberg at the Dartmouth Atlas Project have documented glaring—and, for the most part, inexplicable—variations in how medical resources are apportioned and delivered in the United States. The project builds on Medicare data to provide comprehensive information and analysis about national, regional, and local markets, as well as individual hospitals and their affiliated physicians.



Map 4. Percent of cancer patients admitted to intensive care during the last month of life (deaths occurring 2003-07)

Source: *The Dartmouth Institute: The Dartmouth Atlas of Healthcare*

Consider the map reproduced above from the Dartmouth Atlas Report: "Quality of End-of-Life Cancer Care for Medicare Beneficiaries." It displays the percent of cancer patients admitted to intensive care during the last month of life compared by hospital referral regions. About 24% of cancer patients were admitted to intensive care at least once during that last month. However, the percent thus admitted varied more than sevenfold across those regions (dark red versus light yellow areas on the map), leading the viewer to ask "Why are these rates so dramatically different across the country?"; and perhaps to add an even more significant question: "What should the rate be?"

Geospatial displays of data like this one make the variation in end-of-life care jump off the page in a way that it never could if the data were buried in a table or report narrative. Such geospatial maps and accompanying reports, along with the research upon which they are based, have helped policymakers, the media, healthcare analysts, and others improve their understanding of the efficiency and effectiveness of our health care system. As with the map created by John Snow, the visualizations built for the Dartmouth project make the story easy

to see and understand, and have formed the foundation for many of the nation's ongoing efforts to improve U.S. American health and health systems.

Using Vision to Think – The Power of Tableau ™

The power of these and similar visual displays (and by extension the power of Tableau™) is that they help us use what we see to improve the way we think—how we comprehend, reason, deduce, and respond. Tableau empowers users to quickly grasp the stories and potential opportunities buried in the bottomless oceans of data that wash up around us daily.

But don't be fooled: as with all truly great technology and design of this kind, the apparent simplicity of Tableau™ belies the complex concepts and mechanisms used to create it. Using a new technology that combines Structured Query Language (SQL™) for databases with a descriptive language (Visual Query Language|VizQL™), Tableau translates a user's actions into a database query, then expresses the response graphically. Tableau's drag-and-drop and "Show Me" functionality, as well as its high-quality graphics, are the products of complex engineering built on a solid foundation of substantial research into information visualization and its connection to vision, perception, and visual cognition. Tableau is not just another business intelligence (BI) application for use only by highly skilled engineers; rather, its creation was guided by the scientific principles of how we see and understand data, and it can be used successfully by just about anyone wishing to explore data quickly and easily.

A Practical Book for Practical Use by Healthcare Professionals

As previously noted, we have written and designed this book specifically as a practical, useful, detailed, hands-on guide to Tableau Desktop's rich, powerful array of features for designing, creating, analyzing, and using dashboards and reports. The healthcare data we have sourced from a wide range of sectors (public health, hospitals, clinical settings) demonstrates Tableau's functionality in real-world applications that can be applied to the everyday experience of healthcare professionals.

Each chapter begins with a brief discussion of a chart or other display type and its appropriate use, illustrated by a graphic of the finished chart to be built in the chapter, coupled with a brief explanation of where the healthcare data comes from, and what it means.

The main body of the chapter contains meticulous, logical, step-by-step instructions on how to build the chart, with frequent screen-shots and other images to help orient the reader and clarify each action.

Note also the following:

» Directions formatted like this indicate an action to be performed by the reader.

Key information is highlighted in call-outs containing images or side-text in the following categories:

◂ Tableau Call-outs

Call-outs formatted like this indicate Tableau-specific information and functionality.

Best Practice

Blue boxes display data visualization best practices.

◂ Refreshers

Call-outs formatted like this contain reminders of information discussed in previous chapters.

Those knowledgeable and confident about building a particular chart type can skip the detailed instructions in favor of using our concise and handy ***HDVizoom™***—all the necessary steps distilled into a compact list at the end of each chapter.

We have also included introductory overviews of how Tableau connects to data, and of Tableau Server—emphasis here on "introductory." More in-depth explanations, tutorials, forums, and online Tableau communities may be found at http://tableausoftware.com/support.

Downloading and Using the Datasets

Although you can successfully and effectively use this book without working with the datasets we have created for the book's teaching|training exercises, we believe that completing a visualization using the same data is a terrific, hands-on way to see how Tableau works. To that end, we have stripped the datasets included of all formatting or other distractions, freeing you to fully immerse yourself in learning, step-by-step, how to create visualizations using Tableau.

To download the datasets you'll need, please visit HealthDataViz at: http://www.healthdataviz.com/Tableau-for-Healthcare and follow the instructions we have posted there for you.

To learn more about the different types of healthcare classification systems and databases, we encourage you to check out our award-winning companion work, *The Best Boring Book Ever™ of Select Healthcare Classification Systems and Databases* (available from Amazon). And we invite you to join the ongoing conversation about healthcare data and data visualiza-

tion by signing up for our free newsletter, *Unleash Your Inner Healthcare Data*, at http://www.healthdataviz.com.

Thank You

Thank you for your interest in this book—for supporting our mission, and sharing our vision of creating clear and compelling dashboards and reports that will make opportunities to improve our healthcare systems evident, and move people to action.

Sincerely,

The HealthDataViz Team

CHAPTER 2

Data and Tableau Basics

Readying Data for Tableau

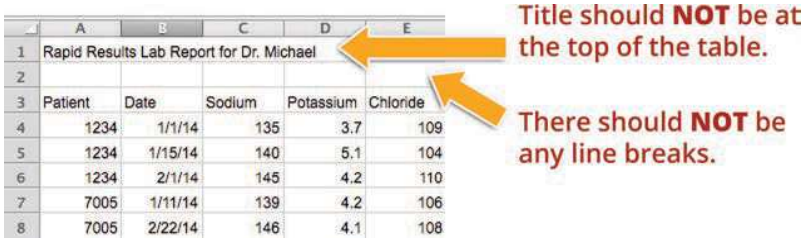
As suggested by its title, this section of the book is not an in-depth, detailed guide to structuring underlying data for use with Tableau. Rather, it is intended to provide the reader with a basic insight into how Tableau interacts with databases and spreadsheets.

Before any picture is painted or story told using Tableau, the underlying data must be properly shaped. While it isn't necessary to be an Information Technology specialist to successfully use Tableau, understanding some fundamental principles before beginning will make it easier to get the most out of Tableau's full functionality.

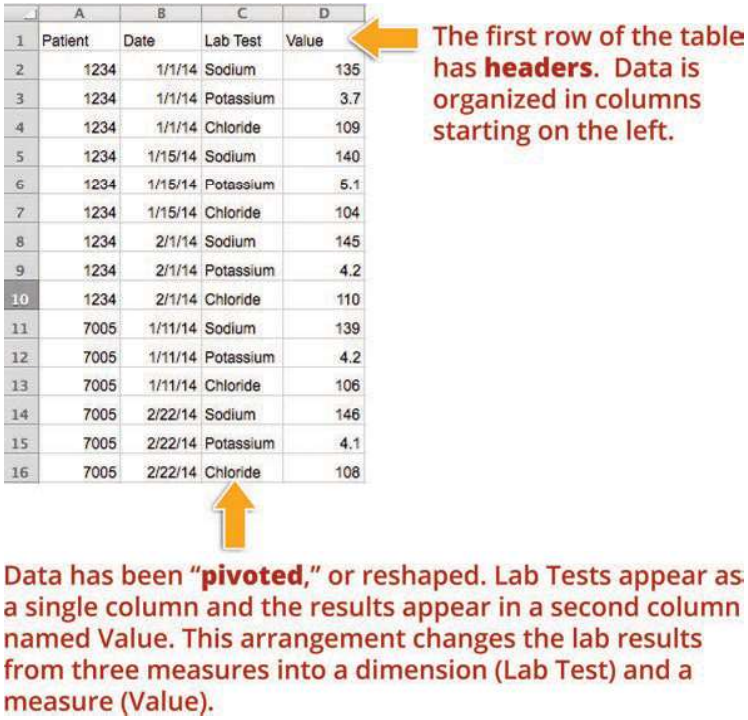
Remember: a raw data table is the required format for the dataset. Repeat to yourself: Feed Tableau Raw Data.

Raw data requires variables to be in columns and values in rows. The table must not have been subjected to any processing; that is, even common, easily read formatting seen in spreadsheets or pivot tables, such as totals and line breaks, must not have been added. The first row in the file should contain field headers or column names. Remove everything else, eliminating empty columns and/or rows. As the difference illustrated in this book between Dimensions and Measures becomes clear, it will also be easier to understand how best to reshape data for optimal use in Tableau.

Incorrect Formatting for Data Tables



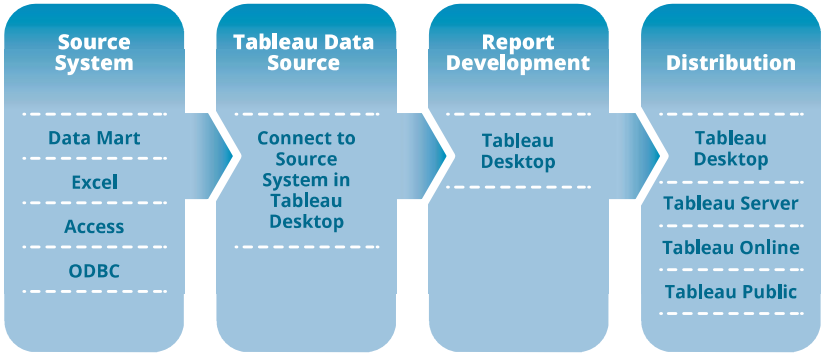
Correct Formatting for Data Tables



	A	B	C	D
1	Patient	Date	Lab Test	Value
2	1234	1/1/14	Sodium	135
3	1234	1/1/14	Potassium	3.7
4	1234	1/1/14	Chloride	109
5	1234	1/15/14	Sodium	140
6	1234	1/15/14	Potassium	5.1
7	1234	1/15/14	Chloride	104
8	1234	2/1/14	Sodium	145
9	1234	2/1/14	Potassium	4.2
10	1234	2/1/14	Chloride	110
11	7005	1/11/14	Sodium	139
12	7005	1/11/14	Potassium	4.2
13	7005	1/11/14	Chloride	106
14	7005	2/22/14	Sodium	146
15	7005	2/22/14	Potassium	4.1
16	7005	2/22/14	Chloride	108

Tableau Overview

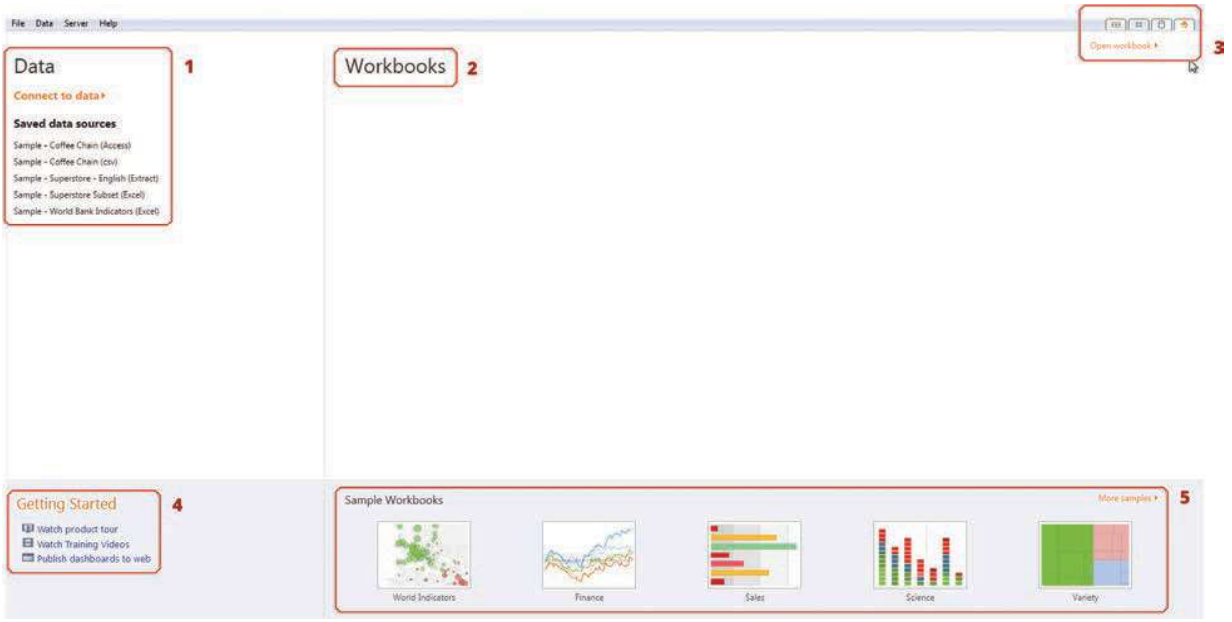
Data starts as a table or series of tables in a source system such as Excel, Access, or a live database. The first requirement in generating a display in Tableau is to connect to the desired data. Tableau Desktop connects as directed to one or more tables in the source system, then permits building reports. These reports can be saved with a snapshot of the data and distributed to other users through multiple channels. More information on distributing reports is in Chapter 28 - Distribution.



The Tableau Start Page

The Start Page contains five sections, illustrated by the screenshot below. Sections 1 through 3 permit connection to data and interaction with workbooks. Sections 4 and 5 provide a practice space where a user can work with Tableau's training dataset.

1) **Data:** enables connecting to the data source.
2) **Workbooks:** displays most recently created/edited workbooks.
3) **Top Right Tabs:** display workspace controls. See callout below for details.
4) **Getting Started:** provides links to Tableau tutorials.
5) **Sample Workbooks:** predesigned material on which new users can practice.



At the top right corner of the Tableau Start Page are workspace control tabs:


Displays the Tableau workspace


Displays thumbnail images of all active worksheets


Displays a Connect to Data page for locating data sources


Navigates back to the Tableau Start page.

Data Sources

» In the Data section, click "Connect to Data."

This new page enables connections to any supported data source. Tableau works with 30+ data sources: traditional databases, OLAP databases, file-based data sources like CSV and

Excel, cloud data sources like Google Analytics and Salesforce.com, and a wide variety of other databases. Additionally, Tableau will connect to data using Microsoft's Open Database Connectivity (ODBC), or allow cutting and pasting data directly into Tableau via the Windows Clipboard.

Connect to Data

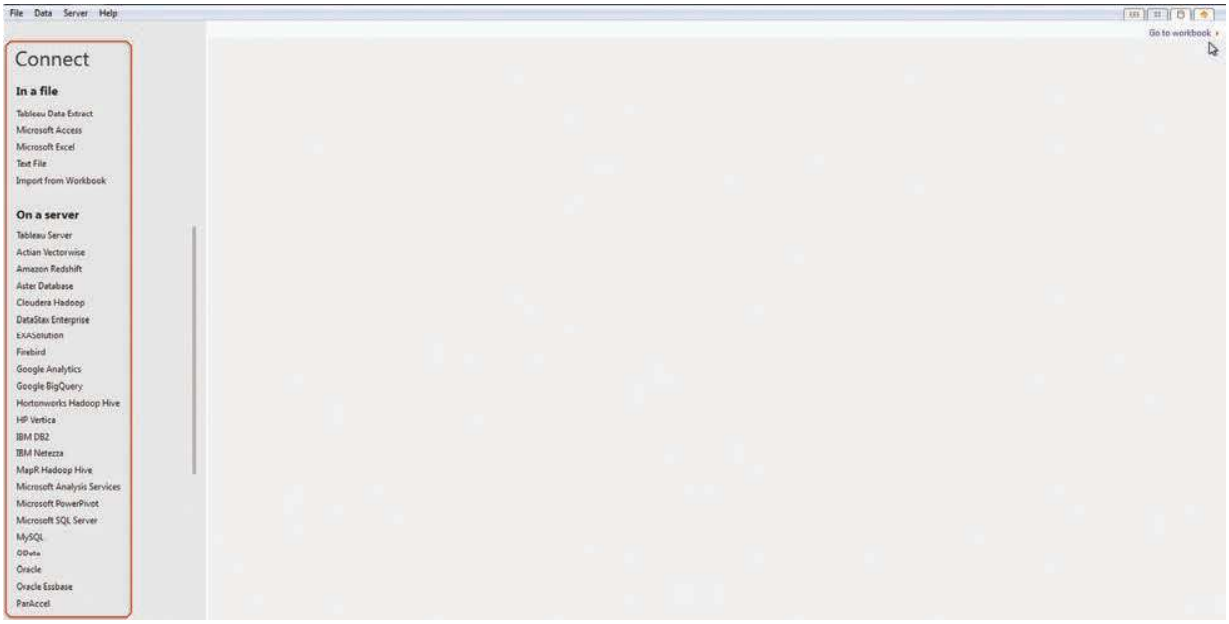


Tableau Editions ▲

*If the menu title **On a server** is not visible on the screen, the Tableau Personal Edition is being used. Only Tableau Professional Edition allows the user to connect to data on a server.*

Connecting to the desired data source determines the next steps. All data connections follow the same general steps; however, each data-connection type will have its minor differences.

Two common connections, Microsoft Excel and Microsoft SQL Server, are shown as examples below. General steps for connecting include:

1. Select data source type
2. Navigate to data source (input credentials if required)
3. Select Sheet(s)/Table(s) to import
4. Name data source or connection

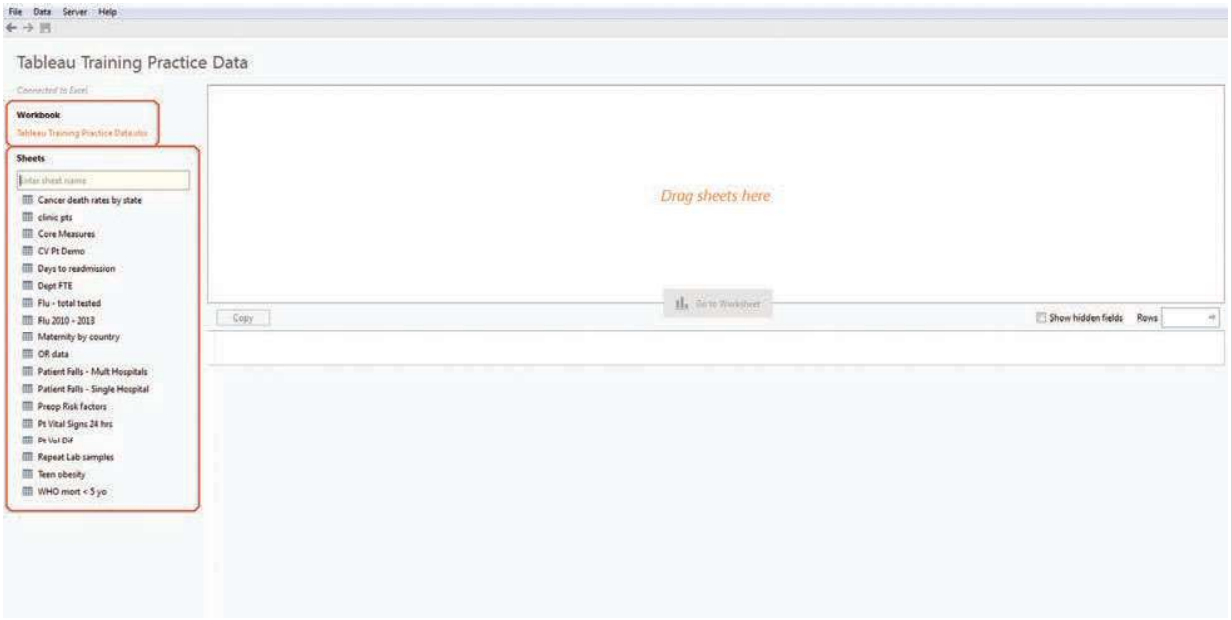
Example 1: Microsoft Excel

1 Select Data Source Type

- Click on "Connect to Data."
- Under the "In a file" heading, select "Microsoft Excel."

2 Navigate to data source and input credentials when required

- Select the desired Excel file. The data connection screen will populate the file name under Workbook.



