John Hansmann: And welcome, everybody, to our Capacity Planning Tool Demonstration and Q&A Session round two. Jason, if you flip forward real quickly. Last week, Jason and I held a similar webcast to talk through our Capacity Planning Tool, and we got into some of the details of the demand side of the curves and the capacity side of the curve. And we're going to review some of that just real briefly.

John Hansmann: But then, we want to talk primarily about some new features that we've added in since the last time we spoke, which is looking at PPE and staffing components. And then, we actually have a new Excel version of the tool that we want to show to you. So, we're going to spend a little bit of time on that. I have a couple slides that we're going to cover. And then, we'll get into the actual demonstration and the Q&A session for the primary amount of time that we're here.

John Hansmann: Why don't we start out with introducing ourselves, for those of you who were not with us last week? For those who were, just remind you who we are. My name again is John Hansmann and I'm a 30-plus-year healthcare veteran, career-wise, formal training in industrial engineering. And I focused in my career primarily on patient flow and staffing and supply chain activities. So, it fits into all the things that we're going to be talking about today. Jason?

Jason Jones: I'm Jason Jones. Thanks, John. I'm responsible for data science at Health Catalysts, and previously, I had the pleasure and honor to serve at Kaiser Permanente and Intermountain Healthcare, among others.

John Hansmann: So, if you want to flip to the next slide, Jason. We have two slides here that we're going to cover real quickly. This first one is kind of a review from last week of where we work to get everybody caught up on the same page. And then, the next slide we'll talk about some of the new features I just mentioned. But basically, we at Health Catalyst created this Capacity Planning Tool to take all the information that we're starting to see out in the world a few weeks ago in terms of number of infected patients that were at a population level, whether it's a state or region, or even a city type level, and help to bring that down to an individual hospital perspective, so then you could start to identify and understand what kind of impacts you may have with COVID patients coming in to your organization.

John Hansmann: We built the tool on top of the Penn Med model that was released a few weeks ago, and we continued to use and stay true to the Penn Med model from the standpoint of we're using that model to bring the demand side of the patients into the hospital. And then, the component that we've added on to that is the capacity side or how many beds do you have available. In the tool, the primary function of it was to give you the ability to be looking forward and estimates the time, or estimate the day that you would potentially start to run out of beds and then give you time, if you will, to start to think about what are your backup plans, what are your emergency plans, where were you going to go for

	additional beds, whether those were internal within your individual hospital, opening up clinic space or same-day surgery space or PACU space, or things like that, or external.
John Hansmann:	I live in the area, the Dallas, Texas area and our convention center downtown has been made into a temporary hospital. So far, we haven't had to use it yet, but it's there waiting if we need to. So, the whole intent of this was to give you time to be able to now put in place your plannings in terms of where would you go and what would you do for those extra beds that you need.
John Hansmann:	The features that we built then and there, as I mentioned, we built this off the Penn Med model, but we wanted to make this as easy and simple to use as possible. It's a Web-based tool. For those of you who haven't been in it yet, it's very easy from a parameter side, and Jason will talk about this in a second, parameters on the lab and visuals on the right. And we've built in some what-if analysis and scenarios and the ability to save, and now upload historical data into the tool itself, with the purpose of having it to be used by your planners, your COVID taskforce, incident command centers, etc., to give you that time to be looking ahead when you will potentially run into problems from a bed capacity perspective and a ventilator perspective.
John Hansmann:	Jason, next slide, please. So, on our roadmap, as we were building this thing out, the next thing we thought would be best to put into the tool would be uses and demand for PPE and demand for additional staffing. So, that's what we've done. We also asked during our webcast last week, what would you as the audience and participants, and those who answered that survey question came back and overwhelmingly told us the same thing. We're on the right track that we want to look at PPE and staffing.
John Hansmann:	There's a couple other new features that we will address with a total line on graph, and then some bed borrowing concept. And then, Jason and I were playing around yesterday, trying to think, "Now, how can we make this even more useful to you?" Because if you really think about it, and we'll get into more detail with the PPE side and the staffing side, we only took it down to critical care and non-critical care. But to make this really operational, you need to take it almost down to the individual unit level.
John Hansmann:	So, we built an Excel add-on to this thing that we'll send out with all the slides here after the webinar or webcast is over, and to give you an idea of what you can do with the downloadable data and take it to another level of analysis. So, Jason, you want to go to the next slide and start the demo part?
Jason Jones:	Absolutely, John. Thank you much. And the first thing we should probably cover is how do you find this tool at all, because that can be frustrating if you are trying to get somewhere and you can't find it. So, if you forget everything else, if you just go to the Health Catalyst site and go up to COVID-19, then you can

scroll down a little bit and find the Capacity Planning tool. You can also use the direct link, by the way. This is not something that we charge for. We're not trying to hide it or put it behind anywhere. You can always just go directly to the link that I just show you, how to find it in case you can't remember the link.

