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| Technology Name: | | | Tableau Desktop [[link for more info](#http://www.tableausoftware.com/)] | | | Version: | 8.2 |
| Reviewer: | Brian Lee @leebrian | | |  |  | | |
| Date: | 10/14/2014 | | |
| Public Health Processes: | | | |
| Diverse alignment across public health processes, but specifically “Process, Store and Analyze Data.” | | | |
| Description / Purpose: | | | |
| Tableau Desktop is a software tool developed by Tableau Software, a company founded out of a Stanford University project in 2003. Tableau Desktop is a visualization and analysis tool that queries data in multiple formats and provides an easy method to generate static and interactive charts, graphs and maps. Specific visualization types include: text tables, heat maps, highlight tables, symbol maps, filled maps, pie charts, horizontal bars, stacked bars, side-by-side bars, treemaps, circle views, side-by-side circles, lines, area charts, scatter plots, histograms, box-and-whisker plots, gantt, bullet graphs and packed bubbles. | | | | | | | |
| **Keywords:** Data Analysis, Data Visualization | | | | | | | |
| **Recommended Attributes:** | | | | | | | |
| Acceptability: | | Tableau has an extensive feature set that is able to be readily used by novice users through to expert users. Extensive training is available for free through Tableau’s website and an active community forum exists to answer user questions and provide examples. Tableau Desktop is able to load data from a variety of common user formats such as comma separated value (CSV) or Excel. A professional version of the tool exists to connect to complex data sources such as MySQL, SQL Server, Google Analytics, Hadoop and other sources. | | | | |  |
| Usefulness: | | Tableau’s primary purpose is to allow users to better interact with data, perform analyses and disseminate results of analyses. Tableau provides a large selection of built-in and user customizable chart times that allow customization and formatting. In addition to charts, Tableau provides US and international mapping features. Tableau creates dashboards of analysis that can be published to TableauPublic for free or to an organizationally hosted Tableau Server Edition. Tableau maintains an active release schedule with major releases every 6-12 months. | | | | |  |
| Accuracy: | | Tableau provides professional support to validate that their analytic routines calculate figures accurately. Tableau does not provide advanced regression and statistical routines that need to be carried out by statistical software. | | | | |  |
| Architecture: | | Tableau Desktop is client software that is installed on 32-bit and 64-bit Microsoft Windows workstations and Apple Macintosh workstations. Tableau also provides a Server version that provides a service application programing interface (API) that allows users of Tableau Desktop to publish and share visualizations through the web. While Server is a paid tool, Tableau also provides TableauPublic for free for visualizations and data sets that can be shared publicly. | | | | |  |
| Data Quality: | | Visualization is a useful component of data quality by allowing epidemiologists to investigate the quality characteristics of a data set. Tableau provides tools to check data for completeness and to calculate representativeness. | | | | |  |
| Timeliness: | | Tableau does not provide functionality to address timeliness and is out of scope for this evaluation. Data sources that provide data to Tableau need to be assessed for their timeliness independent of Tableau. | | | | |  |
| Costs: | | Tableau is commercial software provided by Tableau Software at charge. Tableau Desktop is available for a one-time fee of $999 per user with a $200 per user per year optional support that provides access to upgrades. A professional edition is available for a one time fee $1,999 with a $400 per user per year optional support charge that provides access to upgrades. Tableau also provides a hosted solution for $500 per user per year that includes all software installs, support and upgrades. Tableau costs are per year, not per seat or per workstation so a single user license allows the user to download, install and use the software on multiple workstations. Tableau also provides a mobile version of the tool for free that runs on Apple iOS and Google Android operating system. The mobile version does not have full functionality, but allows for viewing and interacting with dashboards. | | | | |  |
| Organizational: | | Tableau is likely to be used by epidemiologists, statisticians and public health advisors who do not have specialized informatics training. Since this is desktop software it is able to be used without ongoing IT support and maintenance of server components. | | | | |  |
| Supportability: | | Tableau requires no specialized support and can be maintained by its users with minimal interaction with IT support. Installation and upgrades requires temporary administrative access on Windows, but not on Macintosh. This software is currently Level III approved for use on CDC workstations. | | | | |  |
| Conclusion: | | Tableau provides an easy to use, relatively inexpensive tool for public health practitioners to use to analyze, create visualizations and effectively communicate their analysis with a diverse audience. It provides functionality common on health and non-health web sites and allows for interactivity and a pleasant user interface that other analysis tools do not require. While this tool does not replace completely statistical software packages like SAS, R and SPSS it is valuable for visualization purposes. | | | | | |
| Data Representation: | | {"evaluation":{"url":"https://github.com/leebrian/setph/blob/master/evals/structured-evaluation-technology-publich-health-tableau.docx", "technology":"Tableau", "version": "8.2","keywords":["Data Analysis","Data Visualization"], "author":"@leebrian", "acceptability":1, "usefulness":1, "accuracy":1, "architecture":1, "data-quality":1, "timeliness":0, "costs":1, "organizational":1, "supportability":1}} | | | | | |

