Product Description:

The product was inspired by the current state of the pandemic. This school year, children and families immerged from lock-down to return to the classroom. With in-person instruction resuming, it was important to follow covid19 cases in schools so that children stay healthy. The current information available on the Montgomery County School Website was difficult to interpret, and doesn't give the user options to view data over longer periods of time, or for specific schools within the school district.

The goal of the project was to provide visualizations for several views of Covid19 data in the Montgomery County School District. These visualizations provide overviews of data for the whole school district. They give the current weeks' total number of cases, as well as a time series showing levels within schools (as a whole and within geographic locations) from the beginning of the school year to today's date. The project also provides visualizations that allow the user to select specific schools and/or school-levels to view. This information was embedded into a webpage so that it could be accessed by anyone interested in the data.

Product Functionalities:

Overview of District Data

There are two charts when the user first opens the website that give an overview of Covid19 cases in the school district as a whole. The first visualization (Figure 1) is a bar chart that displays the current week's cases, and the schools where they occurred. This gives the user a quick picture of overall cases.

The second visualization is an area chart. This chart gives a temporal view to show the trends in Covid 19 cases over time. The area aspect of this graph allows the user to see the total number of cases for any given date, but also allows the user to see the number of cases in each geographic area – referred to as "strand."   Additionally there is a "tooltip" which allows the user to mouse-over any point on the graph for additional information.

View by School

After viewing overall school district data, the user can utilize a navigation bar and menu to go to a visualization where they can explore Covid19 cases in individual schools (Figure 2). This line chart visualization allows the user to choose which individual schools they would like to view. There is a dropdown selection menu, and the user can choose as many (or few) schools as they like. If they make a mistake, or change their mind, they can click on the "X" and the school will be removed. Additionally there is a ruler tooltip on the graph so that a user can see specific case numbers for a specific date for all the schools on the chart.

View by Level

An additional navigation option takes the user to a line chart with a bar chart (Figure 3). In this visualization, the user can choose the level of schools they would like to see: elementary, middle, high, or administration. Once they choose the level, they will see a time-series line chart that shows all the schools within the level they chose. The bar chart (below the line chart) shows the total number of cases in each of the schools since the beginning of the school year.

Get Vaccinated

A final navigation options can take the user to a page with two links to websites where the user can make appointments for vaccines (Figure 4).   There are buttons which link users directly to the pages where they can make appointments.

Website

All of the visualizations and links are contained within a website. The website was built using Bootstrap5. The webpage is reactive, so it will adjust sizing based on the size of the screen (e.g. desktop, tablet, or phone). A navigational sidebar is available throughout the website to help the user get to specific functions they are interested in. Colors, location, and navigation have been carefully crafted to make the website attractive, easy to read, and easy to navigate.

A link to a demo of the product can be found on VT GitLab.

Design:

The design of the project involved creating visualizations using D3 in Observable, and then embedding them in a website for the user to access. The design also allowed for user choice to determine what data they wanted to view: two of the charts allowed the user to select schools or school-levels to display. The design also offered additional details utilizing a mouse-over tool-tip which showed additional details (such as specific date and number of cases) to the user.

The website design utilized a side navigation bar and menu that could be accessed from anywhere within the website. Additionally, links were embedded to help the user navigate to external sites to make vaccine appointments. Colors and placement were designed to offer an attractive, well-organized, easy to navigate website.

The data for this project was collected directly from the Montgomery County School's daily covid19 cases by pulling data dynamically from their API. This data was automatically updated each time the webpage is refreshed.

Key tools used to build the project included Observable in conjunction with D3 to create visualizations, and Bootstrap 5 (using Visual Studio Code) to build the website.

Retrospection:

The project of building visualizations and embedding them into a dashboard accessible from the internet was a challenging project.

In Sprint 1 I learned to scrape data from an API. Additionally, I cleaned and manipulated it so that the data could be used for visualizations. Further, I learned through trial and error all the necessary building blocks for a website, and was able to embed preliminary data within a framework website.