Jason Jones: And this is the tool that we've put out so far. The last update was this Tuesday, when we added a lot of the things that John was talking about around additional items that you might want to track for capacity. And as John mentioned, the scenario planning and controls are on the left-hand side, and then the charts that you care most about are on the right-hand side. Once again, we should give a shout out to Penn Medicine for building and open sourcing the underlying model, which is pretty terrific.

Jason Jones: So, also scroll down a little bit to give you a sense. Below the text, you'll see new hospital admissions and hospital census, and capacity. And all of this, if you joined us last time, is the same. What has changed is below. Now, we have demand for all of the additional things like personal protective equipment, different types of masks, face shields, gloves, gowns, other PPE. And then you'll see we get into staffing like nurses, physicians, advanced practice providers and the like.

Jason Jones: So, what has stayed the same are the items in this section where you're looking at your admissions into critical care in orange, non-critical care in blue, and then the total, which is in black. So, the black would represent your entire hospital. And on the left is where it is that you change parameters, and then those parameters get used in the calculations to change what's on the right-hand side.

Jason Jones: Because the tool has a lot of functionality, the left-hand side keeps getting longer and longer and longer. So, what we've still maintained, and we've done this in a backwards compatible way, is the ability to save out your scenarios and then just drag them on top. And I'll show you what that looks like now. So, let's go down to the one chart that most people care about, the COVID-19 capacity. And you'll note that right now, it's saying that the total beds are exhausted, May 6th, and then the non-ICU beds are also exhausted on May 6, and the critical care beds are exhausted on May 1st.

Jason Jones: And just to show you how this drag and drop works, I've saved this scenario out here. And all I need to do is to drag that over on top of this box, which becomes red, and let it go. And now, in a moment, I'll have a new scenario that gives me different dates because everything has changed. On the left-hand side it has loaded a different population size, a different market share, a different number of COVID-19 patients in my hospital. It's changed when I first got the patient in the hospital, the chunk of infected patients that are going to non-ICU or ICU beds, the percent that will need ventilators.

Jason Jones: And again, I'm going through this very quickly, although we're happy to answer questions through the Q&A, but mostly want to focus today on what has been added since the last session in this. We'll cover also how you can get to the recording of the last session, should you want to. So, the other part that has stayed the same from last we spoke, if you joined us last week, is the number of beds. But the part that has been added now are the personal protective equipment. So, I'm going to go down to that section.

Jason Jones: And it's split into two parts. And this will be true for staffing as well. How much PPE do you expect to use per patient per day for each of these items? And then, the five masks, surgical masks, face shields, gloves, gowns, and other, which you can use for whatever you would like. And again, all of that was in the non-ICU space. In the ICU, you have all of the same options again, which by default are set to the same, but again, you can change them however you'd like, and then save your scenario and reload it, as you would like to.

Jason Jones: The numbers are driven off of the census, which we looked at above. So, all of this is tied together. Then, below, we have staffing. And the first thing that you'll want to answer about staffing, you go down to the staffing section, is how long is a shift. And 12 hours is fairly common in the United States, but there are different shift lengths, and we've tried to represent everything for you in terms of the peak that you'll need in terms of numbers of people. So, using the appropriate shift for your area will make a difference in what shows up on the right-hand side.

Jason Jones: And again, it's split into non-ICU and ICU. So, what's your nurse staffing ratio, your physician ratio, advanced practice providers, if you have them, healthcare systems, if you have them. If this feels like a lot of information, if there are things that you are not worried about or don't want to enter, that's totally fine. You can put a zero in here. You can just not use it at all. But as you change a value on the left-hand side, it will get represented.

Jason Jones: So, for instance, right now, the peak number of nurses for the entire hospital, 608 shifts per day on May 10th. And if I came in and said, "Well, at our hospital, we have a four-to-one ratio," then the peak will stay at the same place, May 10th. But now, of course, we have many more shifts required because we've reduced our staffing ratio. So, that is how this works.

Jason Jones: Again, there's a non-ICU section and then an ICU section because, often, the ratios are quite different from each other. Again, the list has gotten longer, but below that, you'll see there's still the ability to save a scenario and then use it later as I did, where it just dropped the scenario at the top. And that will reload everything for you. So, I think, John, I'm going to pause there and see if there are any types of scenarios that you would like to run through, so that people get a sense of how they could best use this tool.