3 Select Excel worksheet(s) to import

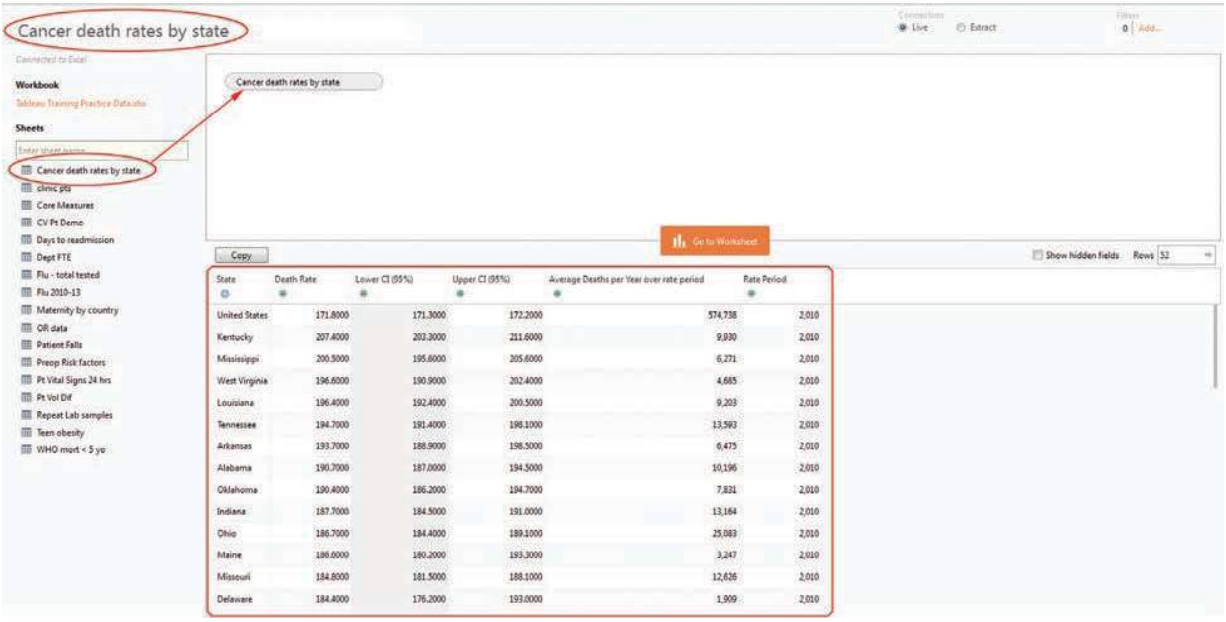
- Tableau lists each worksheet in an Excel file under Sheets. To select one of these worksheets:

  Option 1: Drag desired sheet to white space labeled "Drag sheets here".

  Option 2: Double-click on the file to populate the white space.

Before importing the data into a new Tableau worksheet, it is possible to:

- Preview data
- Rename column headers
- Hide columns
- Change data types



Note that dragging more than one sheet to the data connection window activates table joins. This somewhat complex process is explained in the Data Source Manipulation chapter. The present chapter assumes that only one worksheet is active in the workspace.

4 Name data source/connection

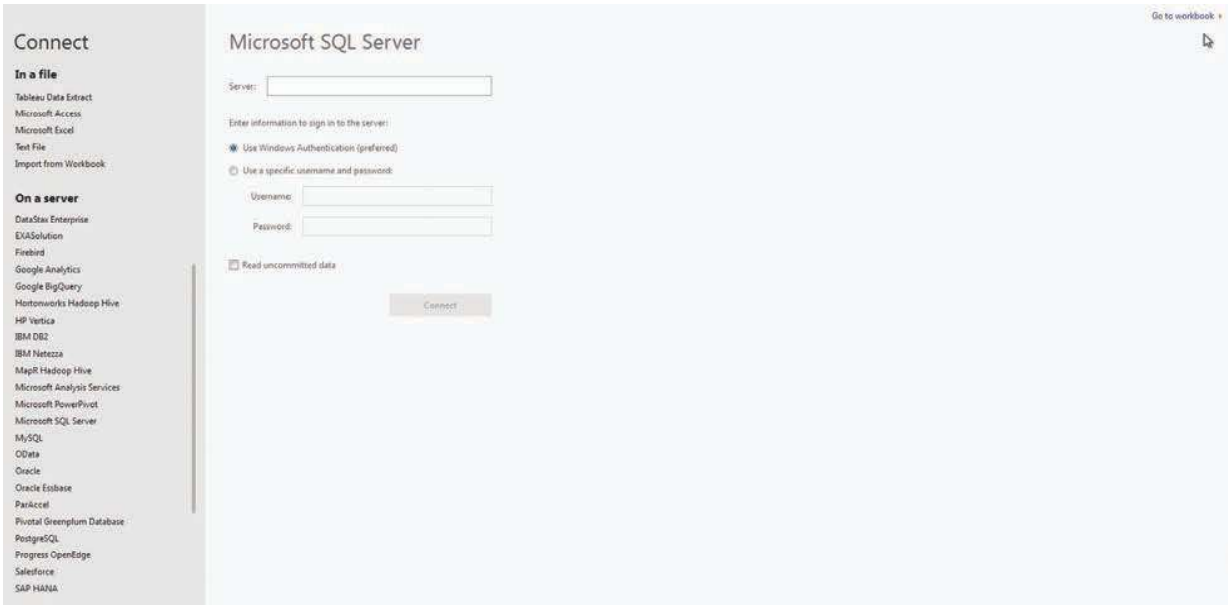
» Replace the pre-assigned title with a descriptive one by highlighting the title field (upper left corner of the workspace) and typing in the chosen name.

Example 2: Microsoft SQL Server

1 Select Data Source Type

» Click on “Connect to Data.”

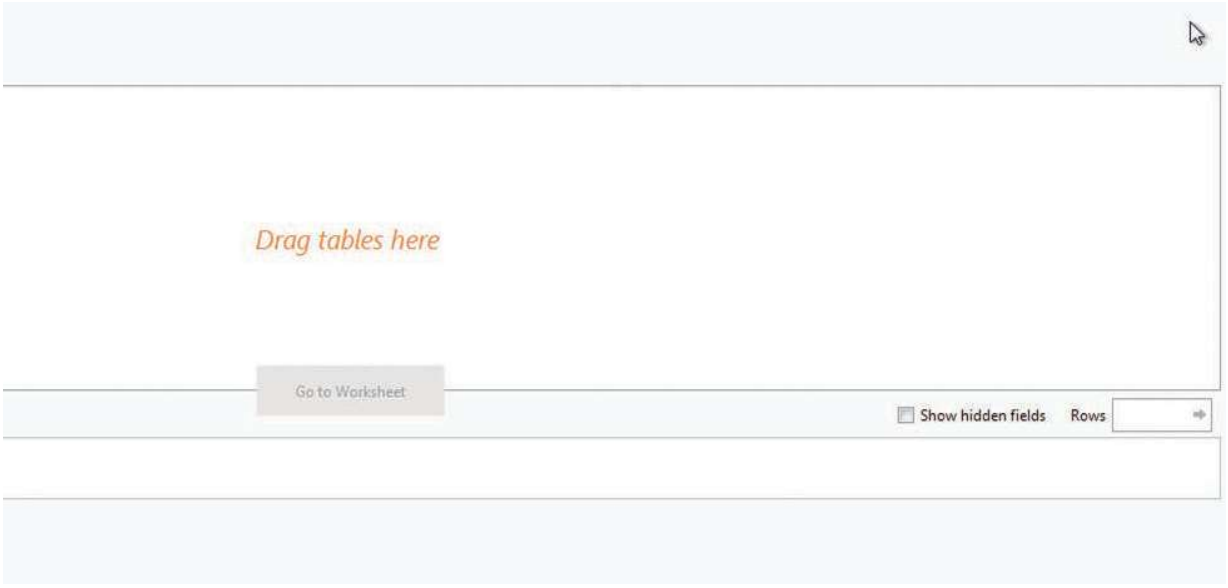
» Under the “On a server” heading, select “Microsoft SQL Server.”



2 Navigate to data source and input credentials when required

To fill in the required fields for a Microsoft SQL Server connection:

- Enter the server name.
- Provide login credentials for the server by specifying whether to use Windows Authentication or a specific username and password.
- Click "Connect."



3 Select table(s) to import

- Choose a database from the "Select Database" drop-down menu to show a list of available tables.
- Select a table or view from the list and drag it into the "Add Table" workspace.

4 Name data source/connection

- Replace the pre-assigned title with a descriptive one by highlighting the title field (upper left corner of the workspace) and typing in an appropriate name.

Live vs. Extract

Before continuing, select a data connection method. Choose whether to connect directly to the data source or import the data into Tableau's data engine by clicking the radio button "Live" or "Extract."

Option 1:

Option 2:

Data Connection ▲

The final step for Data Connection is to decide whether to create a live connection to the data or to extract data from the data source into Tableau's data engine. The connection method depends on user requirements and available network resources.

Live: *Tableau connects directly to the data source and queries this source in real time when the report is rendered or changed. No data is stored in the .twb workbook file used to develop the report.*

Extract: *Tableau takes a snapshot of the data and stores it in a proprietary file type called a Tableau Data Extract (.tde). This .tde data file is combined with the .twb workbook file and extracted to create a Tableau Packaged Workbook (.twbx) file. When the report is rendered or changed, it does not query the original data source, but instead queries the .tde data extract.*

Best Practice

There are many reasons to extract data when developing and distributing Tableau reports. Among them are that:

1) Tableau Extracts are optimized to perform faster.

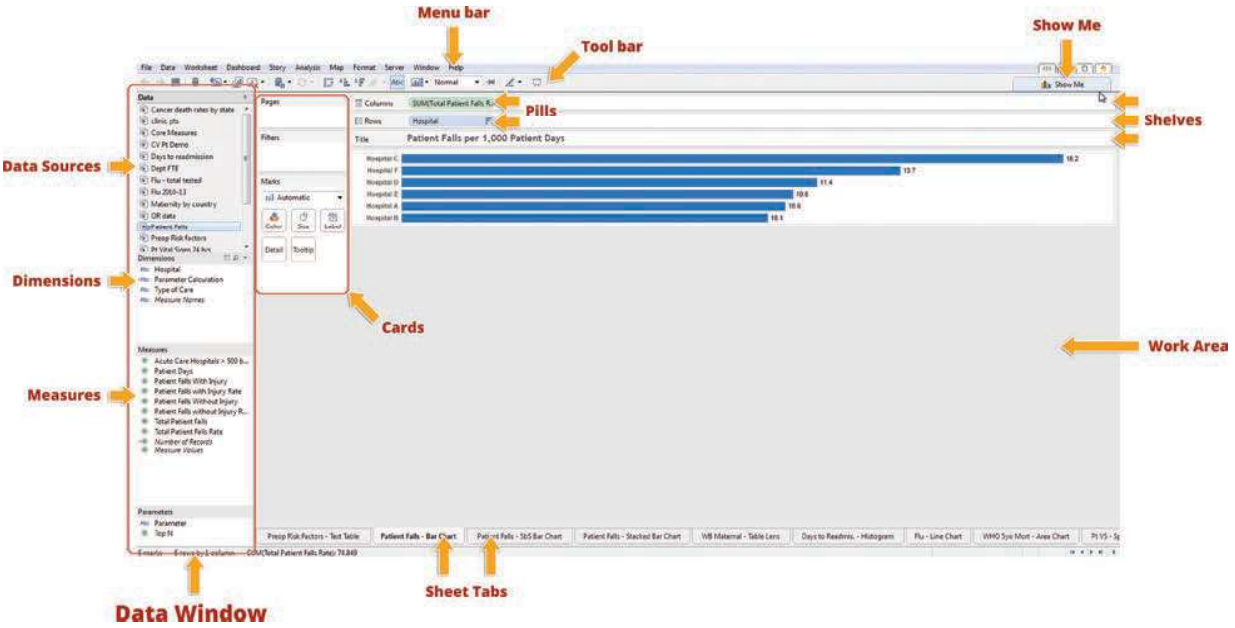
2) Tableau Packaged Workbooks do not require the end user to have access to the underlying (possibly remote) data connections; they can be distributed and used for offline analysis.

3) Data extracts can make use of advanced techniques such as double aggregations.

If real-time analysis is needed, a live data connection can be used.

Tableau Desktop Layout

The top of the Tableau layout is similar to all Window and Mac applications, with the Menu bar across the top of the workspace and the Tool bar below it. These features will be discussed in more detail later in this book. For now, the focus is on the Data Window and the Workspace.

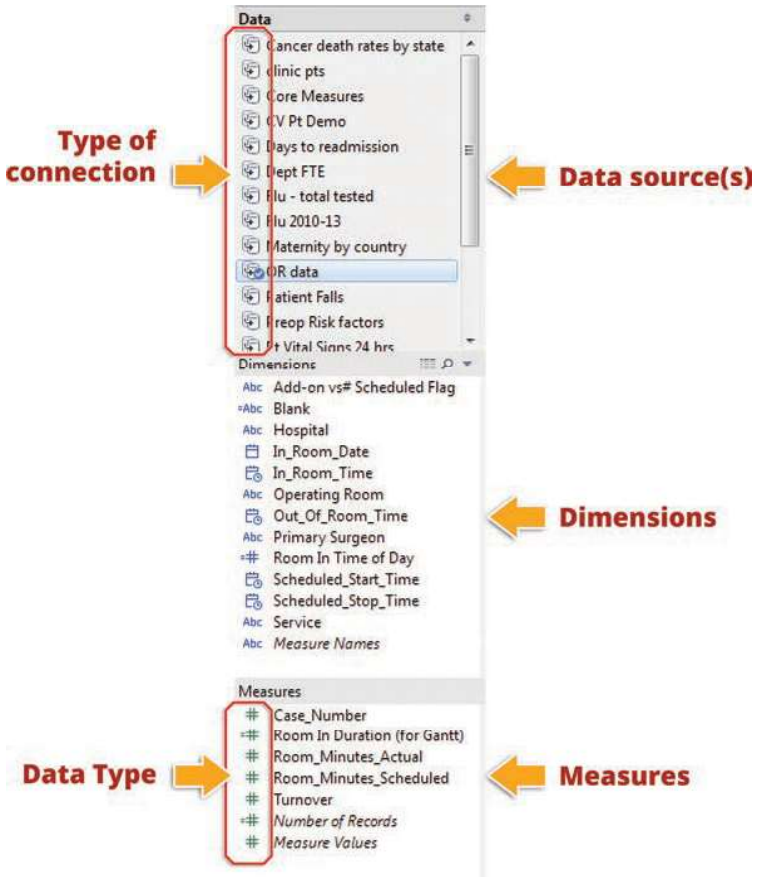


The Data Window

After a connection to the data has been established, Data sources appear at the top of the left-hand column in the Data Window. This area is divided into three sections: Data, Dimensions, and Measures. Data contains all imported datasets; Dimensions and Measures contain fields from the datasets arranged according to Tableau's inherent logic. (The fields can be rearranged if desired.)

Data Window ▸

The Data Window can be hidden from the view by clicking the double caret in its upper right corner. The Window then collapses to the bottom left of the screen. Click the double caret again to reveal the Window.



Data sources

As mentioned above, datasets imported into Tableau appear in the Data sources window. The icon to the left of each data source indicates the type of connection:

Live connection to a relational data source.

Connection to an extract of the data source.

Connection to a multidimensional or cube data source.

A *blue* checkmark appearing on a connection means that the data source is the *primary* one for the worksheet; an *orange* checkmark indicates a *secondary* source.

Dimensions vs. Measures

When Tableau connects to a data source, the fields are displayed at the left side of the workbook in the Data Window, and will be used to build the view of the data. When connecting, Tableau evaluates each field in the dataset: categorical data appear in the Dimensions win-

dow and quantitative data in the Measures window. The differences between the two are displayed below:

DIMENSIONS	MEASURES
Categorical data, headers, groupings, or variables	Quantitative (numerical) data, measures, or metrics
Organizes data into groups	Used in calculations, such as sum or average
Answers the questions Who? What? Where? When?	Answers the questions How much? How many? How long?

▲ **Reassigning Dimensions and Measures**

Occasionally, Tableau gets a field arrangement wrong, and in many cases, a field can serve as both a Dimension and a Measure depending on the analysis performed. If this is the case, however, a Measure can be changed to a Dimension (or vice versa) by: 1) right-clicking a pill in the worksheet and selecting "Convert to Dimension" or "Convert to Measure;" or 2) dragging a field from one pane to the other in the Data window.

If Tableau is connected to a cube data source (such as Microsoft Analysis Services), however, dimensions and measures are predefined in the database and cannot be reassigned.

Data Types

Each field is automatically assigned a Data Type reflecting the kind of information stored in that field. Types might be integers (932), dates (1/23/2014), or strings ("Universal Hospital"). The Data Type is identified by a unique icon placed to the left of each field in the Data Window.

Icon	Value Description
Abc	Text
#	Numerical
	Date
	Date and Time
T|F	Boolean
	Geographic

◀ **Data Type Icons**

Any icon preceded by an equal sign (=) denotes a user-defined calculated value field or a copy of another field—for example =# or =Abc.

Sometimes Tableau matches a field with an incorrect data type—for example, a field that contains dates may be identified as an integer rather than a date. The Data Type can be changed in Tableau by right-clicking the field in the Data window, selecting Change Data Type, and selecting the appropriate Data Type.

Continuous vs. Discrete

Besides the Dimension and Measure settings, fields are also either continuous or discrete, as indicated by color in Tableau: blue signals a discrete field; green, a continuous one. In the Data Window, Dimensions and Measures field icons are colored to indicate the data type. When a field name is dragged onto the worksheet, it turns into an oval "pill" of the same color as the icon.

In the majority of cases, Dimensions are discrete (blue) fields, and Measures are continuous (green) ones. This seems logical, as Dimensions create category headings and Measures create axes along a continuous scale; however, it may sometimes be useful to display continuous Dimensions or discrete Measures in a view. If so, remember that discrete fields always add headers to the view, while continuous fields always add axes.

Tableau-Generated Data Fields

The Data window contains a few fields that are not part of the underlying data source: Measure Names, Measure Values, Number of Records, Latitude, and Longitude.

MEASURE NAMES AND MEASURE VALUES:

These are Tableau's tools for allowing more than one measure to appear in the same place. Tableau automatically adds these two fields to every data set, placing the Measure Names field at the bottom of the Dimensions window, and the Measure Values field at the bottom of the Measures window. "Measure Names" contains all measure names in a single dimension. Measure Values contains all data source measures in one field. These unique fields make it possible to build data views involving multiple measures.

Measure Names and Measure Values offer an easy way to begin exploring a data set, or to create a quick crosstab table.

- Double-click on "Measure Names" in the Dimensions window. This will place Measure Names on the Columns shelf and Measure Values on the Text selector in the Marks card.
- Click the "Swap" icon on the Tool bar.

NUMBER OF RECORDS:

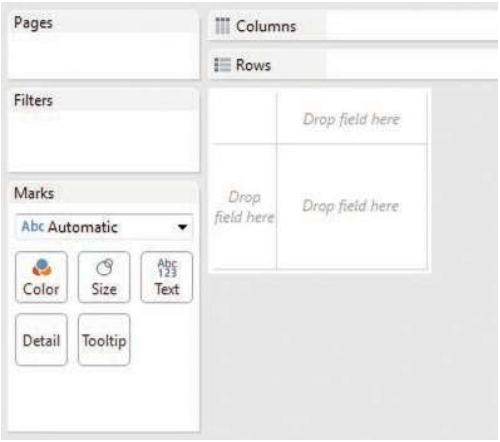
Represents the number of rows in the data source. Because Tableau totals the rows in the data source, the Number of Records is a calculated value; the field icon before it in the data window is therefore an equal sign.

LATITUDE AND LONGITUDE:

In fields defined as geographic (that is, used with maps), Tableau automatically geocodes the data and includes Latitude (generated) and Longitude (generated) fields. These fields can overlay data on live maps.

Shelves, Cards, and Work Area

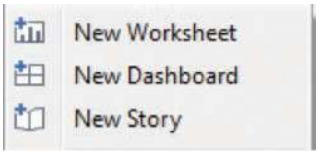
The layout of any chart created in Tableau is controlled by the placement of data fields on Shelves and/or Cards. (These features will be discussed in detail throughout the book.) Placement of fields on Shelves or Cards is accomplished by: dragging and dropping; double-clicking; or using Show Me, Tableau's automated data visualization best-practice tool.



Placing a field on the Columns shelf displays a column view; on the Rows shelf, a row view. The Filters shelf enables the selection of data to be included or excluded in the chart display. The Marks card provides control of color, size, labels, shape, angle, and pop-up Tooltips.

Sheet Tabs

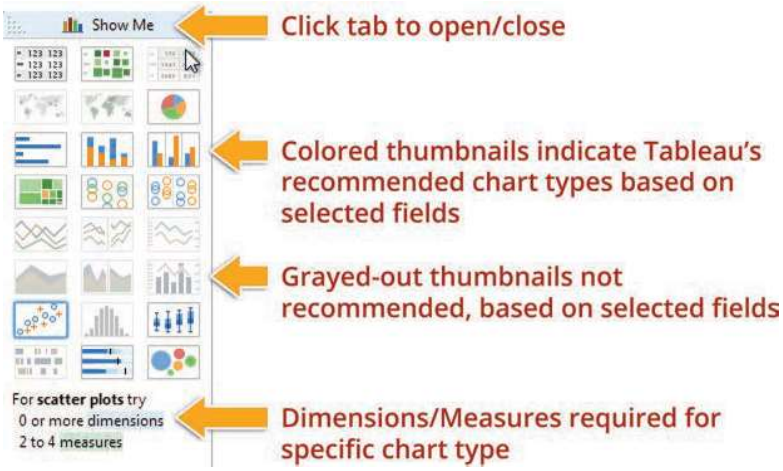
Each Workbook contains three different sheet types: Worksheet, Dashboard, and/or Story. A New Worksheet permits building views of the data. A Dashboard combines multiple views for presentation or monitoring. A Story (also called Story Points) permits narration of views. These sheet types are discussed in greater depth in Chapters 3-19 (Worksheets), Chapter 20 (Dashboards), and Chapter 21 (Story Points).