Sprint 2 involved learning more about D3 to create the four planned visualizations along with user selection and interaction for two of the charts. Although D3 can be challenging to work with, and Observable's documentation is patchy, creating the charts was overall very rewarding. The user selection options work well and the charts are visually easy to understand.

Sprint 3 consisted of a variety of items needed to wrap up the project. The two main challenges were completion of the website and the addition of vaccine appointment links. The links were pretty straightforward. Finalizing the webpage continued to be a stretch for me. I reassessed the capabilities of Bootstrap to determine whether I should change platforms again. In this reassessment, I found that I could make the customizations I desired within the Bootstrap framework. Through this, I gained a better understanding of how HTML, CSS, and JavaScript work together in web development.

Overall, I really enjoyed creating the website and the content for the website. In reflecting on my experience, I clearly underestimated the technical knowledge needed for web development! This has served as an important reminder that often tasks that appear simple on the surface actually require significant time, effort, and expertise. It's important to value each task and each team member performing the task. Additionally, in viewing the charts created for the website, it is clear that they were helpful in evaluating Covid19 levels in schools. It still sometimes surprises me how a simple visualization can uncover or clarify a problem and lead towards a solution. This was certainly the case with the Covid19 data.

Recommendations for future work:

The Covid19 Data for Montgomery County Schools was successful in providing key information to parents, administrators, and teachers. The data provided shows clearly where there are differences between schools which could be helpful in lowering overall Covid19 cases in schools. Future recommended work would include: making the website public, working with the school district to assist them with their efforts to keep children healthy, and incorporating information on vaccination levels in schools.

Making the website public would be very useful especially to parents in the school district. I personally found it helpful to see Covid19 levels for my child's school. Additionally, it was interesting to see how the levels increased significantly (and clearly) right after the Thanksgiving Holiday: I think parents could learn a lot and reflect on their personal responsibility and control if they could see the information on the website.

These factors could also help administrators within the school district: being able to see trends could be instrumental in developing future plans and actions. Additionally, one of the interesting facts that came to light from the data visualization was that Blacksburg Middle School had roughly half the level of cases when compared to the other three middle schools in the district. If school administrators where aware of this difference, they could begin to look for the root causes, and potentially lower cases in all schools as a result.