John Hansmann:	We already filled one of them, Jason, with the changing of the nurse-to-patient ratio on the non-critical care side. You moved that from six to four. I think if we can do that for a couple other groups and just give a sense for the flexibility of the tool and the ability to use this. And, remember, all of these data points that are making up the graphs that you're seeing, you can download those into Excel and then do further analysis with them, if you so choose.
John Hansmann:	And then, Jason talked about, but he didn't cover in great detail, for each of the ICU and non-ICU sections, we have an Other staff category. So, we've specifically identified nurse and patient care techs and physicians and advanced practice individuals, but we have this other bucket. So, if you want to track or work with your respiratory therapists or with phlebotomists, or anybody else that you may have within your organization that you're concerned about from a staffing perspective, you can use that other category. And it fundamentally works the same way based upon a provider-to-patient ratio. And if you can identify that ratio, you can put it into the parameters on the left-hand side. And then your other buckets or other staff bucket then becomes that particular person for you.
Jason Jones:	That's great, John. Actually, we can see how that works here. So, right now, we've said that outside of critical care work and we have the same number of healthcare systems as other staff. But if this was something like a phlebotomist and we didn't need as many, then we could say we could just make a very large number of 50 per other staff. You'll see right now these charts are identical to each other, which is relatively easy to see by just looking at the Y axes here.
Jason Jones:	But if I go in and say, "Well, we have 50 phlebotomists per patient," then you'll see the other staff line changes quite a bit. So, that's how easy it is to change your scenario, and then see how your numbers are reflected as a result. Again, because it's driven off of census, we see the same peaks overall within critical care... I'm sorry, outside of critical care and within critical care, so all the peaks are the same, but the numbers change. And if we were to do something like change the census of critical care relative to... or change the length of stay for critical care relative to non-critical care, then you would see the shifts all be reflected down here, as you would expect.
John Hansmann:	So, effectively, what the tool allows you to do is play a number way of games, staffing components, PPE ratios and usage of PPE ratios, etc. And you can save each one of those scenarios to look at worst case scenario, best case scenario, or more typical scenario. And you can then dump all that data into Excel, which we're going to show you an example of in a second, that then you can do further analysis of best case, worst case, and typical, in my example here, and look at those side by side.
John Hansmann:	So, there's a lot of flexibility with it. Again, we're basing the demand side of the curve on the Penn Med model, and then the capacity side is what we brought to

the table. And now you have access to start to understand or better understand what the impacts may be on your organization.

Jason Jones: And John has mentioned a couple times the ability to download data, and there are a couple of places you can do that. Underneath each section, for instance, right now underneath the PPE section, you can download the data just for PPE. Or at the very bottom, which is perhaps where we'll go next, you can download everything. And by everything, what we mean is it will include all of the settings in the scenario that you use so that you don't lose track of those. And it will include literally every single point from every single curve in the entire application.

Jason Jones: And that can be a bit overwhelming, which is why when we take a look at the at the Excel file, you'll see how John and I have added another tab to help you simplify it a little bit. Do you think it makes sense to go there, John? Or would you like to focus …

John Hansmann: No. I think it makes sense. Why don't we go to the Excel document?

Jason Jones: Okay. Let me first show you the complex version. So, this is the scenario that we were running, and you'll see many of the rows are replicated. It's just output as a CSV file. So, it has the same author. It has the same scenario. It has the same census number, the same census date, and so on and so forth. You see all of the different parameters that were put into this specific scenario, the percentage of people that will end up on a ventilator, and so on and so forth.

Jason Jones: And then, you have to scroll quite a long ways over until you get past parameters. Oops, I just went past it, until you get to, "Okay, but now what's going to happen on each day?" How many admissions am I going to get on each day? How many non-ICU? How many ICU? How many ventilators, and so on and so forth? And that, as well, goes on a long way, which can feel a bit complicated.

Jason Jones: But the nice thing is that, it's relatively easy then to build yourself a little sheet that's just referring to what you've downloaded, but giving you the more detailed information that you're particularly focused on. For instance, what's it going to look like in a particular ICU where I have 30 beds, or a particular unit on a particular floor that's non-ICU?

Jason Jones: So, we'll go through how that can work now. So, we have this. All of the information below here is simply being pulled from this download tab. And by default, it starts with whatever today is, assuming that you don't care quite so much about the time before today. So, from today forward, if I'm saying I'm caring about a particular critical care unit, this critical care unit is going to get 20% of the critical care patients within a hospital or a hospital system, or something like that. I have 30 beds to work with. So, that's why this red line here is at 30 beds.