## Appendix A: Required Attribute Descriptions

1. Acceptability and User Satisfaction – “Acceptability reflects the willingness of individuals and organizations to participate in the surveillance system.” (Klaucke et al., 1988) This attribute is sometimes included within Usefulness as it related to how the intended users of a technology are able to integrate it into practice and are satisfied with its performance and functionality. This attribute

2. Usefulness – The ability of a system to meet the objectives and priorities as designed. “To the extent possible, usefulness should be described by the disease prevention and control actions taken as a result of the analysis and interpretation of the data from the system.” (Buehler et al., 2004) Usefulness can also be defined as the ability of the system to meet the domain characteristics or functionality specific to this system. Evaluation should assess the ability of the system to meet the necessary functionality or accomplish its purpose. This will vary greatly depending on the type of technology and the evaluator should assess this differently depending on the type of tool. In some cases the purpose is apparent (e.g., outbreak investigation) while in other cases the evaluator may need to contact the author of the technology to gain insight.

3. Accuracy – “… is measured by comparing data between facility records and reports, and between facility reports and administrative area databases, respectively.” (Aqil et al., 2009) While the sensitivity and predictive value positive attributes are specific to public health, the accuracy attribute is related but generalized to non-public health tools. This attribute represents a technology’s ability to present data that accurately represents the real value.

4. Architecture or Type of System – Describing the overall architecture of a technology is important for determining fit of a technology for use within a particular public health organization. This attribute is sometimes called system design or technology design and includes important characteristics like whether it uses peer-to-peer or centralized data sharing (Lober et al., 2002). The evaluator must assess the technology in relation to their organizational context as to whether the type of system (web site, mobile application, message queue, etc.) is an appropriate fit for the architecture of other technologies that will be used within an organization.

5. Data Quality – “… reflects the completeness and validity of the data recorded in the public health surveillance system.” (German et al., 2001) Data quality is a compound attributes that in some evaluations is stand-alone but in other evaluations is broken down into sub-components such as completeness, validity, and representativeness. While this is a public health specific definition for data quality, when evaluating non-public health technologies this definition must be adapted to reflect the ability of the technology to either consume or product data that is complete and error free. In many cases, a technology may provide specific benefits over improving data quality and/or reducing the number of errors or faults within the technology.

6. Timeliness – “…surveillance approaches for outbreak detection is measured by the lapse of time from exposure to the disease agent to the initiation of a public health intervention.” (Buehler et al., 2004) Buehler’s definition is specific for surveillance purposes, but a simplified definition is the time lapsed between when an event occurs to when a technology renders the event actionable for a user. The specific methods to measure timeliness will vary depending on the technology under evaluation but is important for comparing different technologies as to how soon a technology is useful within public health. It is important that timeliness be all inclusive to cover all aspects of timeliness that are appropriate to a technology such as onset of exposure, onset of symptoms, onset of behavior, capture of data, completion of data processing, application of analytical processing, generation of alert, initiation of investigation and initiation of public health intervention. For technologies outside of public health, some steps may not be able to be included within the specific evaluation of the timeliness attribute.