Show Me

Show Me is a smart tool that creates a view based on fields selected in the Data Window or according to fields already in use in the view. Tableau automatically evaluates the selected fields and determines what view options are appropriate based on best practices for data visualization. The Show Me window suggests appropriate visualization type(s) for the data selected in the Data Window. (Recommended formats are highlighted by a blue border.)

Hovering over each thumbnail in the Show Me dialog box displays a chart name and required dimensions and measures at the bottom of the box. Clicking on the thumbnail quickly creates the desired chart. Show Me options are available for both new charts and existing ones.



Undo/Redo Buttons

These two useful buttons are located on the far left of the Toolbar. The Undo button reverses the most recent action(s) taken in the order that each was performed. The Undo action works backward to the last time the workbook was opened. The Redo button reinstates any action(s) reversed by the Undo button. The Redo action works forward to the most recent action performed in the workbook.

Important: Action history is saved until the workbook is closed; it is not maintained between sessions.

File Types and Saving

Tableau has no automatic "Save" feature. Work can be saved as several different Tableau-specific file types, depending on user needs.

Tableau Workbook (.twb)

This format is the most common file type, and Tableau's default way of saving work. Tableau workbooks are much like those in Microsoft Excel. They contain one or more worksheets, dashboards, or stories, as well as all the information required to draw a visualization, such as fields used in each view, how measures are aggregated, style and formatting applied, etc. The workbooks also include data-source connection information and any metadata created for that connection; however, they do not include the data itself.

To create a .twb file:

» On Tableau Menu row, select "File."

- Select "Save."

Tableau Packaged Workbook (.twbx)

A Packaged Workbook combines the information in a workbook and bundles it with any local data, meaning any data not on a server. This file type is for sharing work with those who do not have access to the data source. These files can also be read with Tableau Reader.

To create a .twbx file:

- On Tableau Menu row, select "File."
- Select "Save As."
- Choose the ".twbx" option from the dropdown menu at the bottom of the Save As dialog box.

Tableau Data Extract (.tde)

Data Extracts are a local copy of an entire data source or a highly compressed subset that can be used to share data, work offline, or speed up database performance. Connecting to data using Tableau can be either "Live" or "Extract"[ed] into a .tde file. The disadvantage of using an Extract is that the Tableau visualization no longer points to the Live data source; however, the ability to refresh an Extract is only a few clicks away and can be scheduled using Tableau Server.

To create a .tde file:

If the live connection has already been established,

- Right-click the data source connection.
- Select "Extract Data."

If connecting to the data for the first time,

- Select the "Extract" radio button.

Tableau Bookmark (.tbm)

Bookmarks contain the data view from a single worksheet. They act like web browser bookmarks and can be accessed without opening any other document. Even though Tableau has recently enabled the copy and paste function for worksheets, the Bookmark is still a time-saver when creating templates to be used in multiple workbooks.

To create a .tbm file:

- Click "Window" in the Menu row.
- Select "Bookmark."
- Select "Create Bookmark."

To reuse a Bookmark:

- Click “Window” in the Menu row.
- Hover over “Bookmark” and select [Bookmark Name].

Note: A Bookmark cannot be created from a dashboard page.

SECTION 2

Basic Charts

Text Table

A Text Table encodes words and numbers and arranges them in columns and rows. Also called crosstabs or pivot tables, Text Tables are used to display simple relationships between quantitative values and corresponding categorical subdivisions. This structure makes tables ideal for looking up and comparing individual values. When deciding between building a text table and a chart, always think about how the information will be used. Choose a table when your audience will need either to look up individual values or compare values.

How To: Build a Text Table to look up specific preoperative risk factors to compare a hospital's results to benchmark data.

Title: **Preoperative Risk-Factor Rates - Hospital vs. Comparison**

Preoperative Risk Factors	Hospital %	Comparison %
Acute Renal Failure	4.0	3.0
Alcohol Use	16.7	10.0
Bleeding Disorder	3.3	2.0
BMI > 30	33.3	40.0
Congestive Heart Failure	10.0	15.0
Diabetes	25.3	35.0
Disseminated Cancer	1.6	1.2
DNR Status	0.5	0.3
Dyspnea	12.0	15.0
Functional Health Status < Independent	8.7	10.0
History of Severe COPD	17.3	15.0
Hx of MI w/in 6 months	5.3	4.5
Hypertension req. medication	56.7	61.0
Sepsis within 48 hours	6.4	4.5
Smoking	20.0	17.0
Stroke	4.7	4.0
Transfusions	3.3	5.0

Data Source: *Mock pre-operative risk-factors for patients having surgery*

About the Data: *Pre-operative risk factors are important for the fair comparison of surgical outcomes. We created this mock data based on similar information captured by different surgical outcome programs such as the National Surgical Quality Improvement Program (NSQIP), the Society for Thoracic Surgeons General Thoracic Surgery Database (STS GTSD), and the Bariatric Longitudinal Outcomes Database (BOLD), which capture, report, and benchmark, clinical, risk-adjusted surgical outcomes for the improvement of surgical care in hospitals.*

1 Connect to the data

- Open the file "Tableau Training workbook - new.twbx" downloaded from the HealthDataViz website.
- In the Data Window, click on "Preop Risk Factors" to select the dataset.

2 Create the chart

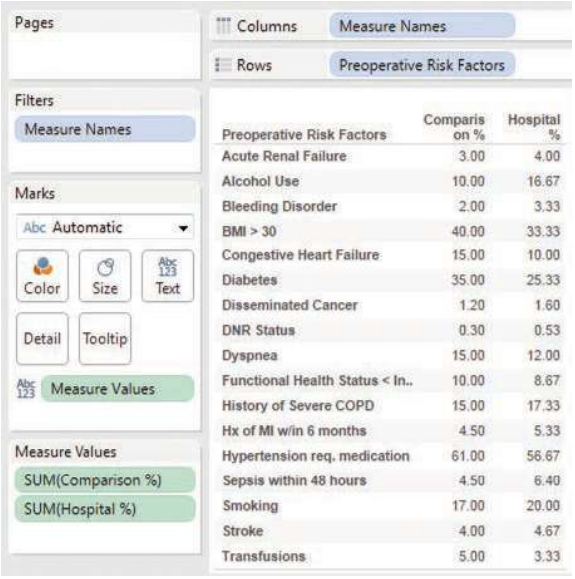
» Double-click on the following three fields:

- "Preoperative Risk Factors" in the Dimensions data window.
- "Hospital %" in the Measures data window.
- "Comparison %" in the Measures data window.

Populating fields via double-click ▸

There are several ways to populate a worksheet with data, including double-clicking fields, dragging and dropping, and using the Show Me button. When a field from the Dimensions or Measures window is double-clicked, Tableau makes its best guess as to where that field should go based on what is already populated in the current report. The order of double-clicking will affect the data display, but fields can always be rearranged once they are on the worksheet.

The table initially looks like this:



Preoperative Risk Factors	Comparison %	Hospital %
Acute Renal Failure	3.00	4.00
Alcohol Use	10.00	16.67
Bleeding Disorder	2.00	3.33
BMI > 30	40.00	33.33
Congestive Heart Failure	15.00	10.00
Diabetes	35.00	25.33
Disseminated Cancer	1.20	1.60
DNR Status	0.30	0.53
Dyspnea	15.00	12.00
Functional Health Status < In..	10.00	8.67
History of Severe COPD	15.00	17.33
Hx of MI w/in 6 months	4.50	5.33
Hypertension req. medication	61.00	56.67
Sepsis within 48 hours	4.50	6.40
Smoking	17.00	20.00
Stroke	4.00	4.67
Transfusions	5.00	3.33

"Measure Names" and "Measure Values" categories

Measure Names and Measure Values pills are Tableau's solution to allowing more than one measure to appear in the same place. Tableau automatically adds the above two fields to the data set, placing the Measure Names field at the bottom of the Dimensions window, and the Measure Values field at the bottom of the Measures window. For certain chart types, when multiple measures are used in the same location, Tableau automatically adds the Measure Names and Measure Values pills to the worksheet, and a Measures Values shelf appears showing the measure fields.

3 Format the data

The next step is to format the data; all numbers should be displayed with one decimal place only.

- Right-click on the "SUM(Comparison %)" pill on the Measure Values shelf.
- Select "Format..."

Measure Formatting

By default, Tableau will typically display measures in the same data format as the underlying data source. Adjusting formatting not only permits great precision (i.e., how many decimal places to include), but also allows correct formatting of elements such as percentages, monetary amounts, and numerical prefixes/suffixes.

Format Measures in one of two ways:

1. Default format change: *Change the default formatting from the Measures section, so all future uses of the Measure will display the new format. Selected formatting will then persist when the field appears in other worksheets.*

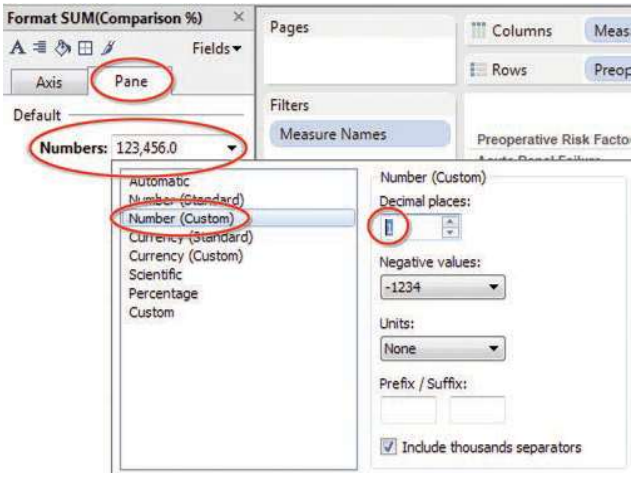
2. Single-use format change: *Change only the formatting of a Measure field already in the worksheet.*

To change the default format: *Right-click on the field in the Measures area of the Data window. Select Default Properties, then choose a new formatting option.*

To make a single-use format change: *Right-click on the field pill already in the worksheet. Select Format; select Number drop-down; change to an appropriate format.*

Selecting "Format" opens the Format Window, replacing the Data Window at the left of the screen.

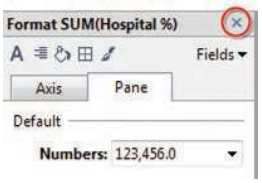
- Ensure the "Pane" tab is selected.
- Click the caret to the right of the "Numbers" field to open the drop-down menu.
- Select "Number (Custom)."
- Change "Decimal places" from 2 to 1.



- Perform the same steps for "SUM(Hospital %)."

To return to the Data / Dimensions / Measures window:

- Click the "X" in the upper right corner of the Format window.

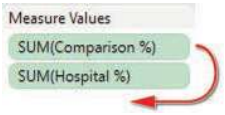


4 Format the columns

The data columns need to be switched so the "Hospital %" data is displayed to the left of the "Comparison %" data.

To switch the columns:

» Drag and drop the "SUM(Comparison %)" pill to below the "SUM(Hospital %)" pill on the Measure Values shelf.



To ensure clear, readable column and row width formatting, adjust the width as follows:

» Hover cursor between the first two columns until it changes to a horizontal bi-directional arrow.

» Click and drag the width to completely display all text.

Preoperative Risk Factors	Hospital %	Comparison %
Acute Renal Failure	4.0	3.0
Alcohol Use	16.7	10.0
Bleeding Disorder	3.3	2.0
BMI > 30	33.3	40.0
Congestive Heart Failure	10.0	15.0
Diabetes	25.3	35.0
Disseminated Cancer	1.6	1.2
DNR Status	0.5	0.3
Dyspnea	12.0	15.0
Functional Health Status < In..	8.7	10.0
History of Severe COPD	17.3	15.0
Hx of MI w/in 6 months	5.3	4.5
Hypertension req. medication	56.7	61.0
Sepsis within 48 hours	6.4	4.5
Smoking	20.0	17.0
Stroke	4.7	4.0
Transfusions	3.3	5.0

◂ Column Sizing

Column widths containing text can be customized as described above. Columns containing figures will remain proportional.

◂ Row Sizing

Rows must remain proportional and evenly spaced in a text table. Adjusting the height of one row by hovering and dragging will change all rows to maintain proportions.

Best Practice

Tableau automatically right-justifies values in a Text Table to ensure values are correctly aligned (i.e., ones, tens, and hundreds) for ease of comparison.

Preoperative Risk Factors	Hospital %	Comparison %
Acute Renal Failure	4.0	3.0
Alcohol Use	16.7	12.0
Bleeding Disorder	3.3	5.0
BMI > 30	33.3	40.0
Congestive Heart Failure	10.0	15.0
Diabetes	25.3	35.0
Disseminated Cancer	1.6	1.2
DNR Status	0.5	0.3
Dyspnea	12.0	15.0
Functional Health Status < Independent	8.7	10.0
History of Severe COPD	17.3	15.0
Hx of MI w/in 6 months	5.3	4.5
Hypertension req. medication	56.7	61.0
Sepsis within 48 hours	6.4	4.5
Smoking	20.0	17.0
Stroke	4.7	4.0
Transfusions	3.3	5.0

5 Add a title

To add a title to the Text Table:

- » In the Menu row, click on "Worksheet."
- » Click "Show Title."

Titles ▸

*Selecting **Show Title** from the Worksheet menu places a checkmark next to the Show Title menu option and makes the title visible in the workspace under the Columns and Rows shelves.*

The Title displays under the Columns and Rows shelves.

The Title text defaults to the generic Tableau worksheet number. To edit Title text:

- Double-click on the text in the Title field (in this example, 'Sheet1'). A dialog box will appear.
- Highlight and delete the current title.
- Enter the new title, "Preoperative Risk Factor Rates – Hospital vs. Comparison" and click "OK."

Title Formatting

Titles provide a powerful tool for conveying metadata about a worksheet. In addition to including and formatting normal text, the Insert option at the top right of the Title menu screen can be used to add fields, data -connection information, or caption text.

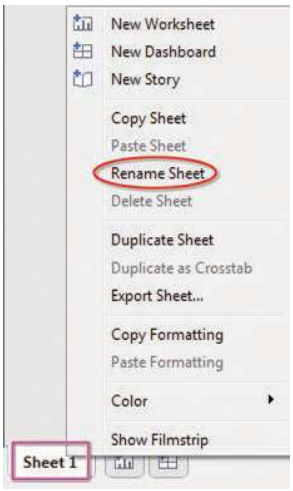
The final table looks like this:

Title	Preoperative Risk-Factor Rates - Hospital vs. Comparison	
Preoperative Risk Factors	Hospital %	Comparison %
Acute Renal Failure	4.0	3.0
Alcohol Use	16.7	10.0
Bleeding Disorder	3.3	2.0
BMI > 30	33.3	40.0
Congestive Heart Failure	10.0	15.0
Diabetes	25.3	35.0
Disseminated Cancer	1.6	1.2
DNR Status	0.5	0.3
Dyspnea	12.0	15.0
Functional Health Status < Independent	8.7	10.0
History of Severe COPD	17.3	15.0
Hx of MI w/in 6 months	5.3	4.5
Hypertension req. medication	56.7	61.0
Sepsis within 48 hours	6.4	4.5
Smoking	20.0	17.0
Stroke	4.7	4.0
Transfusions	3.3	5.0

Insight: Presenting Hospital Preoperative Risk Factors in a text table allows the audience to see exact numbers in a clearly presented format. In this example, it is easy to tell that the Risk Factor Rate for Diabetes is 25.3% for the primary hospital vs. 35.0% for the comparison hospital.

6 Rename the worksheet tab and save the worksheet

- Right-click on the "Sheet1 tab" at the bottom of the screen.
- Click "Rename Sheet."
- Enter a new title ("Preop Risk Factors, Text Table"), then press Enter.



Best Practice

Always use intuitive names for worksheets to keep them organized and easier to navigate.

Best Practice

Save, save, and then save again! Saving during and after each chart is constructed is a sensible habit.

» Click the Save button.

HDVizoom™...to the Text Table

1 Connect to data:

- In Data window, click on "Preop Risk Factors" to select dataset

2 Create chart:

- Double-click on:
  - "Preoperative Risk Factors" in Dimensions data window
  - "Hospital %" in Measures data window
  - "Comparison %" in Measures data window

3 Format data:

- Right-click on "SUM(Comparison %)" pill on Measures Values shelf
- Select "Format..."
- Ensure "Pane" tab is selected
- Click down arrow next to "Numbers" field
- Select "Numbers (custom)"
- Change Decimal places from 2 to 1
- Perform same steps for SUM(Hospital %)
- Click "X" in upper right corner of Format window to close it
- Drag and drop "SUM(Comparison %)" to below SUM(Hospital %) on Measure Values shelf

4 Format columns:

- Hover cursor between first two columns until it changes to horizontal bi-directional arrow
- Click and drag width to display text

5 Add title:

- In Menu row, click on "Worksheet"
- Click "Show Title"
- Double-click on text in Title field
- Highlight and delete current title
- Enter new title, "Preoperative Risk Factor Rates – Hospital vs. Comparison" and click "OK"

6 Rename worksheet tab and save worksheet:

- Right-click on "Sheet1 tab" at bottom of screen
- Click "Rename Sheet"
- Enter new title ("Preop Risk Factors – Text Table"), then press Enter
- Click the Save button.

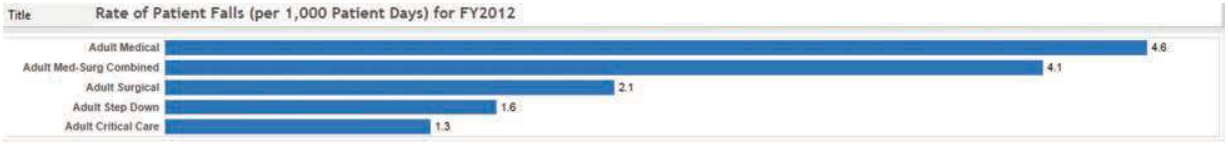
Bar Charts

Bar Charts are the most effective way to compare values across Dimensions or Measures, where the value of the Measure is represented by the length of the bar, revealing high and low values at a glance. One axis of the chart shows the specific categories being compared; the other represents a discrete value. Sorting (ranking) data in descending order highlights high values; ascending order highlights low values.

Because Bar Charts encode data values according to the length of the bar, they should always begin at the value zero. (Tableau's default value for Bar Charts is therefore zero.) There are two exceptions to this best practice: (a) the range of values to be encoded is so large that a Bar Chart's size would be unruly; (b) the differences to be displayed are hard to see over a wide scale. In either case, break the scale of the axis into two increments in an interrupted but clearly continuous scale (as described on Chapter 26, page 374).

4.1 Horizontal and Vertical Bar Charts

How To: Build a bar chart to compare rates of patient falls per 1,000 patient days across types of care for a single hospital.



***Data Source**: Mock patient-fall data*

***About the Data**: The American Nurses Association (ANA) National Database of Nursing Quality Indicators (NDNQI®) is a repository for nursing-sensitive indicators, reported at the nursing-unit level, designed to provide comparative information to hospitals for use in quality improvement activities. For this exercise, we created mock patient-fall data, similar to that captured by the NDNQI and other groups like the Centers for Medicare & Medicaid (CMS), to compare patient-fall rates per 1,000 patient days across types of care for a single hospital.*

1 Create a New Worksheet and Connect to the Data

» A new worksheet can be created in one of three ways:

Option 1: Select the "Worksheet" tab in the top menu and then select "New Worksheet."

Option 2: Click the "New Worksheet" tab at the very bottom of the workbook.

Option 3: Click the "New Worksheet" icon on the toolbar.

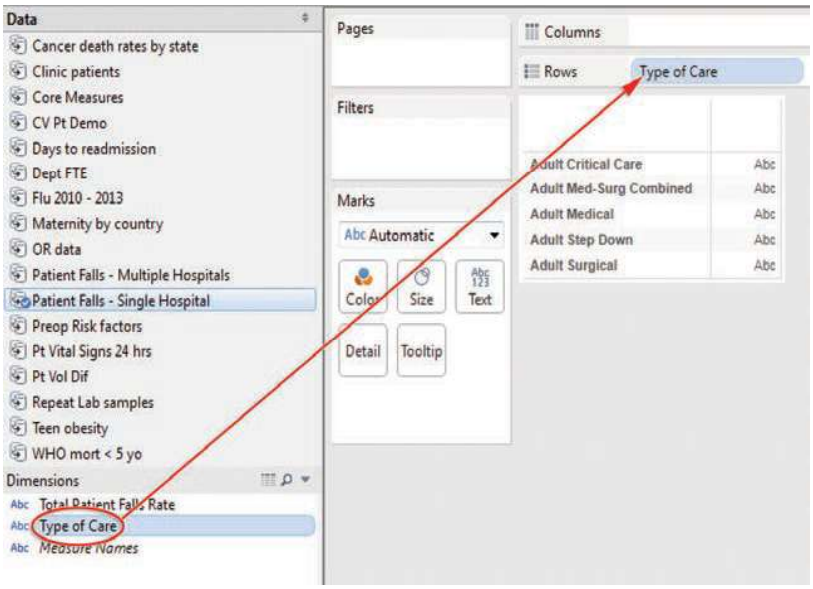
» Click on "Patient Falls - Single Hospital" in the "Data" window to select this dataset.