Jason Jones: Now, what does my immediate future look like? And again, it's just going to pull from the download tab and say, "Okay. Well, here's how many patients I'm going to expect to be in this critical care unit each day," which is the black line here. And as a result, how many nurses I'm going to need and how many assistants I'm going to need, which are represented in this lower chart here. And what's helpful, hopefully, is that because you downloaded the entire file, you don't have to reenter what your nurse ratio or a system ratio is, because it's simply pulling that out of the parameters that you specified in your scenario. So, you don't have to reenter anything at all. It'll pull the information that you've entered already and represented in these two charts.

Jason Jones: So, looking a little bit further then, the spreadsheet will pull out for you immediately what your peak day is. And it'll tell you, in this case with this scenario, it's May 15th. And on that day, we would expect to have 64 patients in critical care, which is quite a bit beyond the 30 beds that we said that we have. We're going to need 32 nurses on that day and seven assistants. So, that is how this sort of tool can be easily used to extend beyond what we've provided in the Web interface, while still allowing you to leverage the Web interface to do all of your macro scenario finding, output the results, and then work with them in a more pragmatic way within Excel.

Jason Jones: So, for instance, I could say instead of this being an ICU, I could say that this is like a med-surg unit. And now, my numbers shift in med-surg, and it maybe have more beds, it depends on how big this unit is. But all of my nursing, the number of nurses that I need changed, the number of the systems changed again, because the scenario that I ran have a staffing ratio of med-surg versus critical care.

Jason Jones: And I could say, "Well, maybe I'm only going to get 10% of the total non-ICU patients." And again, it will adjust everything for me, again, based on the demand curves that came from the Web tool as well as all of the assumptions about my patient ratios and the like. John, what would you like to say about this Excel file?

John Hansmann: I was just going to add some little bit higher level commentary to why we ended up going this route, Jason, if I could, for a second. So, if you think about the results that are coming out of the Web-based tool, what's behind the Excel document at this point on the screen, what that tool was producing was a demand curve for how many critical care patients would be in the hospital and how many non-critical care patients are in a hospital. We all know that from a staffing perspective and, in some respects, utilization of PPE and other tools and equipment, supplies and equipment, it really comes down to an individual unit from a practicality perspective.

John Hansmann: And trying to build that into the Web tool, there were just too many variables that we would have had to build from a scenario perspective to get something

out quickly. It just didn't make sense for us to do that. So, what we wanted to provide was, with this Excel add-on, if you will, that now you can download the data that is looking at the overall hospital, and then the hospital broken down into critical care and non-critical care. But from that point, you can take that data. And now based upon percentages of patients at your non-critical care units would get, if you have four or five med-surg floors or a couple step-downs, you can identify what those percentages of your typical patient population that would go into each of those floors.

John Hansmann: And you could utilize this tool and build out columns for additional units to look at each of the different departments or nursing floors, and see what the impact will be on each of those different floors. Same thing goes to, we were showing it from a staffing perspective and a staffing view, but you can do the exact same mathematics, because the math works the same way, with PPE. And you can then have additional columns for PPE activity down to an individual nursing floor or nursing unit, or functional area. That allows you to take what comes out of the model itself, and even make it that much more real or that much more practical for you to start to make decisions and work off of.

Jason Jones: That's great. So, I'm wondering, we're getting close to the 30 minutes. And as Sarah mentioned earlier, we're more than happy to stay on and answer any questions that you might have for as long as you would... Well, almost, I'm sure, for a while. Let's not take forever. Yeah. Given infinite time and resources, yes. So, should we go back to the slides? Again, we're more than happy to stay on past the half hour. And then come back to these things.

John Hansmann: Yeah. We do have a number of questions that have already come in. So, we can start answering those in a second. But, Sarah, you want to take off for a second?

Sarah Stokes: Yeah. So, we know a lot of you are going to have to drop because we're almost at the 30-minute mark. We did want to ask you just one quick poll question before we move on. And in this, we would just like to know if you would like to see some additional live demos sharing other COVID best practices or solutions. So, we'll just give you a few moments there. Again, we are recording today's session. So, if you do have to drop, you will still be able to see the full Q&A, and we will get a transcript of that as well. And we are sharing the slides. So, keep an eye on your email.

Sarah Stokes: Hopefully, we'll get those materials emailed out today, but no later than Monday, if we can't get them out today. So, just a few more seconds. All right. I'm going to go ahead and close that poll and turn it back to you, John.

John Hansmann: All right. So, you ready to answer questions, Jason?

Jason Jones: I think we probably want to just …

John Hansmann: Oh, yes.

Jason Jones: Yeah.