7. Costs – “Cost is a vital factor in assessing the relative value…” (Buehler et al., 2004) Evaluation of the cost attribute should include both direct costs such as licensing, support, hardware, software purchases, personnel and travel. The rating based on this attribute should address the cost of a system in relation to its value or results from the usefulness attribute. This can include the value of the prevention as a result of the technology but will depend on the particular aspects of a technology. In the case of software technologies, this evaluation attribute also includes the licensing model whether it is open source, commercial or government produced software. The software license model is important for determining initial costs as well as ongoing costs for support and operation.

8. Organizational and Social – “The stakeholders of the system should be listed. Stakeholders include those who provide data for the system and those who use the information generated by the system… Listing stakeholders helps define who the system is intended to serve and provides context for the evaluation results.” (Buehler et al., 2004) This evaluation attribute describes how a technology is adapted within an organization and addresses the social fit of the technology. This can determine how a technology is compatible with other technologies within an organization or how the technology is used differently across stakeholder groups.

9. Supportability and Compatibility – “All aspects of the operation of the syndromic surveillance system should be described in detail to allow stake- holders to validate the description of the system and for other interested parties to understand the complexity and resources needed to operate such a system. Detailed system description also will facilitate evaluation by highlighting variations in system operation that are relevant to variations in system performance.” (Buehler et al., 2004) This attribute is sometimes included in the costs evaluation of a system. This attribute is important in determining the fit of a technology into an existing mix of technologies in an organization.

## Appendix B: Optional Attributes

Select zero or more attributes as deemed necessary to accurately evaluate the technology of interest.

O1. Data Management and Interoperability – Data management represents a variety of technology functions and features focuses on how a technology works with data within its boundaries and how data is received from and sent to outside partners. This attribute is particularly common in describing how a public health system is able to store, control access, provide access, ingest and extract data to enable to the processing of data into information. Each technology may address data management in a different manner. This attribute can be synergistic in with the attribute of standardization for how it enables interoperability with other technologies.

O2. Data Analysis and Data Visualization – “A determination of the appropriate analytic approach to data should be an integral part of the planning of any surveillance system. The data needed to address the salient questions must be assessed to assure that the data source or collection process is adequate.” (Teutsch & Thacker, 1995) While data management focused on the structure and storage and manipulation of data, analysis and visualization focuses on the use of data to perform the necessary functions of public health. Data analysis is related to and enables other attributes like data quality (ability to analyze the data is critical to determining data quality) and timeliness (ability to visualize the data enables swifter decision making with data).

O3. Description and Documentation – “The purpose(s) of the system should be explicitly and clearly described and should include the intended uses of the system. The evaluation methods might be prioritized differently for different purposes.” (Buehler et al., 2004) Each evaluation needs to include a description of the technology to give cover the purpose and intent of the system. This includes the level of documentation available for the technology and will affect the usability (i.e., clarity of documentation makes technology easier to adapt) as well as the usefulness of the system.

O4. Performance and Efficiency – This attribute describes a technology’s ability to consistently and efficiently meet the demands of the users of the technology. This attribute measures the responsiveness of a technology (CDC, 2011b) and its ability to maintain a useful level of responsiveness under expected user activity loads.

O5. Flexibility – “…of a surveillance system refers to the system’s ability to change as needs change. The adaptation to changing detection needs or operating conditions should occur with minimal additional time, personnel, or other resources.” (Buehler et al., 2004) The evaluation of this attribute is important to determine the ability for a technology to expand and adapt to shifting organizational changes. Depending on the type of technology, this attribute will be reflected in different manners. Since technology will be used in different manners depending on its function within public health (i.e., environmental health, health policy, infectious disease, non-communicable disease, etc.) the value of a technology is greater if it can be reused in different configurations by a wide variety of users. This is particularly valuable in data intensive tools that need to adapt as data standards change over time.