Finally, it would improve the current visualizations, and also add another dimension of information, if vaccination levels could be added to the data. With the new vaccine approved for children ages 5-12, the vaccination levels should increase significantly in all schools. This will likely lower Covid19 levels throughout schools. The correlation between the two is not fully understood, however, so it is recommended that data collection, analysis, and visualization continue to move forward.
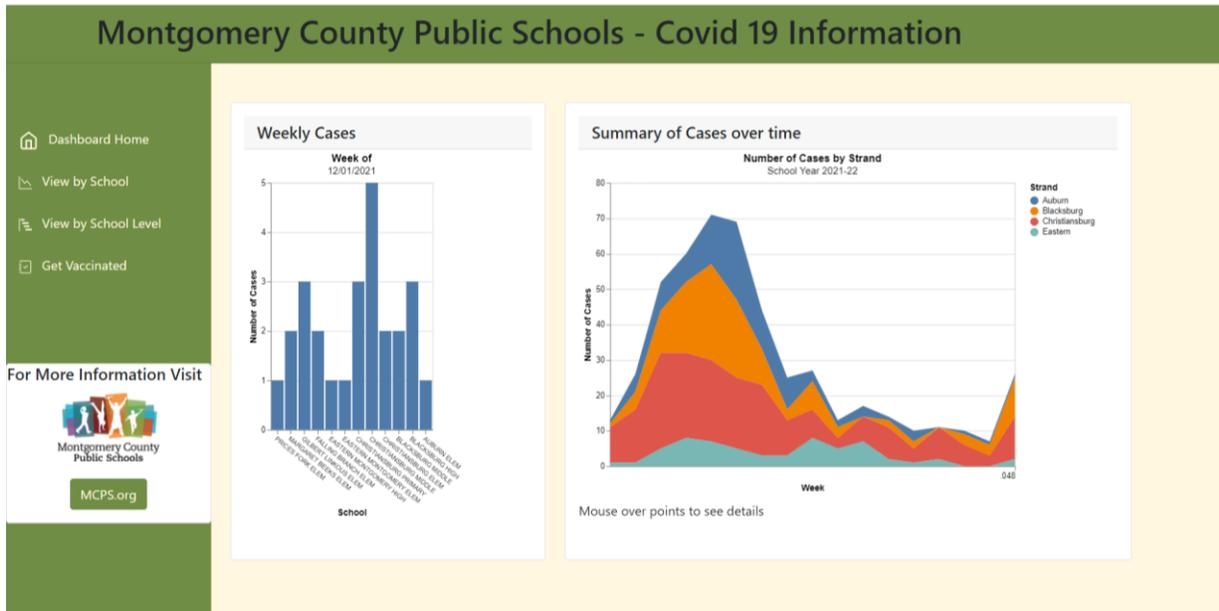
Figure 1: shows the final home page of the website. This page contains two overview (non-interactive) visualizations.
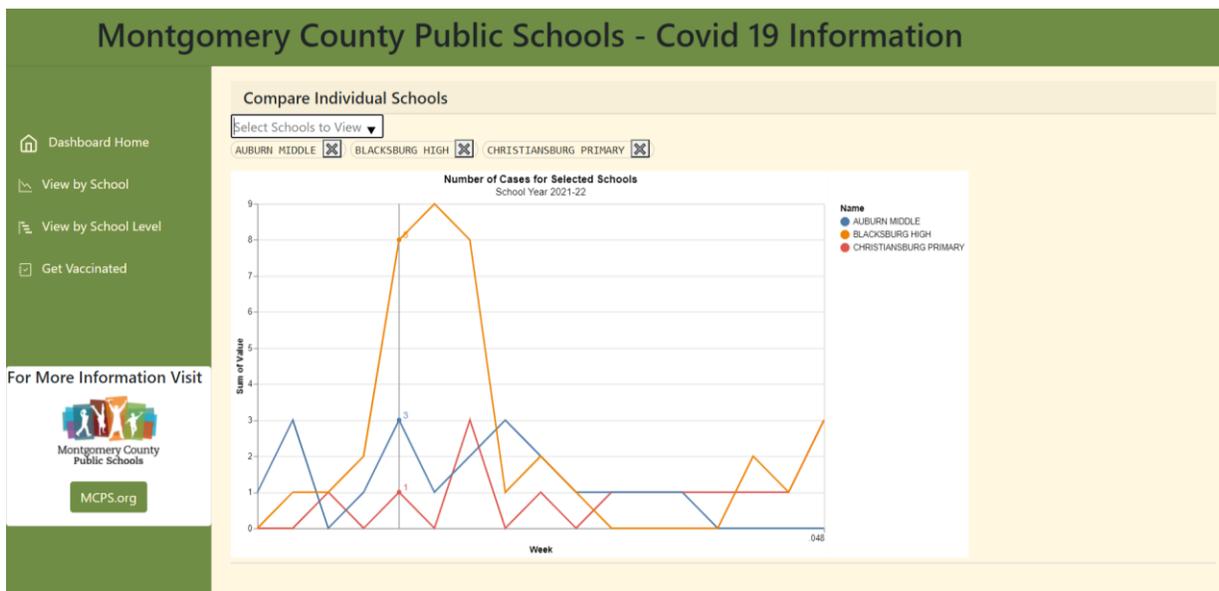