John Hansmann: Go for it.

Jason Jones: Again, we are very grateful to the Penn Med team for open sourcing the basis of the model that we've been using, but also there's been a fair bit of work on the Health Catalyst side. So, if you happen to know any of the people on the left-hand side, perhaps you could thank them for their work, if you appreciate it. I just wanted to give a shout out to them. So, anything else you would like to say, John, on this?

John Hansmann: No. Just on the right-hand side, as you can see the links to an email box. If you have any questions or follow-up questions for us, or commentary, or suggestions, please send us an email at the email address up on top, and then the links to the Capacity Planning Tool into our website where you can get to the Capacity Planning Tool are below. You want to go back to the tool itself, and we'll just start answering questions while we have the tool, because more than likely, we can show some suggestions here.

Jason Jones: Yeah. Let me cover one other thing before we go to the questions, because I had meant to do this earlier and forgot, but off of the site, because I know we went through how to use the tool very, very quickly today. So, if you forgot where you would like more information on just how do you use this tool and where does it come from, if you go to the main Health Catalyst site, and then under Knowledge Center, you can go to webinars. And the full recording of last week's session is there, right here.

Jason Jones: So, if you do have technical questions that we don't get to today about just how does demand work and things like that, please feel free to listen to last week's session. And again, you find it under Knowledge Center, and then webinars. And now, I'm so sorry, John, let's go back and try to answer some questions for people.

John Hansmann: So, the first two are more technically oriented and a good segue into the others, but a couple different questions talking about the open source component of the code. The Penn Med code was open sourced. Are we looking at doing the development side that we put into this as open source?

Jason Jones: We have thought about doing it as open source. The challenge that we've had is that we have been releasing new versions, sometimes a couple times a day, and it's been a bit of a challenge to stay on top of. So, there's nothing in here that we consider to be proprietary. It's just how do we balance the development team's efforts. As you may know, if any of you have contributed to open source,

	often, the development community can be more demanding than the user community.
Jason Jones:	So, that's really why we have not yet open sourced this yet, just to try to protect the development team a little bit, and in being able to continue to do the releases, like John mentioned, the addition of PPE and staffing and all of those kinds of things. Thanks.
John Hansmann:	So, the next question, do you take into consideration the PPE consumption from non-COVID units?
Jason Jones:	That is a great question. So, that, let's go down to that section. Maybe it actually makes sense to back up a little bit and talk about beds before we talk about PPE. So, of course, hospitals have many patients who are not COVID-19 patients and that will increase probably again, as many of you stopped doing elective procedures and the like, and now you're wondering when can you start doing those things.
Jason Jones:	So, what we've been doing from the bed and ventilator perspective is sort of putting, what are the beds and vents that you're going to hope to hold in reserve. And that matters a lot, because we're actually showing when it is that you're going to run out of these things on a macro level. From the standpoint of PPE here, we are only looking at the PPE that is being used by your COVID-19 patients. And similarly, we're only looking at the staffing that was being used to care for your COVID-19 patients.
Jason Jones:	And again, the reason for that is because both of those are being driven off of the COVID-19 hospital census. So then, the question becomes, how do you want to think about PPE or staffs that are caring for non-COVID-19 patients? And I think my recommendation at this point would be to just remember that everything that you're looking at here in terms of demand is demand only for COVID-19 patients. So, if you wanted to get some broader scope of demand or utilization, then please be careful interpreting the numbers that you're getting, because all of these numbers are going to be COVID-19 patient specific.
John Hansmann:	Thank you, Jason. And similarly, we have another question about PPE consumption in the ED. Patients who are not yet admitted, have we considered that?
Jason Jones:	Yes, that is a great question. So, last week, we asked people, "Should we expand this to the ED?" And the answer is no. So, we didn't. Maybe people are thinking that we should. We've had other requests for post-acute care skilled nursing facilities and the like. So, maybe we should have asked again what we asked last week, which is what else would you like to see in here. So, apologies for those of you who really, really wanted the ED with the post-acute or something else. We did not add those because it seems, at the time, people weren't as interested.

John Hansmann: And a follow-on to that, another question about now post-acute care home health, health PACs, etc. Can we talk about the flexibility of the tool to be modified for that, in that environment?

Jason Jones: Yeah, that is one that we spoke about a bit last week, and just to drill a little bit more into it, since there was a specific question. The tricky part with the post-acute care from our perspective, and maybe others have a different one, is they tend to be much, much smaller. So, what we're seeing is two things happening. The spread of the disease does not behave the same way in something like a skilled nursing facility, because the disease can actually spread much more quickly, and the patients are already quite sick. So, the severity of the disease is much worse.