O6. Stability and Reliability – “The stability of a surveillance system refers to its resilience to system changes… Stability can be demonstrated by the duration and consistent operation of the system.” (Buehler et al., 2004) While this definition is specific to surveillance systems, it is useful in the evaluation of technologies to describe how a technology is able to withstand unexpected performance conditions and whether it can consistently respond to the user without an interruption in service. This is important in evaluating how technologies will fit into an organization as gaps in stability and reliability can negatively impact other systems used within an organization.

O7. Data Dissemination – “Data must be analyzed and presented effectively so that decision makers at all levels can readily see and understand the implications of the information.” (Teutsch & Thacker, 1995) This attribute represents a technology’s ability to accurately share information and collaborate with users of other technologies.

O8. Standardization – This attribute reflects the ability of a technology to “use generally recognized and, where suitable computerized formats for each data element to facilitate analysis and comparison with data collected in other systems…”(Teutsch & Thacker, 1995). This attribute is important in determining the interoperability of a technology with other technologies but varies as to how it is important within a technology. Technologies that rely more on data interchange will require this attribute to be used with a higher priority.

O9. Security and Privacy – This attribute is largely driven by the US Health Insurance Portability and Accountability Act (HIPAA) of 1996 that describes privacy controls that are required to protect patient health information. However, this attribute is commonly included into the Usefulness or Architecture attributes of a system rather than broken out as a separate dimension of an evaluation. An evaluator may choose to prioritize this attribute is a technology is particularly sensitive to privacy or security concerns such as when a technology operates within multiple health care institutions (Lober et al., 2002).

O10. Simplicity vs. Complexity – “The simplicity of a public health surveillance system refers to both its structure and ease of operation. Surveillance systems should be as simple as possible while still meeting their objectives.” (German et al., 2001) The simplicity of a technology is closely related to its usability or acceptability attributes. The more complex a system is, the more difficult it is to deploy within an organization and the greater the risk that it conflicts with other technologies used. The evaluation of a system based on its complexity or simplicity will be an important factor for organizations with limited informatics expertise to support the tool and educate users on its functionality.

O11. Ethical and Legal – This attribute is important for determining whether a technology is an appropriate fit based on legal and ethical concerns of an organization using the technology or the user operating the technology (Mandl et al., 2004).

O12. Portability – “The portability of a surveillance system addresses how well the system could be duplicated in another setting… Reliance on person-dependent steps, including judgment and action criteria (e.g., for analysis and interpretation) should be fully documented to improve system portability.” (Buehler et al., 2004) This attribute describes the technology’s ability to be reused in diverse situations. It is related to the simplicity attribute in that technologies that are simple are more likely to be portable to additional situations and organizations. This attribute is also sometimes linked to the generalizability of a technology from one specialized situation to other situations. This attribute is important for evaluators who are concerned with the ability of a single tool to be used within multiple diverse portions of their organization.

## Appendix C: Common Ground Business Processes

1. Conduct Exercise To Evaluate Organizational Response Capacity
2. Conduct Syndromic Surveillance
3. Conduct Notifiable Disease Surveillance
4. Conduct Active Surveillance
5. Conduct Public Health Investigation
6. Initiate Alerts
7. Develop And Report Situational Information
8. Manage Resources
9. Develop And Initiate Risk Communication
10. Administer Medical Countermeasures (MCMS)
11. Data Collection
12. Data Management
13. Process, Store, And Analyze Data
14. Conduct Epidemiological Research
15. Community Health Assessment
16. Develop Strategic Plan
17. Identify And Deploy Health Guidelines
18. Deliver Programs And Services
19. Develop Public Health Intervention
20. Link Individuals/Populations To Programs/Services
21. Develop And Implement Program Evaluation