Figure 2: shows the third visualization. This visualization allows the user to choose which schools to include in the chart. It also offers a tooltip/ruler bar which displays number of cases for each school at a given time.
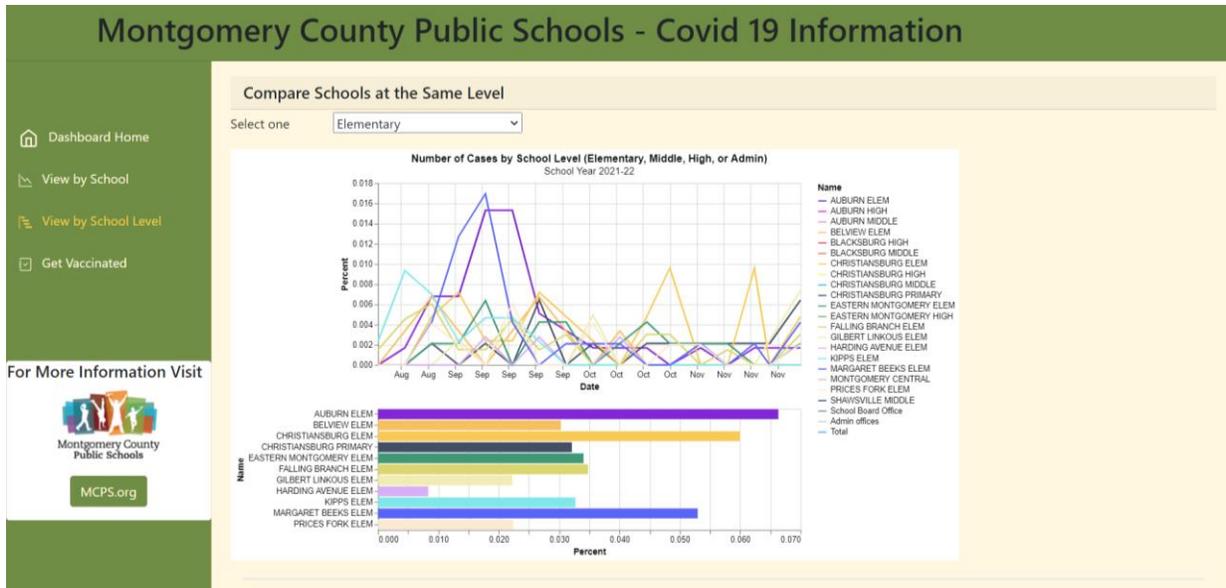
Figure 3: The fourth visualization offers a line chart of the level of schools selected by the user. The level choices are Elementary, Middle, High, and Administration. Additionally, a bar chart displays total covid cases for each of the schools displayed.
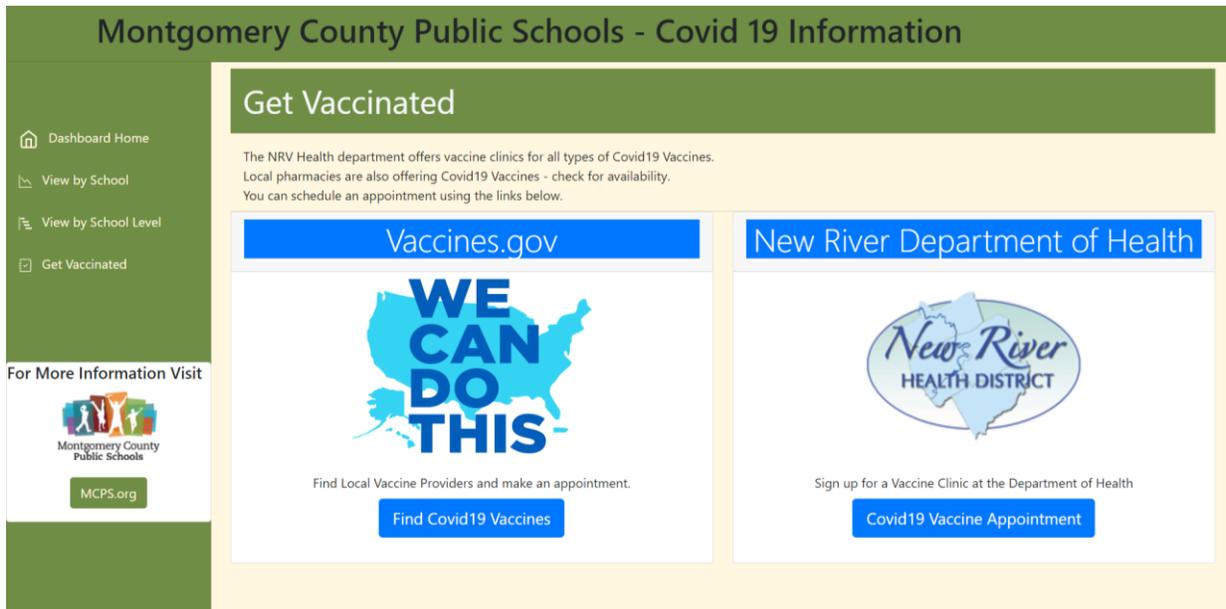