Jason Jones: But the other thing that happens, as we start to think about it from a staffing capacity, is that often those facilities, if they lose two to three nurses, that may be their entire staff. So, it doesn't really behave either from a spreads perspective, a severity perspective, or from a staffing perspective, the same way that our larger hospitals do. So, we've struggled a little bit figuring out how we would support those longer-term care facilities, post-acute facilities and the like. So, if you have thoughts on how we best could support you in your circumstances, please, please do let us know. But it feels like that's a challenging space to work through.

John Hansmann: Yeah. We've had lots of conversations about this. We'd love to hear any suggestions or ideas that anybody else has, because like Jason said, it is very difficult to predict both the demand side, and then also on the capacity side. But in theory, the tool would be applicable, because effectively the tool, if you take everything away and just look at the functionality of what it's doing, it's looking at number of patients coming in, how much capacity you have to take care of those patients, and what is that variance between the ability, what you have on hand, the capacity side to deal with the demand, the input side. So, any thoughts on it, we'd love to hear from you in that scenario or those scenarios.

Jason Jones: Yeah. For those of you who are global in your view, you may know that Singapore had done very, very well flattening the curve, but yesterday actually had a sort of hotspot blow up and had the most COVID positive cases that they had had year to date. And the reason for that, almost all of those cases are coming from dormitory-like settings where certain types of workers tend to live. And those kinds of things can be difficult to anticipate and then tend to spread very, very quickly.

Jason Jones: We don't necessarily have worker dormitories in the US, perhaps, the way that they do in Singapore, other countries, but in some sense, skilled nursing facility behaves a little bit more like that, with the proximity, the difficulty of isolation, and challenges with staffing. So, definitely, it's something that's on the horizon

for us, but not as easy to figure out how to work with hospitals or even emergency departments are.

John Hansmann: So, another question, Jason, for the PPE per patient data or parameters that we're inputting, is there a benchmark or typical usage versus what we use?

Jason Jones: I think you're a vastly better person than I to address that, John.

John Hansmann: Sorry. I didn't mean to set you up there. What we have done, the parameters that we put into the tool are actually from, I think, it's a CDC source, we'll actually send the source out to you in the documents also, that were identified through the SARS and N1H1 epidemics back in the early 2010s and early 2000s. So, there's some basic parameters there of typical use. But as we talked through there, through that of how to give some guidance to people who are using the tool, there's ways that you could do some quick sampling of your own actual practical use of how much are you using per day, per the number of patients you have.

John Hansmann: And you could just do a quick count of how much was taken out the shelves as an example, and divide it by the number of patients that you had that particular day, and specifically separating between ICU patients and non-ICU patients, and give your numbers some more reality to you versus using the fixed numbers that we put in there based upon what the experience was through those other situations the last 20 years or so. Anything else you would want to add to that, Jason?

Jason Jones: No. I wish I'd brought up the CDC, actually, does have on their website a PPE burn rate calculator, which I should have thought about finding and bringing it for people. But, perhaps, we can send that out after the fact.

John Hansmann: Yeah, we can do that too. Talking about that question was, can you fill the total PPE burn down rate?

Jason Jones: That is exactly what CDC did, and interested in people's feedback here. The challenge that we had with PPE, specifically, that we don't have quite as much for beds or even staff is, in order to provide proper burn-down, we would also need to know not only your inventory, but your restocking. And it felt like that was a lot of information to ask people to upload.

Jason Jones: However, if a lot of you come back and say, "No, no, we really do want you to calculate burn down," and are willing to upload, we would probably do that as an upload, like we allow for the upload of actual data. Then, we could consider that as an augmentation of a tool. Again, when we asked last week, people weren't so eager to provide those data to us. And if we don't get the data, then we really can't do the burn-down.