2 Create the Chart

» Drag and drop "Type of Care" from the Dimensions data window onto to the Rows shelf.

Primary Data Source ▸

Notice that once a field is added to the sheet, the data source for that field is marked with a blue check mark icon. This indicates the primary data source for this worksheet. Data from other data sources can be combined with this primary data source only by using a technique called "Data Blending," which will be covered in Chapter 26.



The next step is to move the value "Total Patient Falls Rate" from its current location on the Dimensions shelf to the Measures shelf.

» Drag and drop "Total Patient Falls Rate" from the Dimensions window to the Measures window.

◂ Dimensions and Measures

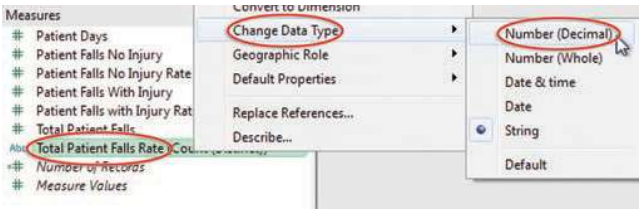
The difference between a Dimension and a Measure was discussed in Chapter 2, pages 20-21. To set a field as a Dimension or a Measure, drag and drop the field to the appropriate shelf. This will not affect the fields already present in your worksheet.

Notice the **Abc** icon to the left of "Total Patient Falls Rate," indicating that the data type is a String. Change the type to Number, as follows:

» Right-click on the "Total Patient Falls Rate" field.

» Select "Change Data Type."

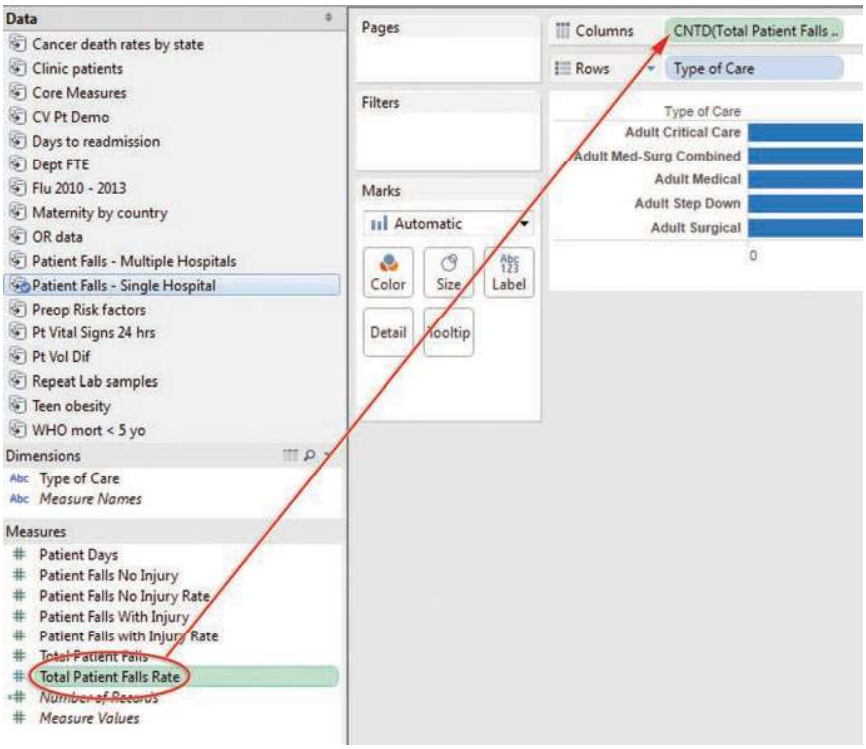
» Select "Number (Decimal)."



» Drag and drop "Total Patient Falls Rate" onto the Columns shelf.

◂ Data Types

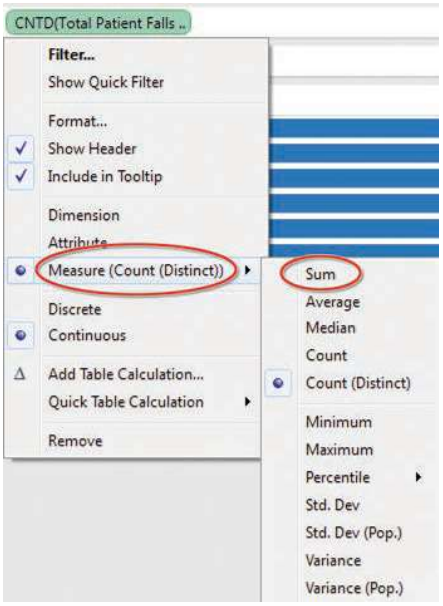
When Tableau connects to a new data source, it makes its best guess about the type of data being displayed (number, string, date, etc.). The data type will determine the types of calculations that can be performed on a particular field. For example, a SUM calculation can only be performed on a Number value; a date function, like DATEADD, can only be performed on a Date or Date & Time field. Data Types are easy to change by right-clicking on a Dimension or Measure field and selecting Change Data Type.



3 Validate the Data

First, notice that the Columns shelf "Total Patient Falls Rate" pill is labeled "CNTD(Total Patient Falls Rate)." (CNTD stands for Count Distinct – the number of unique values in this Measure, not the number of falls.) Since the data should be aggregated as a SUM, change its aggregation like this:

- Right-click on "CNTD(Total Patient Falls Rate)" on the Columns shelf.
- Select "Measure."
- Select "Sum."



Aggregation

It is important to notice which method Tableau is using to aggregate a measure in your report. A Sum will provide a very different result from that of a Count (Distinct).

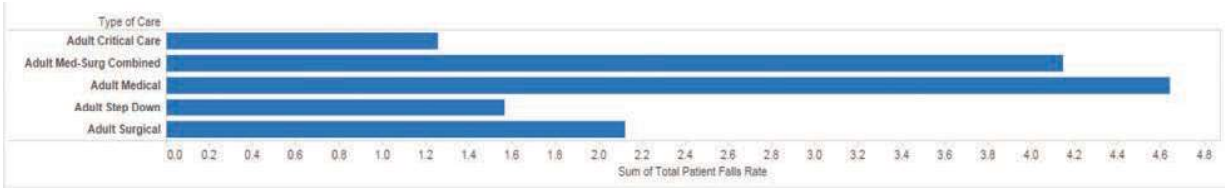
Change the aggregation in one of two ways:

Aggregation of the Pill: *this is a one-time change to the aggregation of a field already present in the worksheet. Right-click on the pill, click on Measure, then select the desired aggregation.*

Aggregation of the Measure: *this will change the default aggregation so the change will persist when the field is utilized in other worksheets. Right-click on the field in the Measures section, click on Default Properties, then select the desired aggregation.*

Note: *In this example, each Type of Care represents one row in the dataset. Therefore, Sum, Average, Median, Minimum, and Maximum of Total Patient Falls will return the same result. Count and Count (Distinct), however, will not.*

The chart now looks like this:



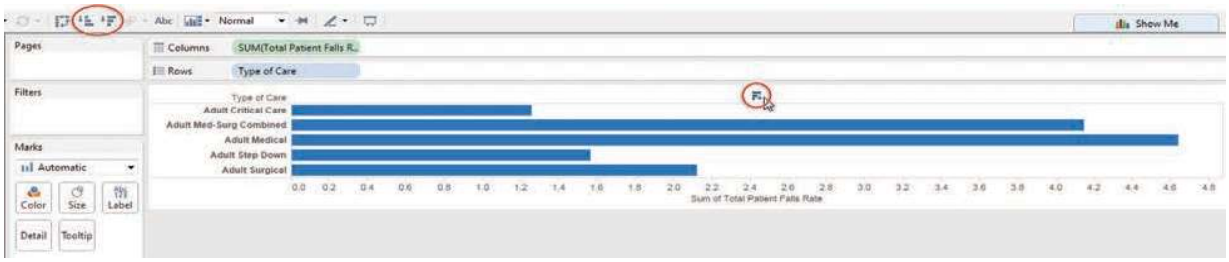
4 Sort and Format the Chart

The display is currently in alphabetical order by type of care. The desired ranking is number of patient falls from high to low.

» Change the ranking in one of two ways:

Option 1: Click on the Sort icon on the Toolbar to arrange in ascending or descending order

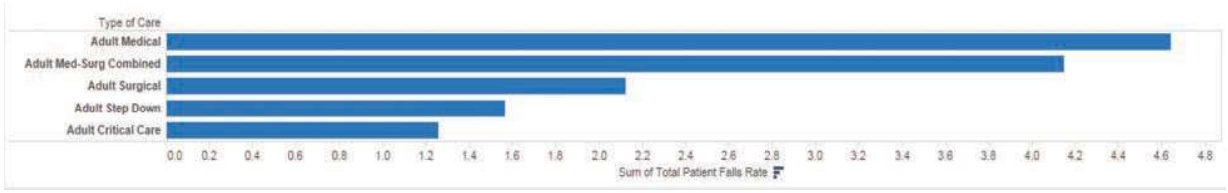
Option 2: Hover over the top of the chart to display the Sort icon, then click to select the desired ranking order—once to rank ascending, again to rank descending, and a third time to return to the original order.



Sorting ▲

Sorting is an important and powerful tool to direct an audience's attention. Chapter 12, page 138 will cover more advanced sorting options.

The chart is now ranked from highest number of falls to lowest.



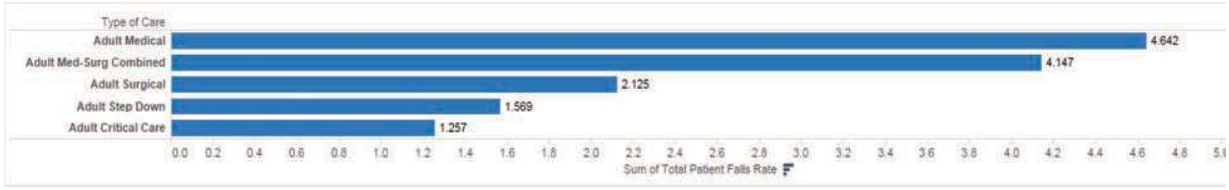
To label each bar with the actual rate of "Patient Falls per 1,000 Days":

» In the toolbar, click on the Abc icon. The label will appear automatically.

Labeling ▶

Alternatively, drag and drop the appropriate field (Total Patient Falls Rate in this example) to the Labels selector on the Marks card to accomplish this task.

The chart now looks like this:

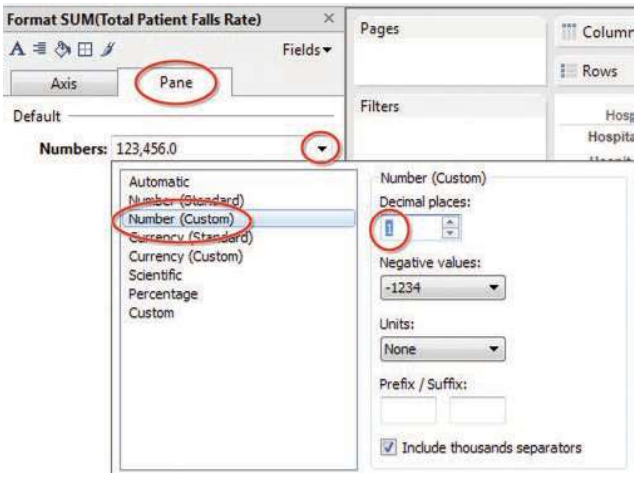


In the above image, the bar labels are carried out to the third decimal. This is unnecessary and creates clutter. To limit the label to one decimal place:

» Right-click on "SUM(Total Patient Falls Rate)" in the Columns shelf.

» Select "Format..."

- Select the "Pane" tab.
- Under "Default," click on the "Numbers" caret to open the drop-down menu.
- Select "Number (Custom)."
- Change "Decimal places" to 1.
- Click anywhere outside of "Numbers (Custom)" to close.

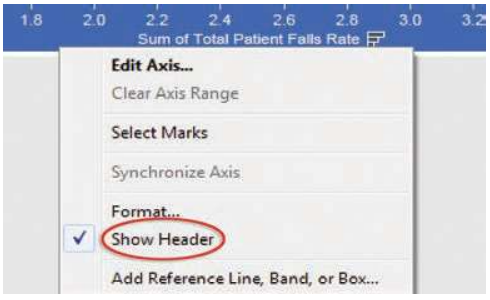


Formatting

Many aspects of a Tableau report can be formatted to meet the specific needs of a visualization: text labels, banding, borders, shading, and totals, among others. Right clicking almost anywhere in a worksheet pulls up a Format menu that lists options for changing the appearance or design of a particular report element.

To hide the X axis:

- Right-click on the X axis.
- Select "Show Header" to remove the checkmark and hide the X axis.



Best Practice

Since the labels in this example report are visible on each bar, the X axis can be hidden to reduce visual clutter. The decision to do this depends on the level of detail needed.

To remove the header on the Y axis:

- Right-click on the Y axis header label ("Type of Care").
- Click on "Hide Field Labels for Rows."

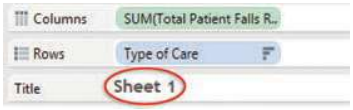
Best Practice

Field headers are sometimes needed to clarify the dimensions being viewed. If, however, field values are well-defined, like the type of care names in this example, remove the headers to reduce clutter.

5 Add a title

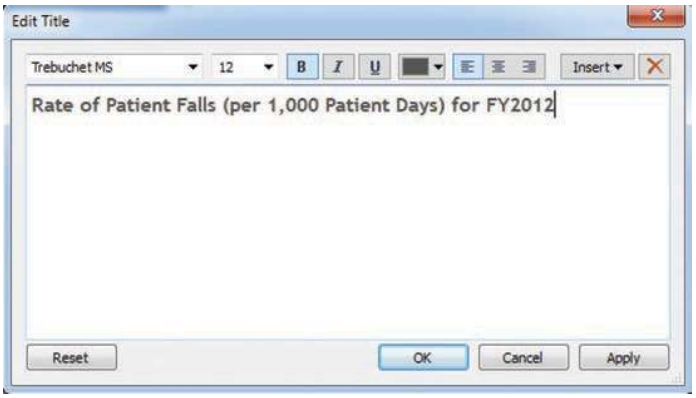
- Click on the "Worksheet" tab.
- Click "Show Title."

The "Title" will display beneath the "Columns" and "Rows" shelves.



The Tableau default title is the number of the worksheet. To change it:

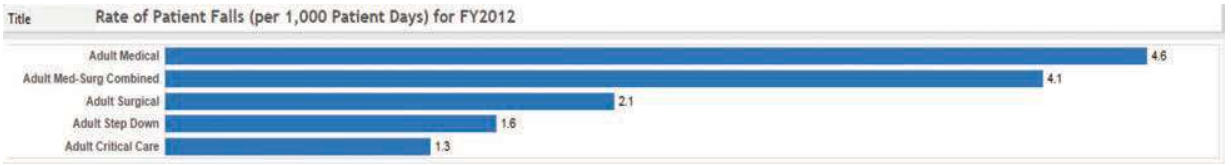
- Double-click on the text in the "Title" field (in this example, "Sheet1"). A dialog box appears.
- Highlight and delete the current title.
- Enter the new title, "Rate of Patient Falls (per 1,000 Patient Days) for FY2012," and click "OK."



6 Rename the worksheet tab and save the worksheet

- Right-click on the "Sheet1" tab at the bottom of the screen.
- Click "Rename Sheet."
- Enter the new title, "Patient Falls – Bar Chart."
- Select "Enter," then "Save."

The final bar chart looks like this:



Insight: The chart now makes it clear that in this example hospital for FY2012, Adult Medical has the highest rate of patient falls per 1,000 patient days (4.6), while Adult Critical Care has the lowest rate (1.3).

HDVizoom™...to Bar Charts!

1 Create new worksheet and connect to data:

» Choose one of three options:

Option 1:

- Select "Worksheet" tab on Menu bar then select "New Worksheet"

Option 2:

- Click "New Worksheet" tab at very bottom of workbook

Option 3:

- Click "New Worksheet" icon on Toolbar

» Click on "Patient Falls – Single Hospital" dataset in Data window to select data set

2 Create chart:

» Drag and drop "Type of Care" from Dimensions window onto Rows shelf

» Drag and drop "Total Patient Falls Rate" from Dimensions windows to Measures window

» Right-click on "Total Patient Falls Rate" field

» Select "Change Data Type"

» Select "Number (Decimal)"

» Drag and drop "Total Patient Falls Rate" onto Columns shelf

3 Validate data:

» Right-click on "CNTD(Total Patient Falls Rate)" on Columns shelf

» Select "Measure"

» Select "Sum"

4 Sort and format chart:

» Choose one of two options:

Option 1:

- Click on Sort icon on Toolbar to select ascending or descending order

Option 2:

- Hover over top of chart to display Sort icon, then click to select desired ranking order – once to rank ascending, again to rank descending, and a third time to return to original order

» On toolbar, click on Abc icon

» Right-click on "SUM(Total Patient Falls Rate)" on Columns shelf

» Select "Format..."

» Select "Pane" tab

» Under "Default," click "Numbers" caret to open drop-down menu

» Select "Number (Custom)"

» Change "Decimal places" to 1

» Click anywhere outside of "Numbers (Custom)" to close

» Right-click on X axis

» Select "Show Header" to remove checkmark and hide X axis

» Right-click on Y axis header label ("Type of Care")

» Click on "Hide Field Labels for Rows"

5 Add a title:

- Click on "Worksheet" on Menu bar
- Click "Show Title"
- Double-click on text in "Title" field (in example, "Sheet#")
- Highlight and delete current title
- Enter new title, "Rate of Patient Falls (per 1,000 Patient Days) for FY2012"; and click "OK"

6 Rename worksheet tab and save worksheet

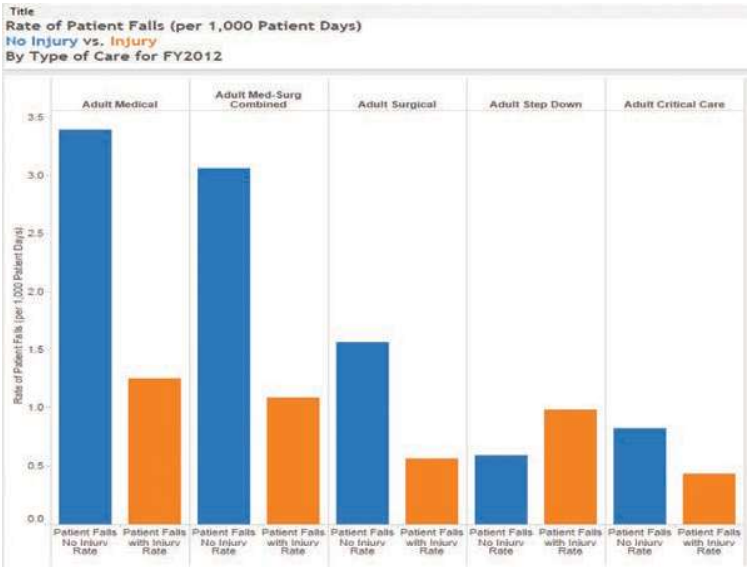
- Right-click "Sheet#" tab at bottom of screen
- Click "Rename Sheet"
- Enter new title, "Patient Falls – Bar Chart"
- Select "Enter," then "Save"

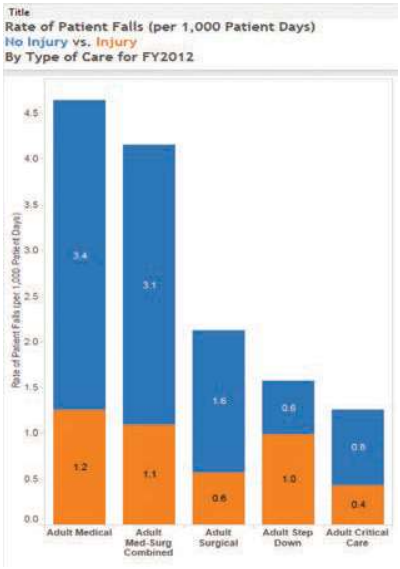
4.2 Bar Chart Variants: Side-by-Side Chart and Stacked Bar Chart

Side-by-Side and Stacked Bar Charts are variations of simple bar charts. Placing bars side by side to compare several variables enables use of both color and placement for interpreting data.

Stacked Bar Charts can be useful for the display of some part-to-whole data, but it is important to note that in the presence of numerous variables, a viewer's ability to quantify them is severely compromised. It is better to limit use of Stacked Bar Charts to the display of only two to three different variables. Use other types of charts, such as Small Multiples, to enhance display and interpretation of this type of data.