Figure 4 shows links to webpages where users can sign up for Covid19 vaccination appointments.

- **GitLab Repository:** MCPS Covid19 Dashboard
    i. Demonstration of completed website functionality (posted on Wiki page)
    ii. Observable code can be accessed directly below, and the links are also on GitLab.
    iii. Kanban Chart
    iv. Webpage code
- **Observable Programming links:**
    i. https://observablehq.com/@meglalley/covid19-cases-in-montgomery-county-schools-va
    ii. https://observablehq.com/@meglalley/mcps-covid19-dashboard-visualizations

- **Final Burndown Chart**

Backlog ID	User Stories		Initial Estimate Week 0	Sprint 1 Oct 4 - Oct 24 Week 1	Week 2	Week 3	Sprint 2 Oct 25 - Nov 14 Week 4	Week 5	Week 6	Sprint 3 Nov 15 - Dec 5 Week 7	Week 8	Week 9
1	• As the Covid19 Dashboard System Administrator, I want data on the website to be accurate and up-to-date.	Total	8									
		Task 1.1		2								
		Task 1.2		1								
		Task 1.3		0.25								
		Task 1.4			0.25							
		Task 1.5			1							
		Task 1.6			1	2.5						
2	• As a parent I want to access to a website that tells me about Covid19 cases in my school district	Total	7									
		Task 2.1		1	2							
		Task 2.2			1	3						
3	• As a district administrator, I want to see overall levels of covid throughout the district so I can determine if mitigation are methods are working well enough.	Total	0.5									
		Task 3.1				0.5						
4	• As a parent I want to compare covid levels of my child's school to a similar school in the district so I can be sure my child's school is doing all they can to keep covid case levels low. • As a school administrator, I want to see my school's covid levels so I can determine if changes to mitigation methods are needed.	Total	14									
		Task 4.0					4	4				
		Task 4.1							2.00			
		Task 4.2							1.00			
		Task 4.3							2.00			
		Task 4.4							1.00			
5	• As a parent I want to look at covid levels this week for schools so I can determine if case levels are going up or down. • As a district administrator, I want to see schools at each level (high, middle, elementary) so I can determine if schools at different levels need different support to reduce their covid levels. • As a parent I want to compare covid levels in different schools at the same level as my child's school so I can see if my child's school is doing better or worse than other schools with children that are the same age. • As a school administrator, I want to compare my school's covid levels to other schools with similar aged students so I can see if similar schools have similar levels.	Total	7.75									
		Task 5.1							2.00			
		Task 5.2							0.75			
		Task 5.3							3.00			
		Task 5.4							2.00			
7	• As a parent I want to look at covid levels in my child's school so I can determine if he/she is at risk.	Total	0.375									
		Task 7.1							0.38			
8	• As a webpage administrator, I want to manage a website that is well designed so that all aspects are easy to see and easy to update. It is important that the webpage have an intuitive design so that it will be easy to maintain. • As a school administrator, I would like to be able to see Covid19 levels throughout the school district. I want this information to be quickly and easily accessible in one website. • As a parent, I want to be able to easily find information on my school district's Covid19 case levels.	Total	9									
		Task 8.1										4
		Task 8.2								2		
		Task 8.3								1	2	
9	• As a parent of a school-age child under the age of 12, I want to get him/her vaccinated. I need to be able to find out who is carrying the vaccine (for 5 - 12 year-olds) and make an appointment.	Total	5									
		Task 9.1									1	
		Task 9.2									2	
		Task 9.3									2	
6	• As a district administrator, I want to see the map of overall covid levels for each strand so I can see if some areas are having very different levels of covid (higher or lower).	Total	1.25									
		Task 6.1								0.75		
		Task 6.2								0.25		
		Task 6.3								0.25		
			52.875	4.25	5.25	6	4	4	14.125	4.25	7	4
	Remaining Effort		52.875	48.625	43.375	37.375	33.375	29.375	15.25	11	4	0
	Ideal Trend		52.875	47.000	41.125	35.250	29.375	23.500	17.625	11.750	5.875	0.000