John Hansmann:	An associated question to that, talking about the burn down was, have we taken into consideration the reuse or the N95 masks or any other of the items in the calculation? And to add on to what Jason just said, we kind of stayed away from the whole consumption side of PPE, primarily because this would have been a ton of data that you would have had to have uploaded. As Jason suggested that, with the capabilities now, doing it through a file, that may be a little bit more palatable.
John Hansmann:	But in terms of having that identifying activity of putting in what your actual usage rate is, and then you would also have to put on top of that any restocking rates, too, when have you gotten new materials brought in. So, there's a whole lot of extra data that wouldn't be necessary that you can work with your materials management folks on to try and get a better handle upon that burn rate. Specifically, this question, then we would have to apply that reuse factor to it, and I'm not exactly sure how to do that.
John Hansmann:	Jason, maybe you have some ideas just off the top of your head. But with a reuse factor, you're not going to be disposing of those items as quickly. And therefore, the replenishment rate would not have to be as quick. And therefore, the usage would not be as deep.
Jason Jones:	Right. So, yeah. The way that I might suggest to piggyback on what John had said a couple questions ago, if you looked at your own current utilization of, say, N95 masks, and you saw that, in fact, you weren't using five per patient today outside of critical care, you were reusing them, and as a result, you're only using three N95 masks per patient per day, then you can just update the information that makes sense to you. And it will update all of the demand numbers on the right-hand side.
Jason Jones:	So, that's probably the easiest way to account for reuse, is just to put in your actual calculated numbers. Or if you wanted to run this as a scenario, what if we started reusing N95 masks, then you could also run it as a scenario where you change from five to three per patient per day, or something like that.
John Hansmann:	And there's one other question on the PPE supply side, and then there's a handful of staffing ones. We'll jump to the staffing ones here in a second. But the last supply of PPE question, in addition to what we've identified as masks and gloves, etc., there are other activities, sanitizing wipes and germicides, and other supply items that are used to help clean and maintain a sterile environment. And we thought about putting those types of materials into the tool as well.
Jason Jones:	Yeah. What we did is we created an Other bucket which appreciating that's not going to cover probably wipes and germicides and things like that. You probably don't want to put that all into one bucket. The reason that we did that, again, is just to limit the number of total data entry points, which you had. If there's

something that people are finding really is very, very important to have on this list, and quite a few people would like it, then we can add it.

Jason Jones: And for those of you who don't want to use it, you can just skip it. And we've so far maintained 100% backwards compatibility. So, don't worry if you saved this scenario, and let's just say wipes get added because everyone wants wipes, then we would add wipes. And anything else that you had modified in this space or anywhere else, once you reload the scenario in a new version, all of the changes that you made would be reflected, like the population and the market share, and how many beds you have.

Jason Jones: And as it relates to PPE, it would bring over whatever you'd use in the scenario for masks. And then, if wipes have been a new added feature, then it would simply populate it with the default until you changed it, and then save the scenario down at the bottom. So, we've tried very hard to keep those backwards compatible, and so far has been successful. So, don't worry if you want to suggest that we add something. It doesn't mean that it's going to break everything else that you have spent time entering before.

John Hansmann: So, I will jump over to some staffing questions. We have a handful of staffing questions in the list here to answer. The first one here, Jason, is for the unit demand, the quantity of nurses, physicians, whatever the graph shows, the numbers on there. Is that a per day or a per shift total?

Jason Jones: Great clarifying question. Thank you for that. So, this is telling you - and hopefully the labels are clear, if we can improve the labels, please let us know - that it is shifts per day. If you want to start doing double shifts, and whatnot, that will be different. But it is the number of shifts per day for all of the staff. So, if we change this to an eight-hour shift and don't change anything else, then we'll see that the number of shifts per day will go up quite a bit from 600 to 900, for instance, total nurses, by virtue of having changed the shift duration. So, now we'll need three shifts per day instead of two shifts per day. So, hopefully that addresses that.

John Hansmann: So, another staffing question. With regards to staffing, do you have any thoughts about healthcare providers contracting COVID-19? And how best to plan for that?

Jason Jones: So, we've seen really different approaches to that. I think in most or in many places are now still letting COVID-19 positive providers care for COVID-19 positive patients. I don't know, John, if you're hearing different things, but there are also providers who are quite scared and not willing, not feeling able to come in, and despite not being positive, yes.

Jason Jones: So, that's a really tricky one. That feels like something that you would know much better in your local situation than we would be able to put in any kind of