How To: **Build a Side-by-Side Bar Chart and a Stacked Bar Chart as options to compare patient falls' rates per 1,000 patient days with and without injury across a range of types of care.**





Data Source: *Mock patient-fall data for a single hospital for FY2012*

About the Data: *The American Nurses Association (ANA) National Database of Nursing Quality Indicators (NDNQI®) is a repository for nursing-sensitive indicators, reported at the nursing-unit level, designed to provide comparative information to hospitals for use in quality-improvement activities. For this exercise, we created mock patient-fall data, similar to that captured by the NDNQI and other groups like the Centers for Medicare & Medicaid (CMS), to compare patient-fall and falls-with-injury rates per 1,000 patient days across types of care for a single hospital.*

1 Create a new worksheet and connect to the data

- Open a new worksheet.
- Click on the "Patient Falls - Single Hospital" dataset in the Data window.

2 Create the chart

» Holding down the Control key, click on:

- "Type of Care" in the Dimensions data window.
- "Patient Falls No Injury Rate" and "Patient Falls With Injury Rate" in the Measures data window.

» Click the "Show Me" tab.

» Select the "side-by-side bars" image.

Show Me ▸

When several fields are either selected in the Data window or present in the active worksheet, the Show Me menu highlights the most likely visualizations to fit the specific combination of Dimensions and Measures present. Choosing one of these options rearranges the fields onto the appropriate cards to create the chosen chart type. (Note: Tableau can only make its best guess; adjustments are often necessary.)

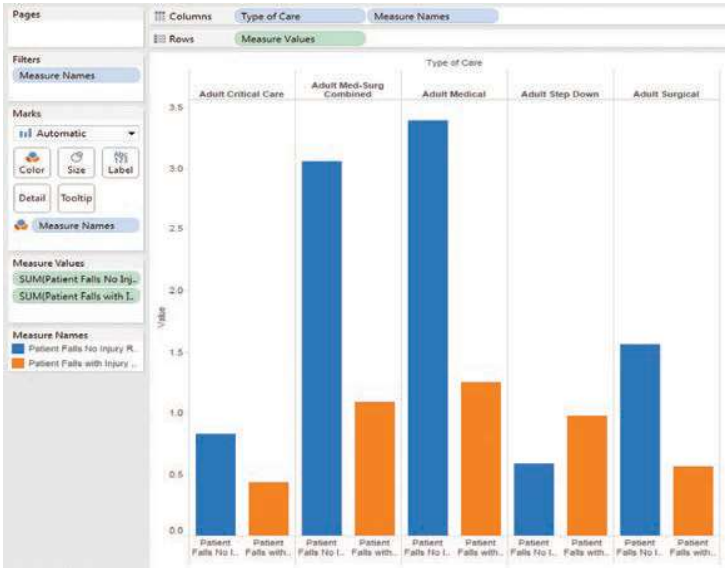
◂ Show Me Recommendations:

At the bottom of the Show Me menu, Tableau lists the number of Dimensions, Measures, and dates necessary to create a particular visualization. Hovering over a grayed-out chart type reveals how many and what type of fields are needed to create that chart.

» Click the "Show Me" tab again to close the tab.

Tableau's Show Me feature has automatically added a field called Measure Names to the Color selector on the Marks card. A different color is assigned to each field on the Measure Values shelf.

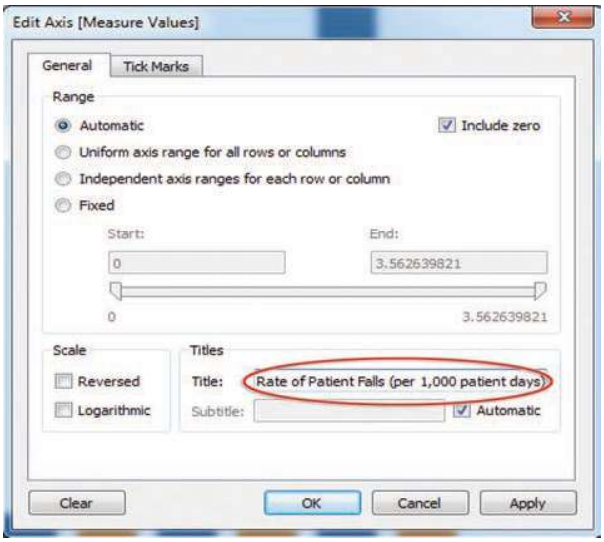
The chart now looks like this:



3 Format the chart

Edit the Y axis title:

- Right-click on the Y axis.
- Select "Edit Axis..."
- Change the title to: "Rate of Patient Falls (per 1,000 patient days)"



Widen the columns so complete labels are visible:

- Hover cursor over the far right column divider until it changes to a horizontal bi-directional arrow.
- Drag the column indicator to the appropriate width.

The header "Type of Care" is not necessary. To remove:

- Right-click on the column header "Type of Care."
- Select "Hide Field Labels for Columns."

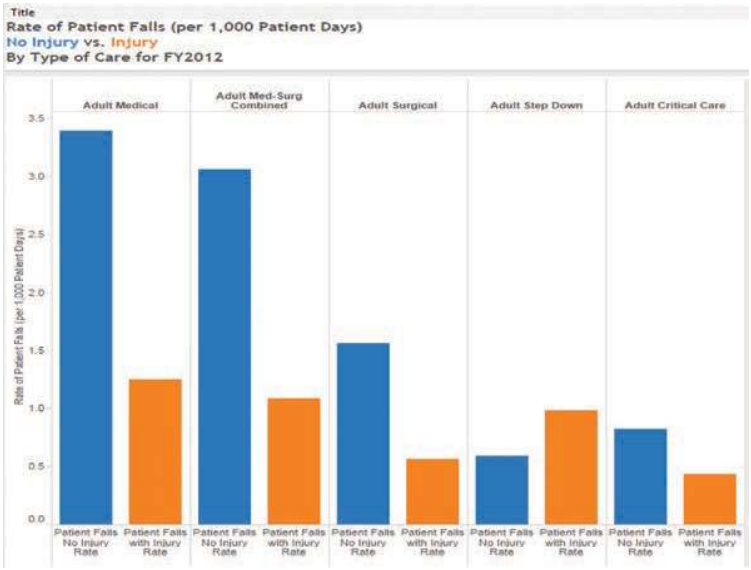
Sort the bars from highest to lowest:

- Click the "Type of Care" pill on the Columns shelf to highlight.
- Click the Sort icon on the Toolbar to select descending order.

4 Add a title

- Click on "Worksheet" on the Menu bar.
- Select "Show Title."
- Double-click on the displayed title field ("Sheet #") to open the "Edit Title" box.
- Enter the title, "Rate of Patient Falls (per 1,000 patient days) – No Injury vs. Injury by Type of Care for FY2012".
- The bars and their labels in the title should be color-coordinated for clarity. Highlight "No Injury" and click the color icon. Change the color to blue. Perform the same steps for "Injury," changing the color to orange.

The final Side-by-Side Bar Chart looks like this:



5 Rename the worksheet tab and duplicate the worksheet:

- Right-click on the Sheet Tab at the bottom of the workspace, then select "Rename."
- Enter a new name, "Patient Falls, Side-by-Side Bar."
- Right-click on the Sheet Tab again, then select "Duplicate Sheet."

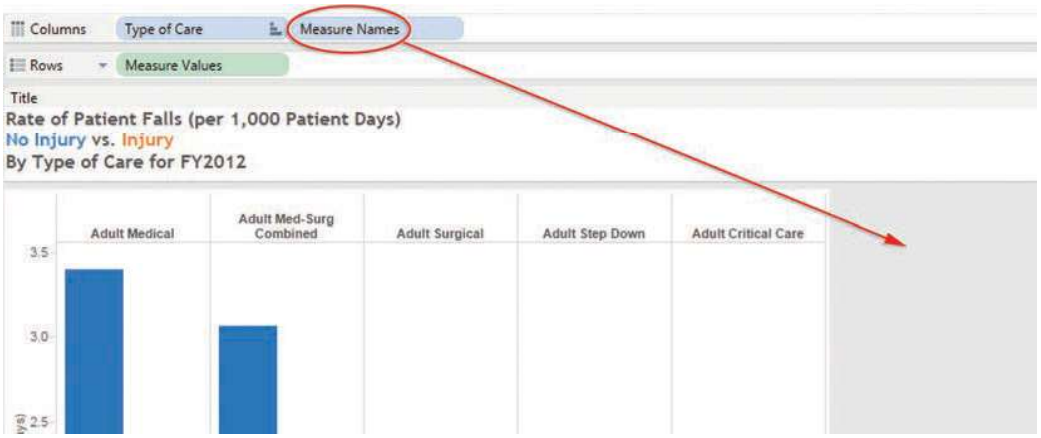
Duplicate Worksheets ▲

Duplicating an existing worksheet to create a new report is a common time-saver in Tableau. Duplicated sheets retain all filters, titles, and formatting customizations of the original sheet. Duplicating sheets is also a great way to test different chart variations without altering the original view.

6 Stack the bars:

To change each pair of side-by-side bars to a stacked bar:

- Drag the "Measure Names" pill off the Columns shelf and drop it onto the gray non-workspace to delete it.



For clarity, add labels to the newly created stacked bars.

» Click the "Label" icon on the Toolbar.

Reduce the label values to one decimal place:

» Right-click on "Measure Values" pill on the Rows shelf.

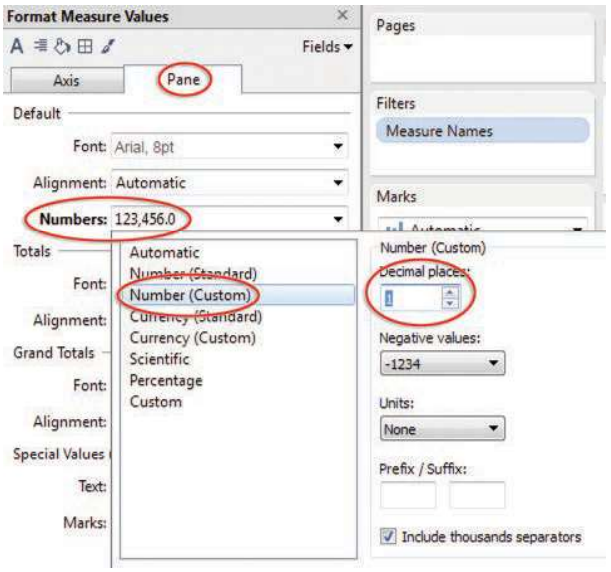
» Select "Format..."

» Select the "Pane" tab.

» Under "Default," click on the "Numbers" caret to open the drop-down menu.

» Select "Number (Custom)."

» Change "Decimal places" to 1.



» Click anywhere outside of "Numbers (Custom)" to close.

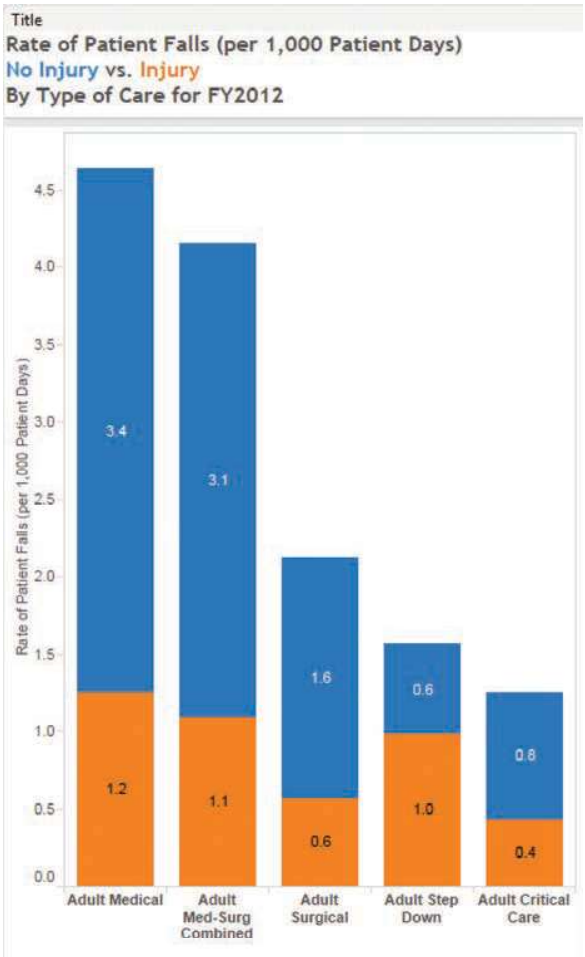
7 Rename the worksheet tab and save the worksheet

» Right-click on the worksheet tab at the bottom of the workspace, then select "Rename."

» Enter a descriptive title.

» Click the "Save" icon on the Tool bar.

The final Stacked Bar Chart looks like this:



Stacked Bar Option ▸

This Stacked Bar visualization displays multiple measures. If desired, however, a single-metric Stacked Bar can be created with one Measure on the Columns/Rows shelf and one Dimension added to the Color selector to display a part-to-whole relationship.

Insight: Adult Medical has both the highest rate of falls (4.6) per 1,000 patient days and the highest rate of falls with injury (1.2) per 1,000 patient days.

HDVizoom™...to Side-by-Side Bar then Stacked Bar Charts

Side-by-Side Bar Chart

1 Create new worksheet and connect to data:

- Open a new worksheet.
- Click on "Patient Falls - Single Hospital" dataset in the Data window.

2 Create chart:

- Holding down Control key, click on:
  - "Type of Care" in Dimensions window
  - "Patient Falls No Injury Rate" and "Patient Falls With Injury Rate" in Measures window
- Click "Show Me" tab
- Select "side-by-side bar chart" image
- Click the "Show Me" tab again to close the tab

3 Format chart:

- Right-click on Y axis
- Select "Edit Axis..."
- Change title to: "Rate of Patient Falls (per 1,000 Patient Days)"
- Hover cursor over far right column divider until it changes to horizontal bi-directional arrow
- Drag column indicator to appropriate width
- Right-click on column header "Type of Care"
- Select "Hide Field Labels for Columns"

4 Add title:

- Click on "Worksheet" on Menu bar
- Select "Show Title"
- Enter title, "Rate of Patient Falls (per 1,000 Patient Days) – No Injury vs. Injury By Type of Care for 2012"
- Change color of "No Injury" to blue and "Injury" to orange

5 Rename worksheet tab and duplicate worksheet:

- Right-click on Sheet Tab at bottom of workspace, then select "Rename"
- Enter new name, "Patient Falls, Side-by-Side Bar"
- Right-click on Sheet Tab again, then select "Duplicate Sheet"

Stack Bars

- Drag "Measure Names" pill off Columns shelf and drop onto gray non-workspace to delete
- Click Label icon on Toolbar
- Right-click on "Measure Values" pill on Rows shelf
- Select "Format..."
- Select "Pane" tab
- Under "Default," click on "Numbers" caret to open drop-down menu
- Select "Number (Custom)"
- Change "Decimal places" to 1
- Click anywhere outside of "Numbers (Custom)" to close

6 Rename worksheet tab and save worksheet:

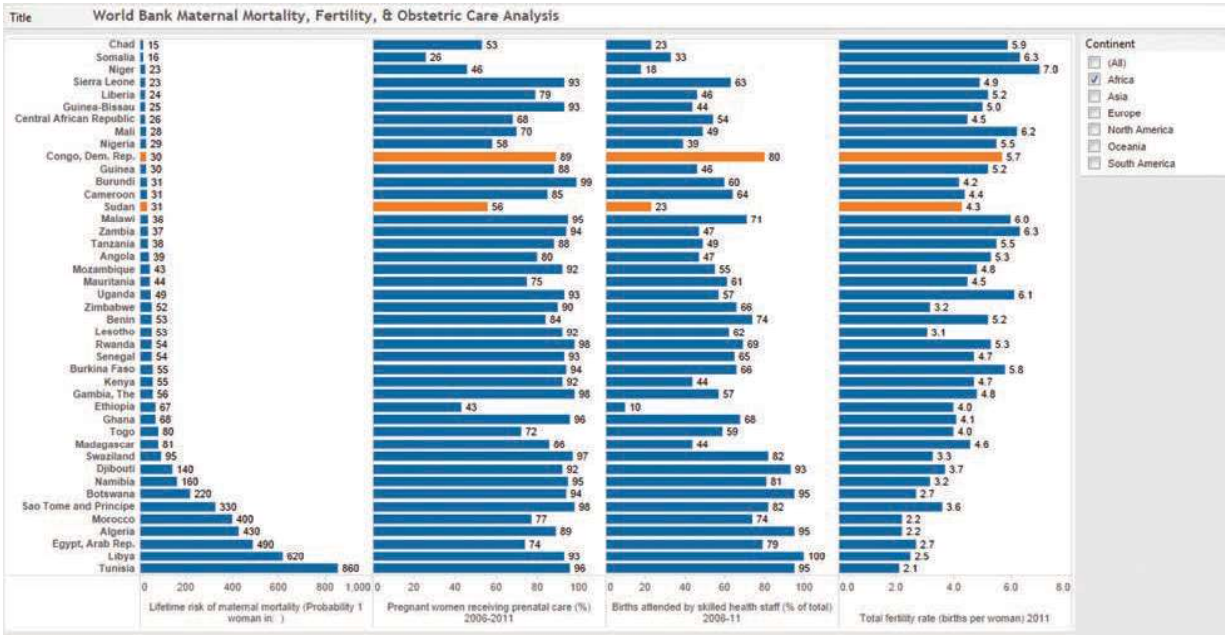
- Right-click on worksheet tab at bottom of workspace, then select "Rename"
- Enter descriptive title
- Click "Save" icon on Tool bar

Table Lens

A Table Lens is a type of data visualization that provides the viewer with a quick way to see any potential correlations and/or outliers in a multivariate dataset.

A Table Lens contains a series of side-by-side horizontal bar charts that share the same categorical variable, but with each chart showing different quantitative variables. These variables in the same chart are ranked (from high to low, or low to high) keeping the associated variables in alignment with them. As a result, any potentially interesting correlations or outliers in the data are easy to identify. If warranted, more rigorous statistical analysis may be performed.

How To: Build a Table Lens to compare maternal mortality rate, prenatal care, births attended by healthcare professionals, and fertility rate by different countries.



Data Source: *The World Bank: Maternal Mortality, Fertility & Obstetric Care Analysis*

About the Data: *The data for this exercise are taken from publicly available information captured by the World Bank Group in alignment with the two goals it hopes to achieve by 2030: 1) the ending of extreme poverty; 2) the promotion of shared prosperity.*

The potential correlations to be examined (by country) in this exercise are:

- Lifetime risk of maternal mortality; that is, one woman dying for every particular number (varies by country) giving birth. (For example, in 2010 the risk of maternal mortality was 1 in 16 for Somalian women.)

- Percentage of women receiving any type of prenatal care (2006-2011 only)
- Percentage of women with skilled health staff present during childbirth (2006-2011 only)
- Number of births per woman (total fertility rate) for 2011

1 Create a new worksheet and connect to the data

» At the bottom of the Tableau workspace, click the icon for a new worksheet.

» Click on the "Maternity by Country" dataset in the Data window.

2 Create the chart

» Drag and drop the following Measures (in the order below) onto the Columns shelf:

Lifetime risk of maternal mortality

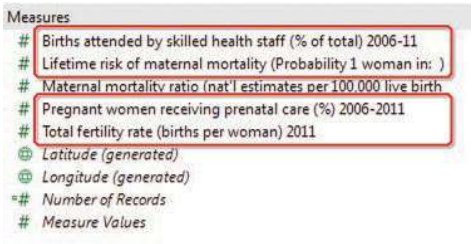
Pregnant women receiving prenatal care

Births attended by skilled health staff

Total fertility rate

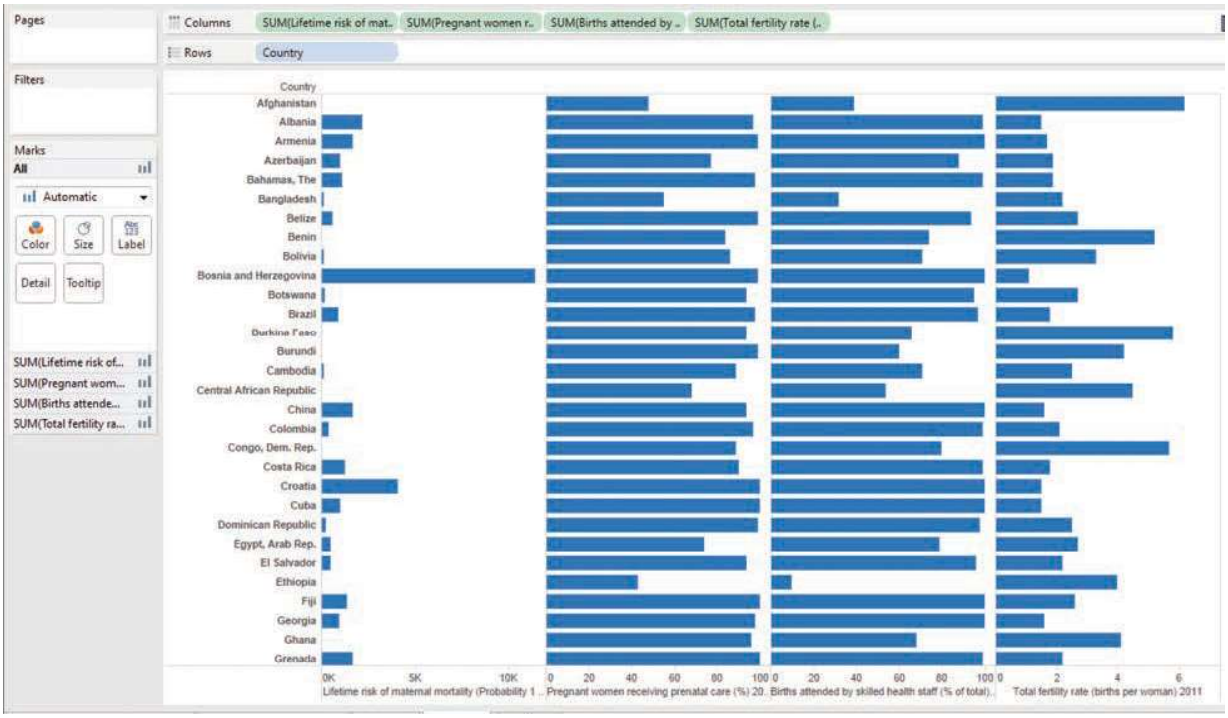
Drag and Drop ▶

Tableau's Drag and Drop interface makes it easy to explore data and test different visualizations quickly. Drag fields from the Dimensions or Measures lists and place them on any of the worksheet shelves. Tableau also permits dragging a field already in the worksheet (represented as a blue or a green pill) to another place on the worksheet to change the visualization.