Figure 5: Bright blue (Sprint1) and dark green (Sprint2) cells show where more time was needed to complete the task. New tasks were added to Sprint 3.

Burndown Chart (updated 12/08/21)
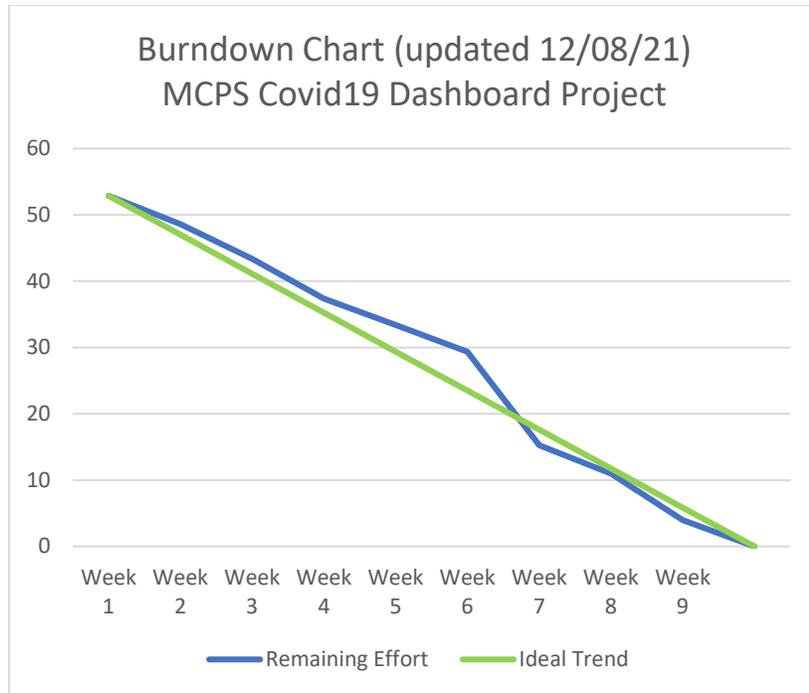## MCPS Covid19 Dashboard Project

Figure 6: The burndown chart reflects the high level of activity in Sprint 1 and Sprint 2. Sprint 3 finished 3-5 days early in order to manage final requirements for the project.