» Drag and drop "Country" from the Dimensions data window onto the Rows shelf.

The chart now looks like this:



3 Sort the data

To sort the first column, "Lifetime risk of maternal mortality" from lowest to highest:

» Highlight header of the first column (the "Sort" icon appears when the cursor hovers over the header).

» Click the "Sort" icon twice to sort ascending.

▲ End-User Sorting

The Sort icon in the Measure axis is visible to the end-user as well as to the report-builder. Hovering over the Measure axis (where "Country" appears in the current example) makes the icon appear, allowing viewers to sort the Table Lens with one click.

The chart now looks like this:

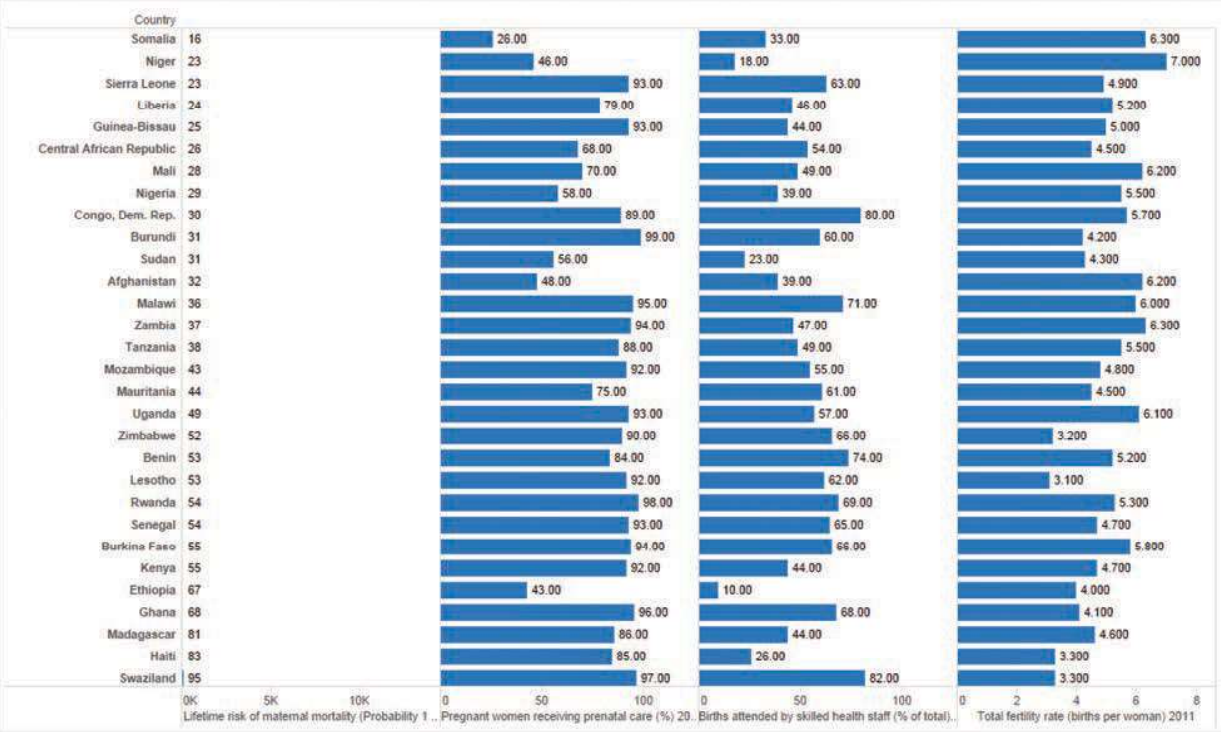
Best Practice

Each Measure in a Table Lens has its own X axis. If two Measures have the same unit type (such as percentage, rate, etc.), the range of the scales must be the same for accurate comparison.

Right-click on the axis to be modified and select Edit Axis to adjust the ranges.

When a column contains a very large range of values (0 - 10,000, as happens above), certain bars may not display at all. To make the actual numbers for any country appear, add Labels.

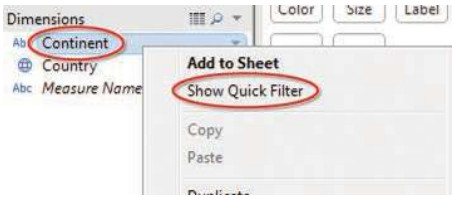
» Select the "Label" icon to add labels.



4 Filter the data

» Right-click on "Continent" in the Dimensions window.

» Select "Show Quick Filter."



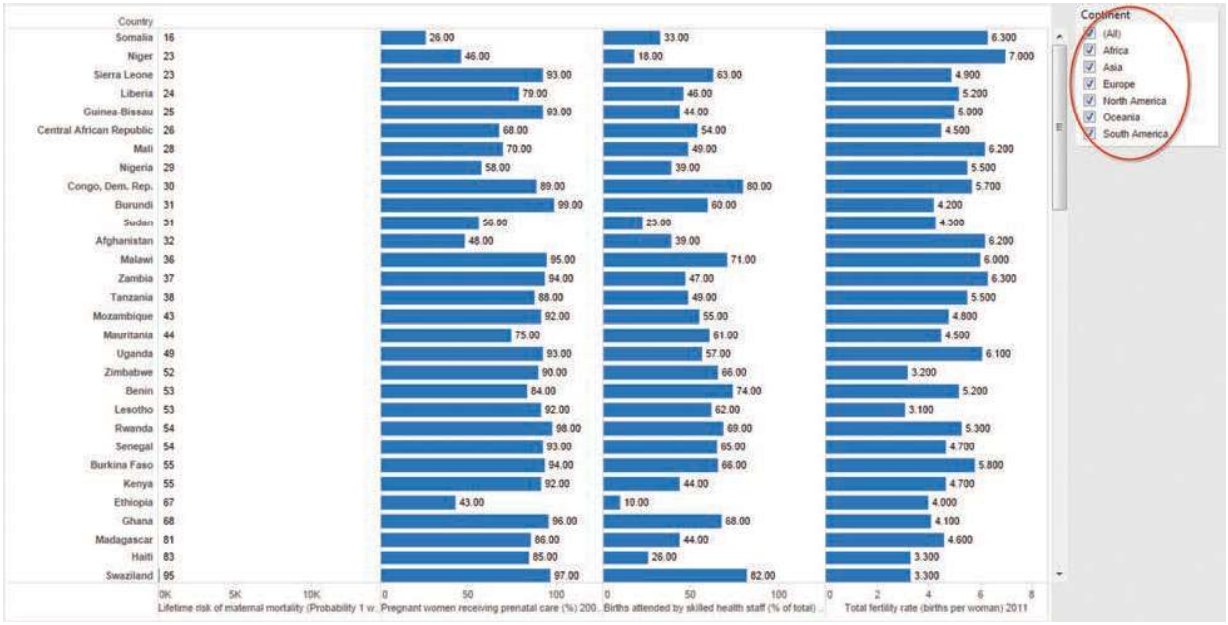
◂ Quick Filters

Quick Filters are a type of selection menu added to a report that allows end-users to interact with the fields on the Filters card. This feature permits a user to quickly and intuitively change data displayed in the report without having to select filters one at a time. Quick Filters can be displayed as lists, dropdowns, or type-in fields, and can be customized to display data for maximum clarity and utility. The caret in the upper right corner of the Quick Filter screen shows additional options.

The "Continent" field is now present on the Filters shelf. The Quick Filter displayed to the right of the chart permits display by continent. To view data for Africa only:

» De-select "(All)."

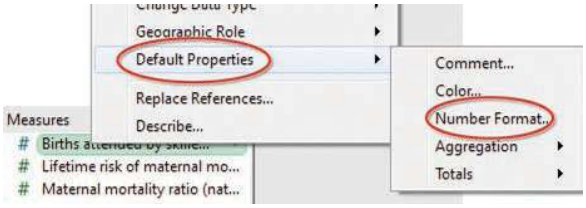
» Select "Africa."



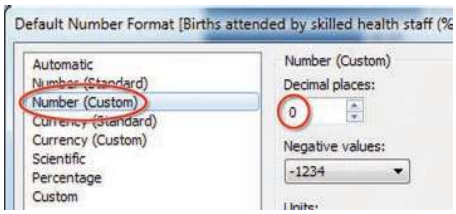
5 Format the chart

Numbers in the columns are carried out to two or three decimal places. To reduce the number of places:

- Right-click on one of the four fields in the Measures window.
- Select "Default Properties," then "Number Format..."



- Select "Number (Custom)."
- Change "Decimal places" to 0.



- Perform the same steps for the other three measures.

Note: On the Total Fertility Rate measure, as there are data carried out to one decimal place, reduce "Decimal places" to 1, not to 0.

To adjust the height of the X axis to display the complete title for each section:

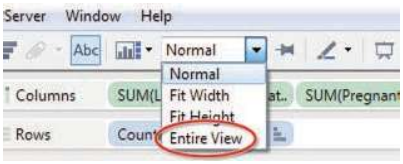
- Hover the cursor exactly over the X axis line, when it changes to a bidirectional arrow, click and hold so that it changes to a dotted line.
- Drag the line to the desired height.

To hide the "Country" row header:

- Right-click on the header.
- Click on "Hide Field Labels for Rows."

To change the size of the view:

- Hover over the "Normal" on the Taskbar; a balloon pop-up "Fit" appears.
- Click on the caret to open the drop-down menu.
- Select "Entire View."



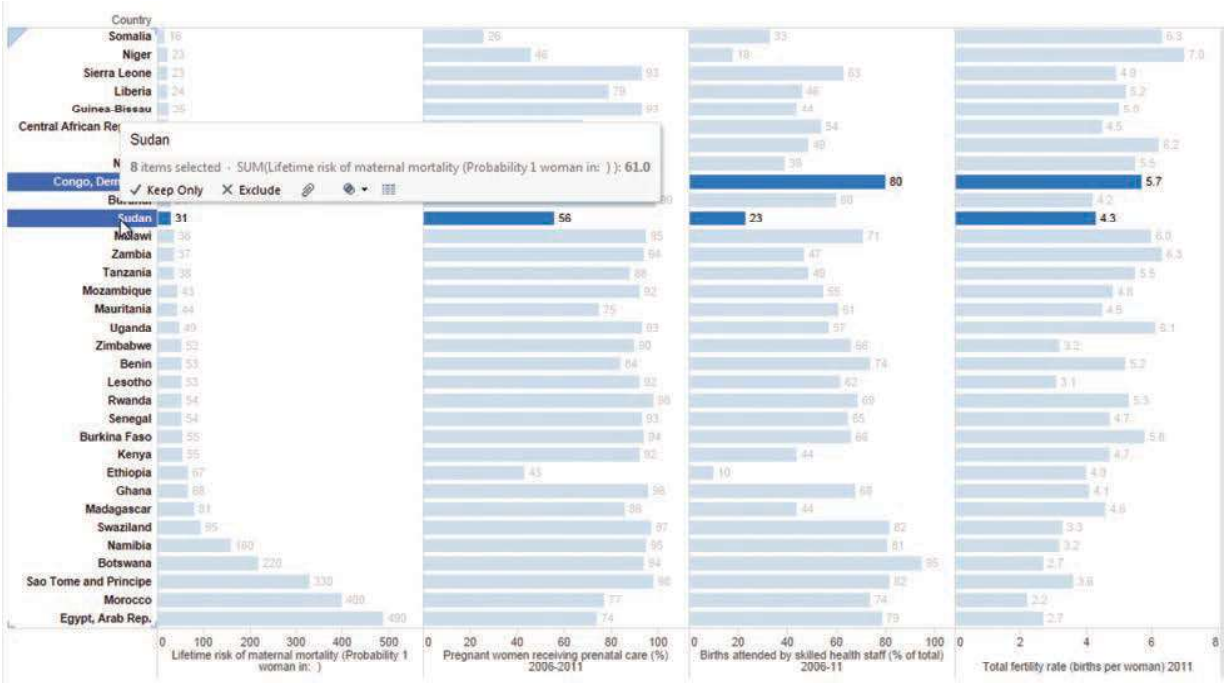
Adjusting the Chart to the Workspace

When a great deal of data is displayed, the chart may automatically size itself larger than the screen space. If this happens, scroll bars will appear. This may in some cases be necessary, but if the bars are unwanted, the report can be adjusted horizontally or vertically to make it fit. Using the "Fit Width," "Fit Height," or "Entire View" commands may affect the appearance, proportions, and/or display speed of the chart.

6 Create a set

As there are many countries to review in the four columns of data, color-coding the countries of interest helps the viewer identify pertinent data quickly. To color-code selected rows of data, first create a Set, then drag it to the Color shelf.

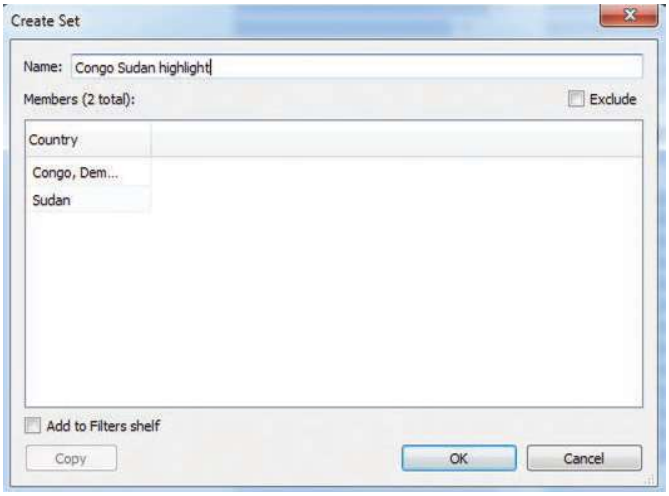
- Hold down the Control key and click on "Congo" and "Sudan" to highlight. A Tooltip will appear.



» Click on the "Set" icon (see circled image below).

» Select "Create Set."

» Enter a title for the Set, "Congo Sudan highlight."



Sets ▸

The set feature can be used to capture or highlight a subset of the data. In this example, the set is used to color code the countries of interest to grab the audience's attention.

The new Set field is now displayed in its own window below the Measures window.

» Drag and drop the "Congo Sudan highlight" Set to the Color selector on the Marks card. The field aggregate is changed to IN/OUT of the set (IN = Congo and Sudan; OUT = all other countries).

» Click on the caret to the right of the color legend header IN/OUT.

» Select "Edit Colors."

» Click on the "In" label to highlight, then click on an Orange square.

» Click on the "Out" label to highlight, then click on a Blue square.

7 Add a title

» Click on "Worksheet" on the Menu bar.

» Select "Show Title."

» Enter the title, "World Bank Maternal Mortality, Fertility & Obstetric Care Analysis."

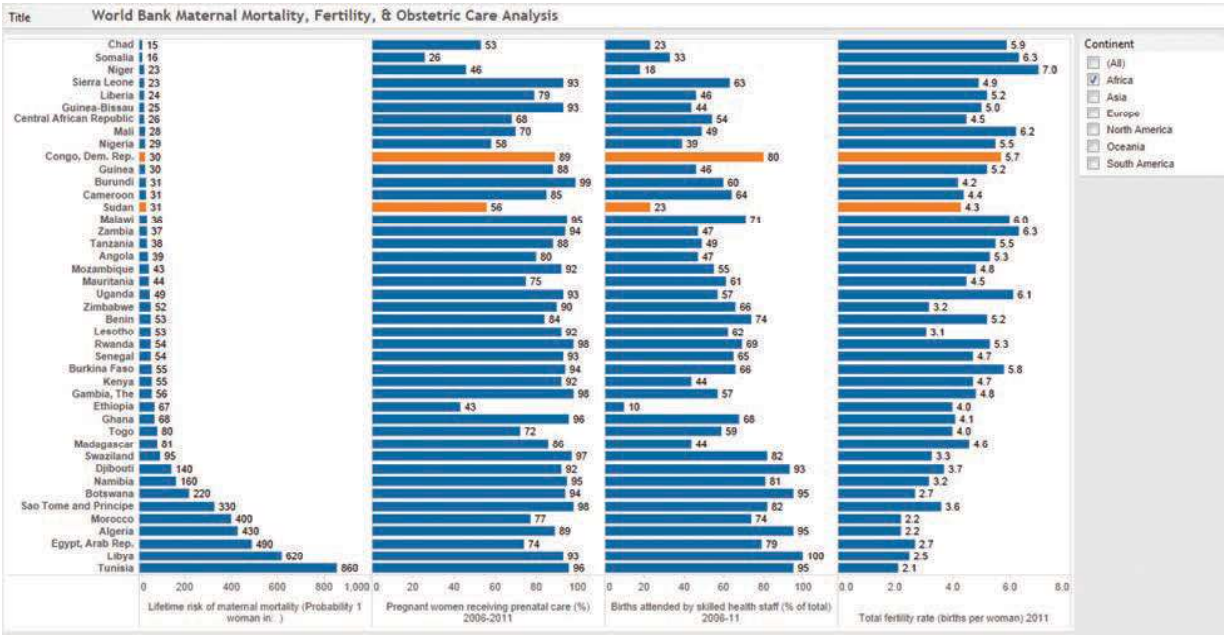
8 Rename the worksheet tab and save the worksheet

» Right-click on the worksheet tab at the bottom of the workspace, then select "Rename."

» Enter an intuitive title.

» Click the "Save" icon on the Tool bar.

The final chart looks like this:



Insight: This Table Lens chart allows the viewer to consider potentially interesting relationships between and among prenatal care, skilled health staff attending childbirth, and fertility rates for women living in different countries for further study and investigation. For example, although Congo has a much higher rate of prenatal care (89% vs. 56%) and childbirths attended by skilled health staff (80% vs. 23%) than Sudan, their maternal mortality rates are essentially the same (1 in 30 for Congo and 1 in 31 in Sudan).

HDVizoom™...to the Table Lens

1 Create new worksheet and connect to data:

- At bottom of Tableau workspace, click icon for new worksheet
- Click on "Maternity by Country" dataset in Data window

2 Create chart:

- Drag and drop following Measures (in order below) onto Columns shelf:
- Lifetime risk of maternal mortality
- Pregnant women receiving prenatal care
- Births attended by skilled health staff
- Total fertility rate
- Drag and drop "Country" from Dimensions data window onto Rows shelf

3 Sort data:

- Highlight header of first column
- "Sort" icon appears when cursor hovers over header
- Click "Sort" icon twice to sort ascending
- Select "Label" icon to add labels

4 Filter data:

- Manage data by creating filters:
- Right-click on "Continent" in Dimensions window
- Select "Show Quick Filter"
- De-select "(All)"
- Select "Africa"

5 Format chart:

- Right-click on one of four fields in the Measures window
- Select "Default Properties," then "Number Format..."
- Select "Number (Custom)"
- Change "Decimal places" to 0
- Perform same steps for other three measures (for Total Fertility Rate, reduce "Decimal places" to 1)
- Hover cursor exactly over X axis line, then click and hold so it changes to dotted line
- Drag line to desired height
- Right-click on header
- Click on "Hide Field Labels for Rows"
- Hover over "Normal" on Taskbar; balloon pop-up "Fit" appears
- Click on caret to open drop-down menu
- Select "Entire View"

6 Create set:

- Hold down Control key and click on "Congo" and "Sudan" to highlight; Tooltip will appear
- Click on "Set" icon
- Select "Create Set"
- Enter title for Set, "Congo Sudan highlight"
- Drag and drop "Congo Sudan highlight" Set to Color selector on Marks card
- Click on caret to right of color legend header IN/OUT
- Select "Edit Colors"
- Click on "In" label to highlight, then click to select Orange square
- Click on "Out" label to highlight, then click to select Blue square

7 Add title:

- Click on "Worksheet" on Menu bar

- Select “Show Title“
- Enter title, “World Bank Maternal Mortality, Fertility & Obstetric Care Analysis“

8 **Rename worksheet tab and save worksheet:**

- Right-click on worksheet tab at bottom of workspace, then select “Rename”
- Enter intuitive title
- Click “Save” icon on Tool bar

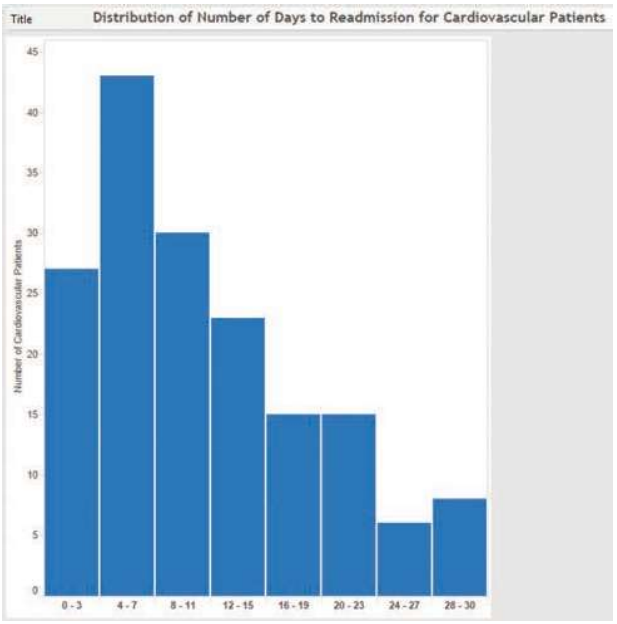
Histogram

A Histogram is a type of vertical bar chart used to display the frequency distribution of data within an ordered (ordinal) range of values, arranged in intervals called bins, categories, or buckets.

The bins for a Histogram are ranges of values, placed close to one another as a way of conveying that one measure is being displayed, and that there is an order to the measure. Unlike bar charts, which rely on sorting for visual interpretation of data, Histograms cannot be rearranged. Some examples of the types of data displayed in a Histogram are age ranges (0-5, 6-11, 12-17), number of days (0-3, 4-7, 8-11), and time such as minutes or hours (0-1, 2-3, 4-5).

Visualization of data distribution in this way allows the viewer to look for peaks, valleys, and ranges in it, and to discover more than just the mean or median of the values. Because bar charts and Histograms can appear similar, and many people are unfamiliar with the concept of distribution, the design of the chart (including axis labels and titles) is as important as the data itself.

How To: Build a Histogram showing the distribution of the number of days from hospital discharge to readmission for cardiovascular patients.



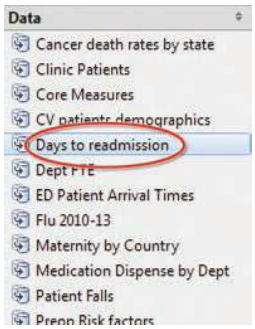
Data Source: *Mock hospital readmission data for cardiovascular patients*

About the Data: *In the United States, the public reporting of 30-day risk-standardized readmission measures aims to: a) improve healthcare quality; b) enhance population health; and c) reduce costs. Readmission rates are reported by hospitals as part of the Centers for Medicare & Medicaid (CMS) Core Measures of national, evidence-based quality standards.*

1 Create a new worksheet and connect to the data

» At the bottom of the Tableau workspace, click the icon for a new worksheet.

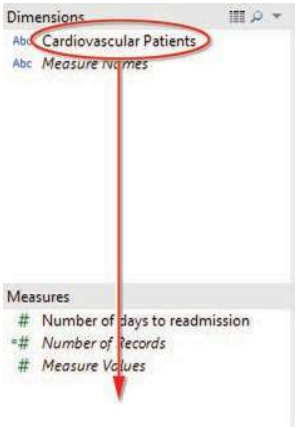
» Click on the "Days to Readmission" dataset in the Data window.



2 Analyze the data

Examine the Dimension "Cardiovascular Patients." Note that the frequency of patients being readmitted is a Count (Measure), not a Dimension, here.

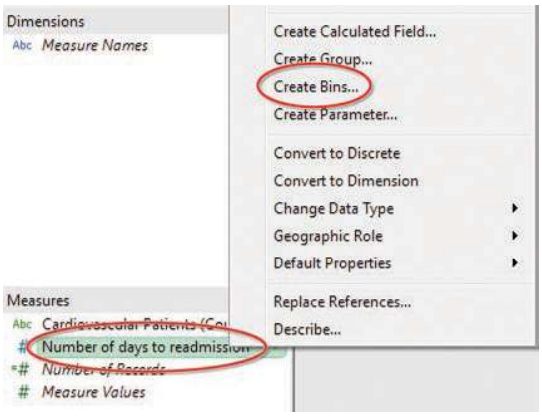
» Drag and drop "Cardiovascular Patients" from the Dimensions window to the Measures window.



3 Create Bins

Right-click on the "Number of days to readmission" in the Measures window.

» Select "Create Bins" from the context menu.



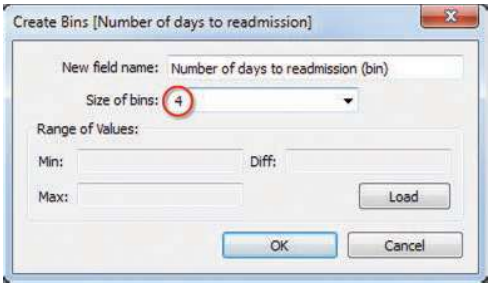
Binning

Tableau simplifies the process of breaking down a Measure into uniform bins by automatically creating a new field that breaks a Measure into equally spaced ranges. This new field, a binned version of the original one, appears as a Dimension because Bins are treated as discrete categories. If desired, a Parameter can allow the end user to dynamically change bin size for added interactivity. Parameters are covered in Chapter 23.

A dialog box appears with the "New field name" automatically created; this name may be customized if desired. Below the New field name is "Size of bins" with a default value of 10. The drop-down menu allows the option of entering new values or creating new parameters.

» For this exercise, enter the new value of 4.

The bins will now group the number of patients readmitted by sets of four days (0-3, 4-7, 8-11, etc.).



Best Practice

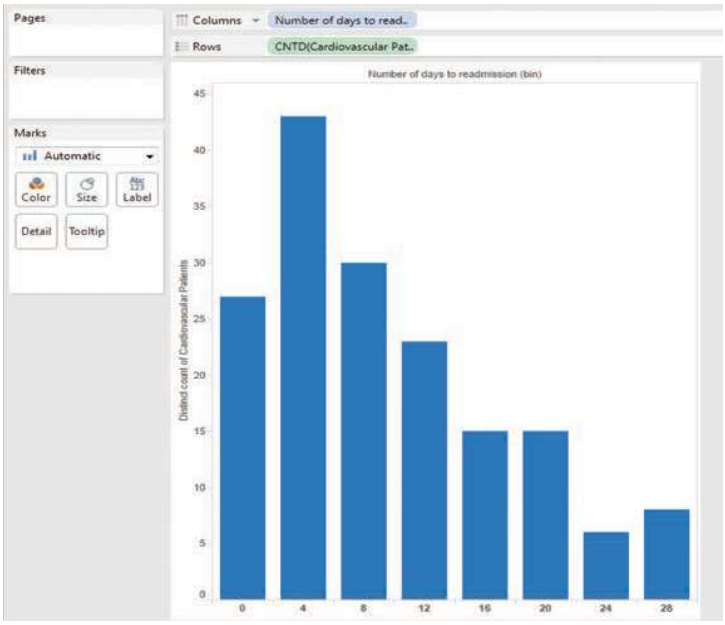
When creating bins, make sure to choose a size small enough to show detailed distribution, but not so small as to provide too much specificity. Clicking the Load button shows Min, Max, and Diff values to aid in the selection of an appropriate bin range.

4 Create the chart

» Drag and drop "Number of days to readmission (bin)" Dimension onto the Columns shelf.

» Drag and drop "Cardiovascular Patients" Measure onto the Rows shelf.

The chart now looks like this:



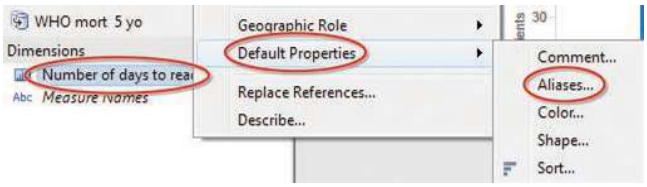
Best Practice

By default, each bin will show the first number in its range. This means the 0-3 bin displays 0, the 4-7 bin displays 4, and so on. Use Aliases to create bin labels.

5 Format the chart

The X axis label does not clearly display the range of days in each bin.

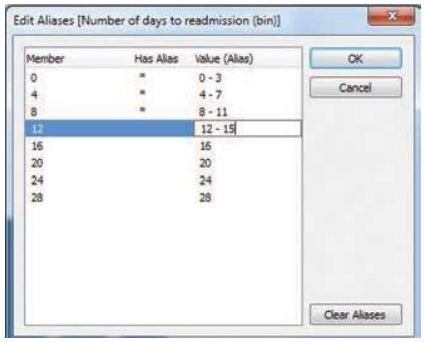
- Right-click on the "Number of days to readmission (bin)" Dimension in the Data window.
- Click "Default Properties," then select "Aliases."

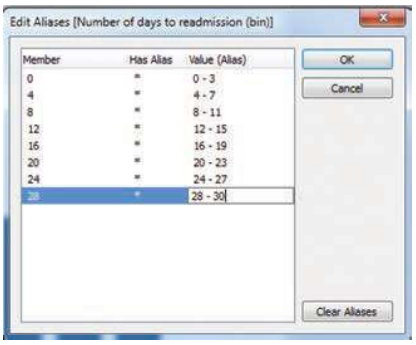


- Click each "Value (Alias)" field and enter value range as shown below.

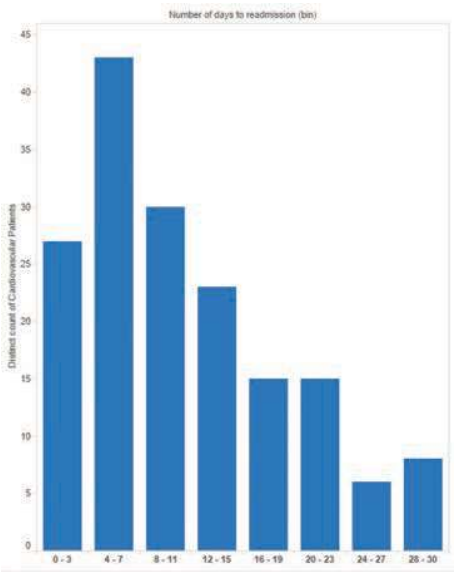
Edit Aliases ▸

Dimension display values may be changed by assigning Aliases. This change does not affect the underlying data, but does propagate the Alias through all worksheets in the workbook using that Dimension. This feature permits clarifying display data without the need to alter underlying information. Note that every Alias value must have a unique name.

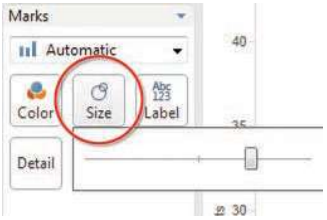




The chart now looks like this:



- Click on the "Size" selector on the Marks card to access the slider bar.
- Adjust the slider to the right to increase the width of each bar on the Histogram.



Marks Card (Size)

The Size selector on the Marks card is available on many chart types where data is graphically displayed. The slider will affect bar width and line thickness, as well as the size of plotted shapes.

Further, to encode additional data elements, drag and drop a Dimension or Measure onto the Size selector.

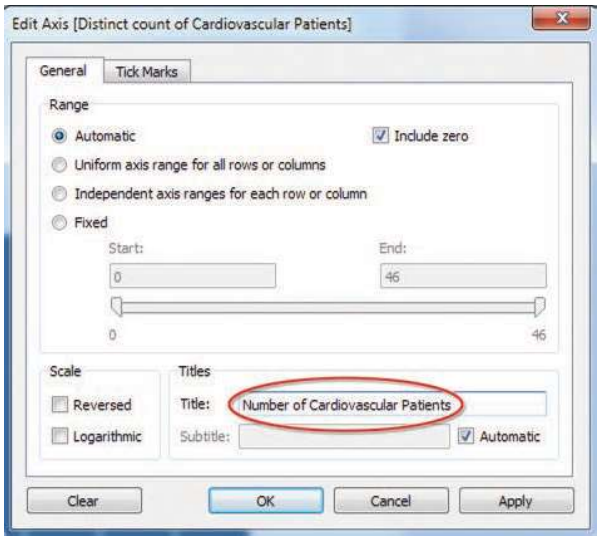
» Right-click on the Y axis.

» Select "Edit Axis..."

Edit Axis ▸

Tableau automatically populates a chart axis with a header, number range, and tick marks. Right-clicking on an axis and selecting Edit Axis... will present a menu of customizable axis options. On the General tab, Tableau automatically sets the axis range to account for the minimum and maximum values in the visualization. A fixed range with a static start and end may be selected, or alternative range settings may be considered. The title may be edited or removed; the axis scale may be Reversed or Logarithmic. Modify tick marks by using the Tick Marks tab.

» Change the Y axis title to "Number of Cardiovascular Patients."



Best Practice

By default, Tableau bar and line graphs start at zero so as not to obscure bar or line length or distort the message in the data.

In more complex circumstances, a split-axis approach can be used; see Tips & Tricks, Chapter 27, pages 373-374.

The Field Label for the Bin at the top of the chart is unnecessary; the title describes what the bars/bins represent. To hide this label:

» Right-click on the Field Label.

» Click on "Hide Field Labels for Columns."

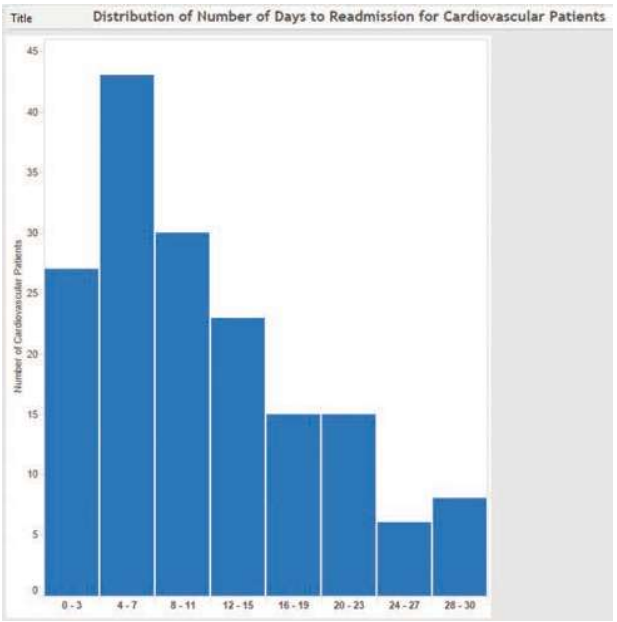
6 Add a title

- Click "Worksheet" on the Menu bar.
- Click "Show Title."
- Add a title, "Distribution of Number of Days to Readmission for Cardiovascular Patients."

7 Rename the worksheet tab and save the worksheet

- Right-click on the worksheet tab at the bottom of the workspace, then select "Rename."
- Enter an intuitive title.
- Click the "Save" icon on the Tool bar.

The final chart looks like this:



Insight: The data displayed in this Histogram are positively skewed, which makes it clear that the majority of cardiovascular patient readmissions occur within the first 15 days after discharge.

HDVizoom™...to the Histogram

1 Create new worksheet and connect to data:

- At bottom of Tableau workspace, click icon for new worksheet
- Click on the "Days to Readmission" dataset in the Data window.

2 Analyze data:

- Drag and drop "Cardiovascular Patients" from Dimensions window to Measures window

3 Create bins:

- Right-click on "Number of days to readmission" in Measures window
- Select "Create Bins" from context menu
- Change size of bins to 4

4 Create chart:

- Drag and drop "Number of days to readmission (bin)" from Dimensions window onto Columns shelf
- Drag and drop "Cardiovascular Patients" from Measures window onto Rows shelf

5 Format chart:

- Right-click on "Number of days to readmission (bin)" in Dimensions window
- Click "Default Properties," then select "Aliases"
- Click each "Value (Alias)" field and enter value range
- Click on "Size" selector on Marks page to access slider bar
- Adjust slider to right to increase bar width
- Right-click on Y axis
- Select "Edit Axis..."
- Change Y axis title to "Number of Cardiovascular Patients"
- Right-click on Field Label
- Click on "Hide Field Labels for Columns"

6 Add Title:

- Click "Worksheet" from Menu bar
- Click "Show Title"
- Add title, "Distribution of Number of Days to Readmission for Cardiovascular Patients"

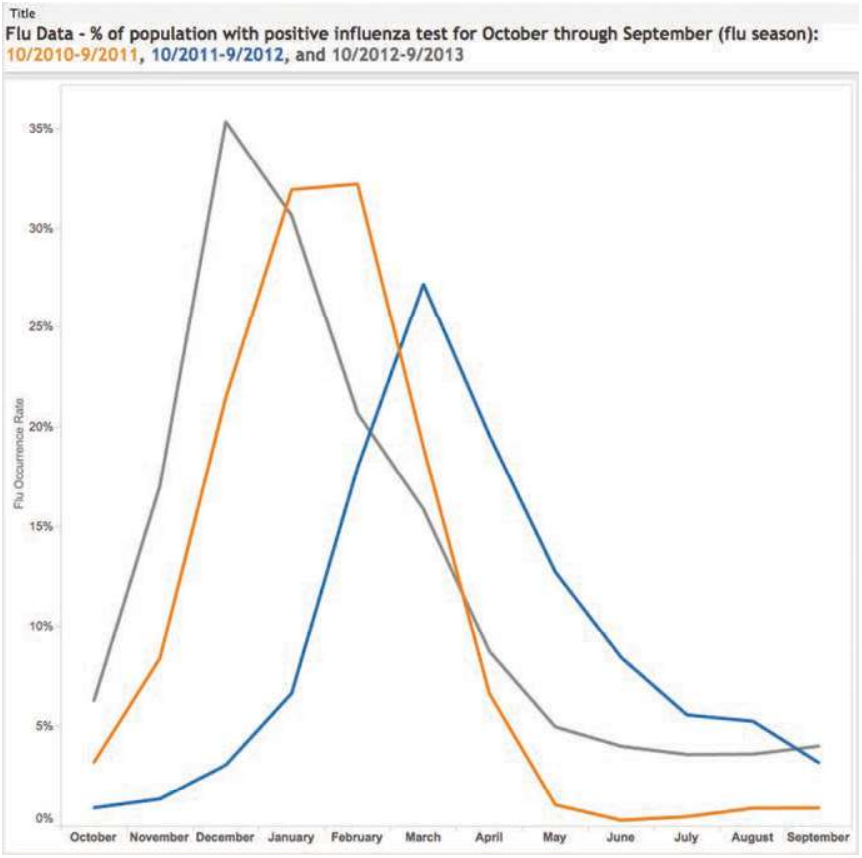
7 Rename worksheet tab and save worksheet:

- Right-click on worksheet tab at bottom of workspace, then select "Rename"
- Enter intuitive title
- Click "Save" icon on Tool bar

Line Charts

Lines may be used in many different ways to visualize trends or distributions of data, or to forecast results. In the case of a Scatter Plot, a line of best fit may be used to determine if there is a positive, negative, loose, or no relationship (correlation) between variables. This chapter will guide the creation a Line Chart to connect a series of data points over time in order to display the distribution and trend of the points.

How To: Build a Line Chart to compare positive flu outbreaks by months over a three-year time span.



Data Source: *Centers for Disease Control and Prevention (CDC) Seasonal Flu Activity.*

About the Data: *National influenza rates (percent of patients presenting with flu-like symptoms with a positive flu test) by month for three flu seasons: Oct 2010–Sep 2011, Oct 2011–Sep 2012, and Oct 2012–Sep 2013. The Influenza Division at the CDC, working with state and local health departments, labs, hospitals, clinics and other healthcare facilities, collects and analyzes flu data year round and presents the data through its weekly report, FluView.*

1 Create a new worksheet and connect to the data

» At the bottom of the Tableau workspace, click the icon for a new worksheet.

» Click on the "Flu 2010-13" dataset in the Data window.

2 Create the chart

» Drag and drop "Month" from the Dimensions window onto the Columns shelf.

A Date field in Tableau defaults to Year (top of date hierarchy) and to a Discrete variable (blue pill) when it is first added to the workspace.

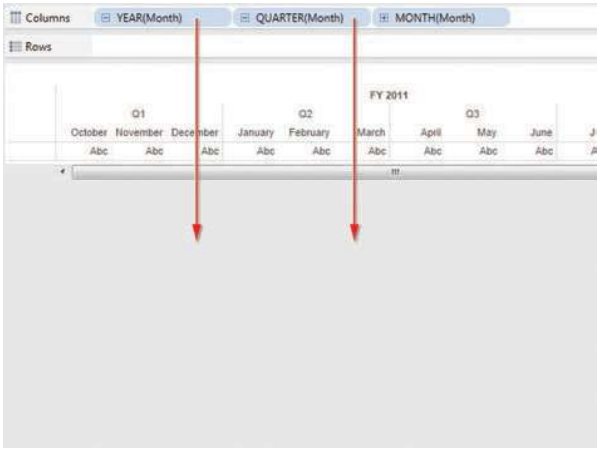
Date Defaults ▸

It is important to understand how Tableau orders dates. No matter which way dates are entered into the data source, Tableau views them hierarchically, aggregating first by Year. If another view is desired, see Options 1 and 2 below.