- **Product Backlog (Updated)**

Backlog

Backlog ID	Prioritized User Stories	Tasks	Testing	Time estimate (days)
1	• As the Covid19 Dashboard System Administrator, I want data on the website to be accurate and up-to-date.	1.) System Administrator needs to learn how to scrape data from website 2.) System Administrator needs to scrape data from MCPS website 3.) System Administrator needs to find population per school on MCPS website 4.) System Administrator needs to scrape population data from MCPS website 5.) System Administrator needs to clean data from MCPS website 6.) System Administrator needs to merge and organize Covid19 data and Population data from MCPS website	Data downloaded temporarily to CSV file to verify format is correct for use on website	2 1 0.25 1 0.5 1
2	• As a parent I want to access to a website that tells me about Covid19 cases in my school district	1.) System Administrator follow tutorial on setting up AWS website 2.) System Administrator Design and launch opening page of website	Website can be accessed. *Data will be live but website will not go public*	0.25 2
3	• As a district administrator, I want to see overall levels of covid throughout the district so I can determine if mitigation are methods are working well enough.	1.) System Administrator needs to pull weekly Covid levels from scraped data and display on website	Current aggregate Covid19 data visible on website	0.5
4	• As a parent I want to compare covid levels of my child's school to a similar school in the district so I can be sure my child's school is doing all they can to keep covid case levels low. • As a school administrator, I want to see my school's covid levels so I can determine if changes to mitigation methods are needed.	1.) System Administrator needs to add school name data to database 2.) System Administrator needs to create visualization for individual or multiple schools in javascript 3.) System Administrator needs to create user interaction capability to choose one or multiple schools in javascript 4.) System Administrator needs to update website to include covid levels by week by school	User choices can be made User choices result in the correct visualization	0.25 0.75 0.125 2
5	• As a parent I want to look at covid levels this week for schools so I can determine if case levels are going up or down. • As a district administrator, I want to see schools at each level (high, middle, elementary) so I can determine if schools at different levels need different support to reduce their covid levels. • As a parent I want to compare covid levels in different schools at the same level as my child's school so I can see if my child's school is doing better or worse than other schools with children that are the same age. • As a school administrator, I want to compare my school's covid levels to other schools with similar aged students so I can see if similar schools have similar levels.	1.) System Administrator needs to add school level data to database 2.) System Administrator needs to create visualization in javascript 3.) System Administrator needs to create user interaction capability in javascript 4.) System Administrator needs to update website to include covid levels by week by level	User choices can be made User choices result in the correct visualization	0.25 0.75 0.125 2
7	• As a parent I want to look at covid levels in my child's school so I can determine if he/she is at risk.	1.) System Administrator needs to add detail dropdown information by school to the website	User snapshot choices display the correct values	0.375
8	• As a webpage administrator, I want to manage a website that is well designed so that all aspects are easy to see and easy to update. It is important that the webpage have an intuitive design so that it will be easy to maintain. • As a school administrator, I would like to be able to see Covid19 levels throughout the school district. I want this information to be quickly and easily accessible in one website. • As a parent, I want to be able to easily find information on my school district's Covid19 case levels.	1.) Update wireframe design for needs of current webpage design 2.) Research a better template for current webpage 3.) Migrate all components (old and new) to new template	Website is intuitive to navigate and asthetically pleasing. All Navigation units work. Information is easy to read and understand.	1 2 5
9	• As a parent of a school-age child under the age of 12, I want to get him/her vaccinated. I need to be able to find out who is carrying the vaccine (for 5 - 12 year-olds) and make an appointment.	1.) Determine who is carrying the vaccine in Montgomery County. 2.) Add a component/link to the webpage for each pharmacy administering the vaccine. 2.) Add a link to Montgomery County Dept of health to make an appointment.	Vaccine information is available on the website. Links to other sites work correctly.	0.75 0.75 0.75
6	• As a district administrator, I want to see the overall covid levels for each strand so I can see if some areas are having very different levels of covid (higher or lower).	1.) System Administrator needs to research creating heatmap in map shape on d3 2.) System Administrator needs to develop map in d3 for Montgomery County with school area strands separated within the map, 3.) System Administrator needs to combine map and data in d3 into heatmap for Montgomery County 4.) System Administrator needs to add map to website.	Area graph visualization by strand accessible on website	2 3 1.5 0.25

Figure 7: The project backlog shows that all items scheduled in Sprint 1, Sprint 2, and Sprint 3 have been completed.