» To change this variable to Month, choose one of the following two options:

Option 1:

- Click the + sign to the left of YEAR on the pill (see previous image). This drills down to the next date level, Quarter.
- Click the Quarter + sign to drill down to the Month date level.
- Drag and drop the YEAR(Month) pill and the QUARTER(Month) pill from the Columns shelf onto the gray workspace to remove them. Only the MONTH(Month) pill should remain on the Columns shelf once the other two have been removed.



▲ Date Hierarchy for Report Queries

Because Tableau organizes dates in a hierarchy, users can query reports at increasing levels of detail. For example, they may view data for a year, then by month and day by selecting the + sign on the blue date pill or by hovering over the field header and selecting the + sign in the actual visualization.

Option 2: This option permits the user to both change the date level and simultaneously make the date either discrete or continuous.

- Right-click on the "YEAR(Month)" pill on the Columns shelf. The context menu offers two options for date formatting.

◄ Discrete vs. Continuous Dates

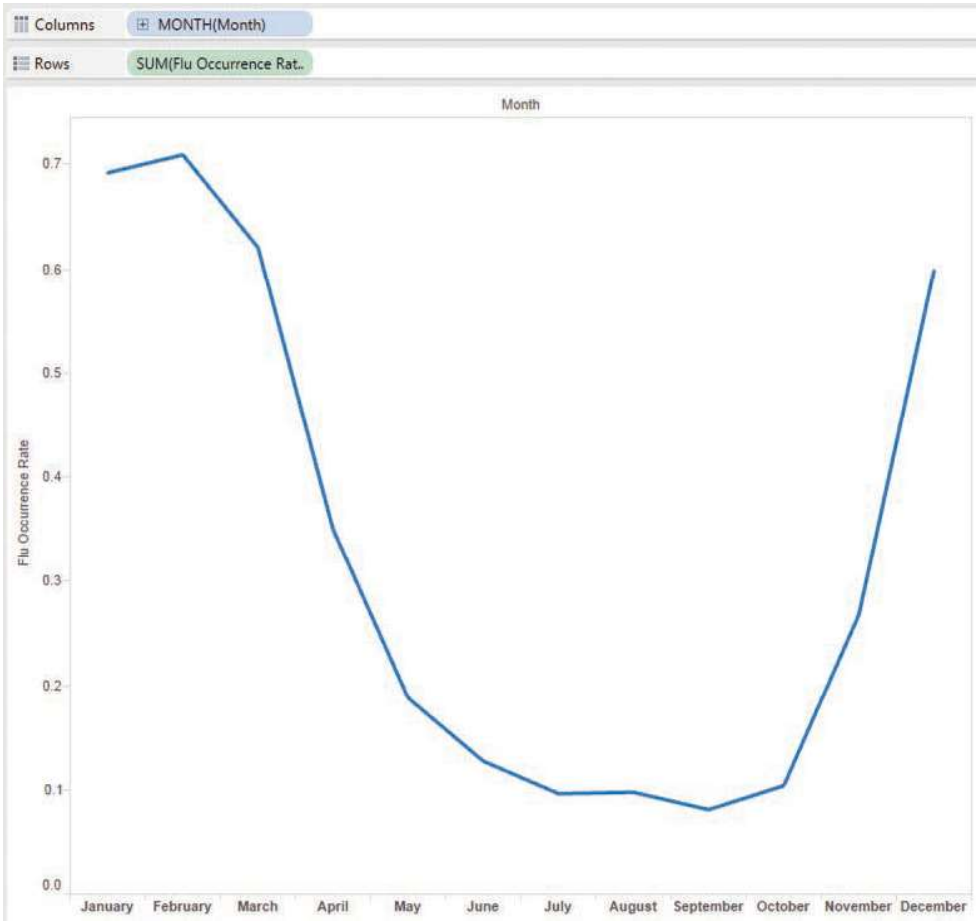
A Discrete line chart divides dates into separate blocks of time for the comparison of similar time periods—for example, year-to-year, as in the flu example. Each time period is separate from each other one. A Continuous line chart has no breaks and displays a trend over time with one unbroken line.

Discrete data creates an axis with categories (Year 1, Year 2, etc.), whereas Continuous data creates an axis with a scale (for example, 1–10).

For this chart, keep the default date as a discrete field (indicated by the blue color of the date field's pill).

- Select "Month" from the first section: a discrete Month will allow for seasonal comparison across three different years.
- Drag and drop the "Flu Occurrence Rate" from the Measures window onto the Rows shelf.

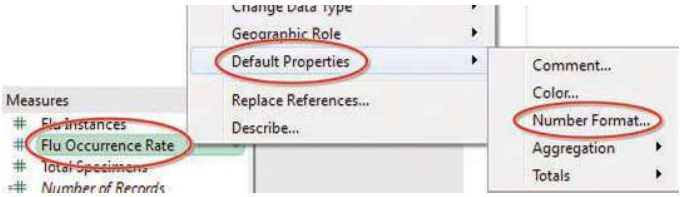
The chart now looks like this:



3 Format the chart

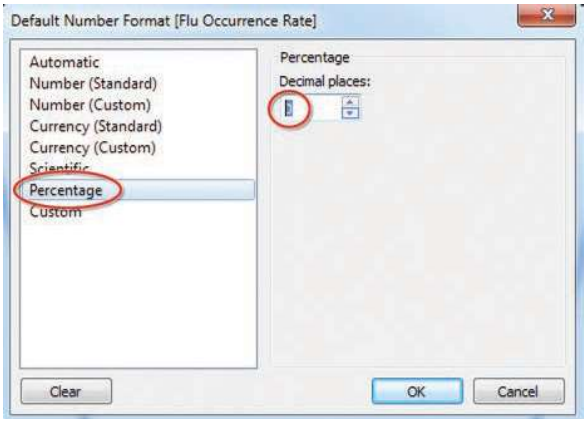
To change the "Flu Occurrence Rate" field from a decimal to a percentage:

- Right-click on "Flu Occurrence Rate" in the Measures window.
- From the context menu, select "Default Properties."
- Select "Number Format."

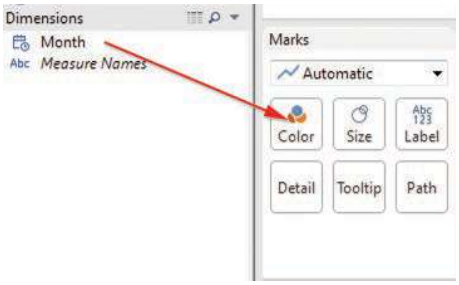


The Default Number Format dialog box appears.

- Select "Percentage."
- Change Decimal places from 2 to 0.



- Drag and drop the "Month" from the Dimensions window onto the Color selector on the Marks card to give each of the three flu seasons in the dataset a unique line color for the chart.

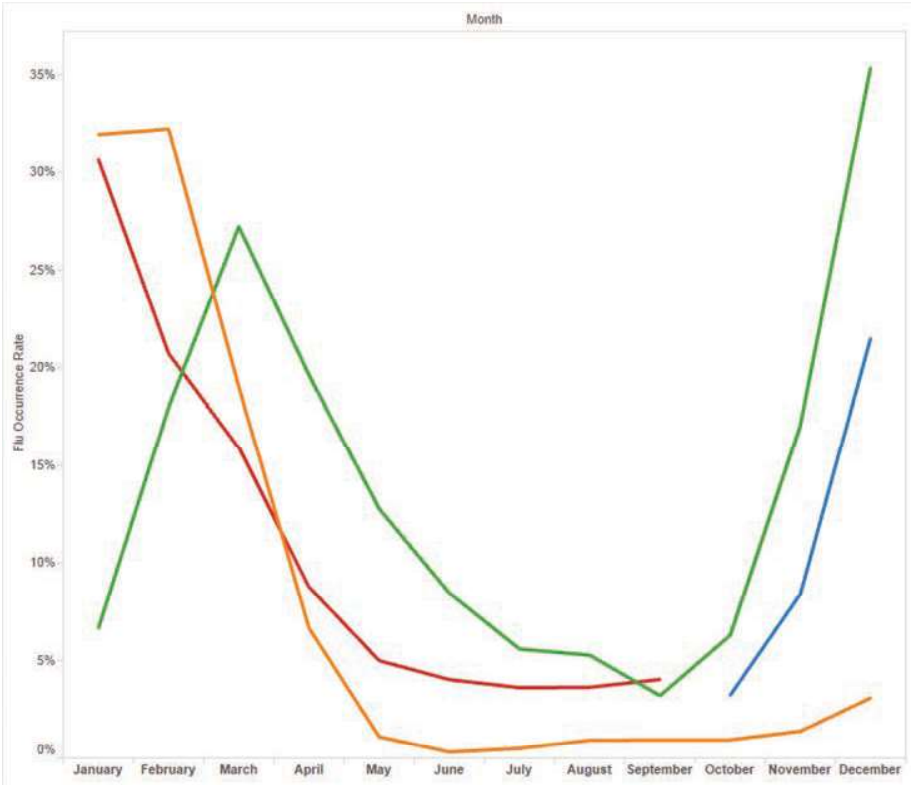


◂ Marks Card – Color

Dragging and dropping a Dimension or Measure onto the Color selector on the Marks card permits creation of a key to data elements in a chart. Coloring by a discrete Dimension (Year/Season in the example) will result in a categorical color key that can be customized. Continuous Measures will also generate a customizable color spectrum.

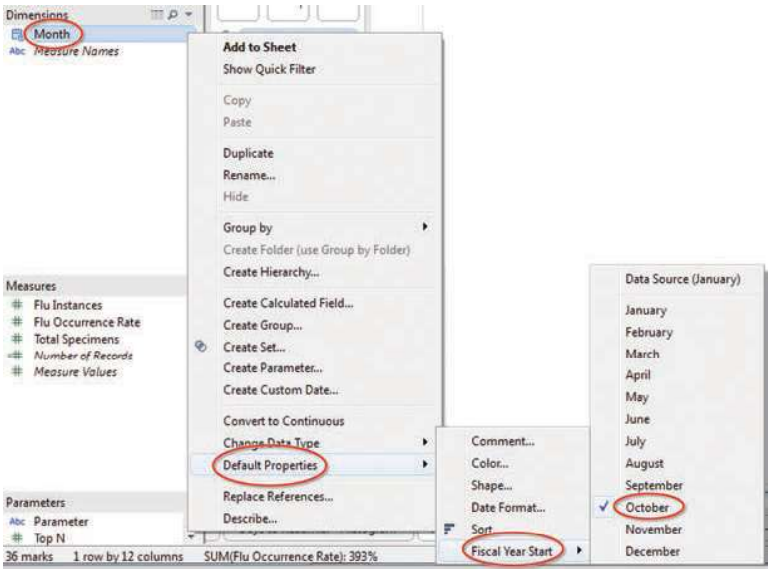
If there is no field on the Color selector, the default colors can still be changed by clicking on the selector.

The chart now looks like this:



The above chart does not display the data in a meaningful or compelling way. Since the flu season tends to begin in the fall, it is more logical to display the data from October through September instead of a calendar year. To change the order of the months,

- Right-click on "Month" in the Dimensions window.
- Select "Default Properties."
- Select "Fiscal Year Start."
- Select "October."



▲ Changing the Start of the Year

Tableau date fields default to January. Sometimes, as with fiscal-year reporting, the start date must be changed to a different month.

The reformatted chart makes clear that flu occurrences rise dramatically beginning in October and peak in the winter.

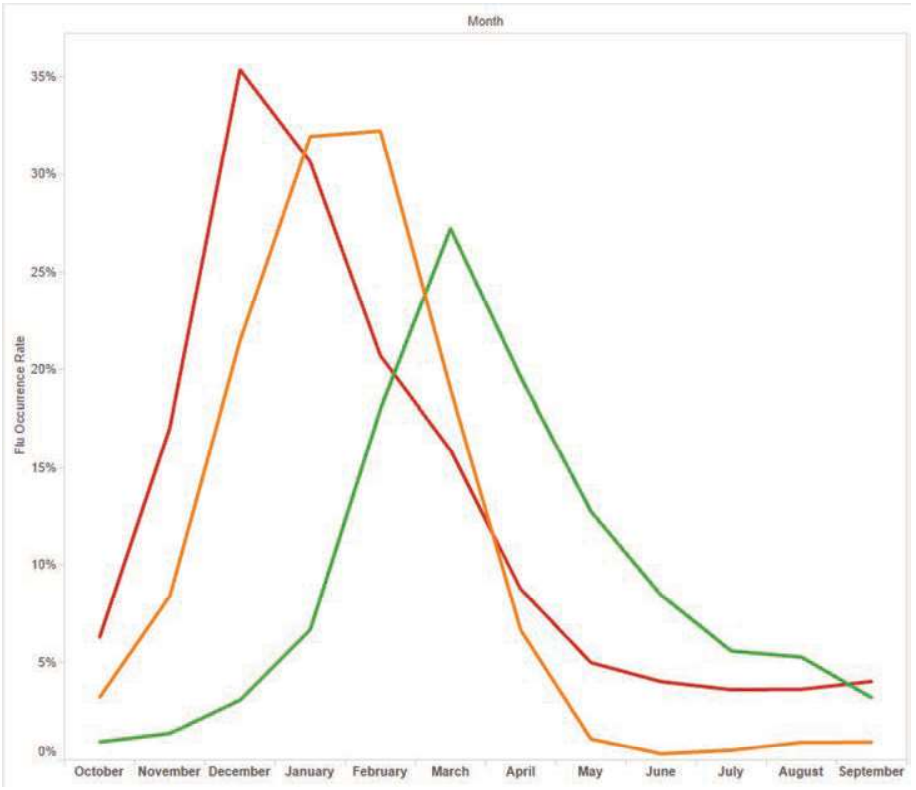


Tableau auto-generates a color for each line: red, green, and orange. To change the colors:

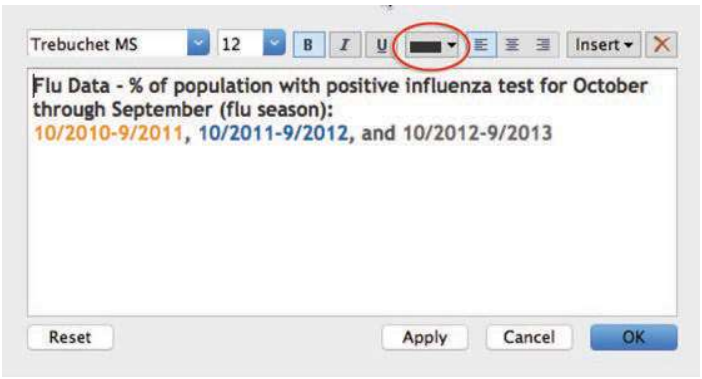
- Click on the YEAR(Month) color legend caret to open the sub-menu.
- Select "Edit Colors."
- Click the caret for the Color Palette drop-down and select "Color Blind" color palette.
- Click "FY2012" in the left column to highlight and select a blue color square.
- Click "FY2013" in the left column to highlight and select a gray color square. Click "OK."

The header containing the word "Month" can be deleted; since months are displayed at the bottom of the chart, this label is unnecessary. To hide it:

- Right-click on the label.
- Select "Hide Field Labels for Columns."

4 Add a title

- Click "Worksheet" on the Menu bar.
- Click "Show Title."
- Double-click on the title to edit.
- Add the title, "Flu Data - % of population with positive influenza test for October through September (flu season): Oct 2010–Sep 2011, Oct 2011–Sep 2012, and Oct 2012–Sep 2013."
    - Color-code each of the three date ranges to match their corresponding lines: Oct 2010–Sep 2011 (orange); Oct 2011 to Sep 2012 (blue); and Oct 2012 - Sep 2013 (gray).



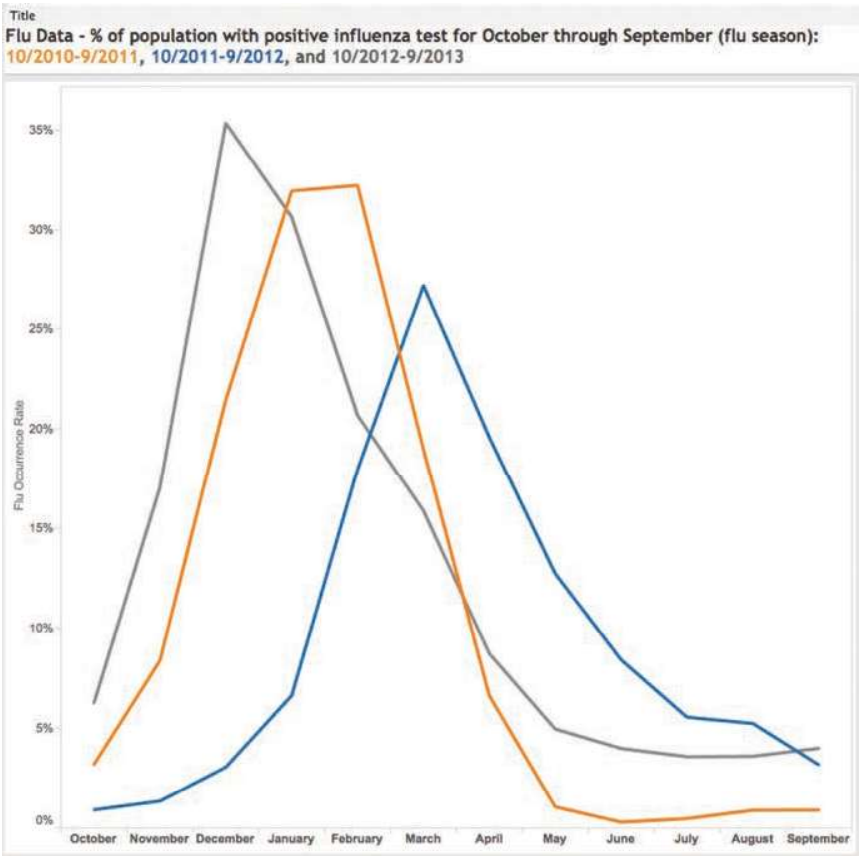
Best Practice

Use colors in titles to double-encode data and improve readability.

5 Rename the worksheet tab and save the worksheet

- Right-click on the worksheet tab at the bottom of the workspace, then select "Rename."
- Enter an intuitive title.
- Click the "Save" icon on the Tool bar.

The final chart looks like this:



Insight: This chart enables the viewer to see that flu rates for Oct 2010–Sep 2011 and Oct 2011–Sep 2012 were highest during the winter months from about November to February, with over 30% of patients testing positive for the virus. From Oct 2012–Sep 2013, the rates peaked later in the season—March and April—and lower, around 25%, than in the previous two seasons.

HDVizoom™...to the Line Chart

1 Create new worksheet and connect to data:

- At bottom of Tableau workspace, click icon for new worksheet
- Click on "Flu 2010–13" dataset in Data window

2 Create chart:

- Drag and drop "Month" from Dimensions window onto Columns shelf

  Option 1:

  - Click + sign to left of YEAR on pill
  - Click Quarter + sign to drill down to Month date level
  - Drag and drop YEAR(Month) pill and QUARTER(Month) pill from Columns shelf onto gray workspace to remove them. Only MONTH(Month) pill should remain on Columns shelf

  Option 2:

  - Right-click on "YEAR(Month)" pill on Columns shelf
  - Select "Month" from first section
- Drag and drop "Flu Occurrence Rate" from Measures window onto Rows shelf

3 Format chart:

- Right-click on "Flu Occurrence Rate" in Measures window
- From context menu, select "Default Properties"
- Select "Number Format"
- Select "Percentage"
- Change Decimal places from 2 to 0
- Drag and drop "Month" from Dimensions window to Color selector on Marks card
- Right-click on "Month" in Dimensions window
- Select "Default Properties"
- Select "Fiscal Year Start"
- Select "October"
- Click on YEAR(Month) color legend caret to open sub-menu
- Select "Edit Colors"
- Click caret for Color Palette drop-down and select "Color Blind" color palette
- Click "FY2012" in left column to highlight and select blue color square
- Click "FY2013" in left column to highlight and select gray color square. Click "OK"
- Right-click on "Month" field label at top of chart
- Select "Hide Field Labels for Columns"

4 Add title

- Click "Worksheet" on Menu bar
- Click "Show Title"
- Double-click on title to edit
- Add title, "Flu Data - % of population with positive influenza test for October through September (flu season): Oct 2010–-Sep 2011, Oct 2011–Sep 2012, and Oct 2012–Sep 2013"
  - Color-code Oct 2010–Sep 2011 in orange to match corresponding line; Oct 2011 - Sep 2012 in blue; and Oct 2012 - Sep 2013 in gray

5 Rename worksheet tab and save worksheet:

- Right-click on worksheet tab at bottom of workspace, then select "Rename"
- Enter intuitive title
- Click "Save" icon on Tool bar