	assumption here. We did consider putting in the staffing, something about a six-day rate or something, and then we could adjust up. So, if you really needed 900 shifts per day, but you wanted to assume that 10 or 20% six-day rate, then we could adjust this up for you.
Jason Jones:	But it felt like to most users, it would be confusing. So, we've just left it at the number of shifts that are required. And then, if you would like to adjust this based on sick days, or something else, then better for you to do it from there. But that's our current thinking, anyway. John, do you have additional perspective to add?
John Hansmann:	Yeah. Well, I'll add on to that. And actually, could you bring up the Excel document and show that while I talk to here? So, another thought that I had, to build upon what Jason was saying, you could in column, if you can see the Excel document now, columns C, D, and E are the census and the demand for nurses and patient care assistants, for this particular four, based upon the parameters that were put in, you could build out in columns F, G, and H what's your actual number of nurses and patient care assistants that you have available for that particular floor.
John Hansmann:	Or you could do it for the whole house, too, but let's just stay in one individual floor. And then, in that count your availability, you could include some kind of a factor four. We've had 10% of our staff is now out or 15% or 5%, or some number like that. And you could modify your availability in the additional columns F, G, and H, in my scenario here, to identify what you actually really have available for staffing. And then, in the columns to the right of that, just do the very... the subtraction of what you need versus what you have, and then that can give you a quick and dirty view of how to take a look at what the impact would be from a COVID infected staff.
Jason Jones:	It's a great point. I'm hesitating a little bit to do it on the fly, but let me just call out here that right now, what we've said is, if you've put in, you have 36 beds in this unit that you're working with, then typically you would expect six nurses and four assistants, if you were at fully staffed capacity. Just so that you know what these two numbers are.
Jason Jones:	So, as John was saying, and I'll probably get myself into trouble here, but you could come off here and say, okay, then our typical capacity, we'll just do it for nurses, is six. So, when do we run into a problem, or starts running into a problem about down here? But then you could add on to that a sick factor, and say, to John's point, but that's 10% of your staff. We'll have to make it a little bit bigger, John, for it to matter for a small number.
Jason Jones:	Which means that on, any given day, then you would expect to be down that number times your 20%, then this will be how many nurses you would actually expect to have. We probably want to floor that just to be conservative. So, now

	you really only have four nurses to work with once you've adjusted your scenario. Whoops. Hold on. I forgot to-
John Hansmann:	You're going to freeze yourself.
Jason Jones:	To fix this. There we go. Okay. Good to have negative nurses, huh? Okay. So, now, you'll have four across the board. And of course, you could modify your sick factor by row or something like that. But that would allow you to see that you start to run into trouble a little bit earlier than you would have, otherwise. So, hopefully that can help a little bit. Is that what you had in mind, John?
John Hansmann:	Yeah. That's exactly what I had in mind. And you could do the same type of math, going back to the PPE question of a couple minutes ago of the reuse factory. You can apply a reuse factor, like we had the 20% for the sick factor here. So, with the ability to take all the data down into Excel, you can expand this off into a whole another series of analyses that are more pertinent to you, and then allow you to play with the numbers and do your what-if games that you need to have there. Another question …
Jason Jones:	Sorry, John. But maybe then you say to yourself, "Well, I need to plan on trying to attract another two travel nurses," or something, you're going to be able to get back to the typical capacity, as an example.
John Hansmann:	Yeah. So, we have just a couple questions left in our list here. One talks about something that you and I have had lots of conversations on, Jason, and that's to deal with the issue of a model itself focuses on critical care patients and non-critical care patients. And the assumption within the original model is the length of stay for a critical care patient will stay in the critical care unit for the entire time they're there, as does the model portrays that for non-critical care patient, the length of stay that they're in the system will be all in non-critical care.
John Hansmann:	It does not allow for movement between different levels of care. And we know that in some respects, it does overstate critical care in a little bit and understates non-critical care beds, but that's the basic model. And we've been trying to stay true to the Penn Med model. Now, as we're starting to move away from it some, we want to think about how we can take into effect that scenario. What else would you like to add, Jason?
Jason Jones:	Yeah. John touched on something just in passing, which is that the Penn Med model is perhaps the best we can do very early on, where we have to rely very heavily on assumptions and not much on actual data. And as we start to accumulate more and more actual data, meaning by we, I mean mostly you out there in the real world, then we should be able to leverage your real-world data much more than the Penn Med model does. So, we're working on incorporating real experience more effectively.

Jason Jones: And when we do that, which we're hoping is within the next week, we're then also considering allowing you to specify the length of stay differently. And what we've been thinking about doing is either using a percent of time in critical care if you ever need critical care, or a percent of time on the vent if you ever need to vent, or perhaps we just provide absolute numbers where you're allowed to say, the total length of stay for someone who needs critical care is going to be three weeks, of which two weeks are going to be in critical care and the other week is going to be outside of critical care, similarly, with the ventilator. So, we're thinking about how to do that best for you all. If you have specific ideas of what you think would be best for you, please let us know.

John Hansmann: So, we have one more staffing question, then we have a couple technical questions, and then our list is empty here. So, the last staffing question, and I'll take a first stab at this, Jason, and then if you have anything to add, jump in, but the question is, how are the staffing norms calculated, or who set them? And they are actually not calculated. They're part of the parameters that you input on the left-hand side, just where Jason has on the screen.

John Hansmann: The staffing inputs of patients per nurse for non-ICU is six in the model that we have here, and patients per physician are 20. What we said this with, as the starter set, if you will, our typical ratios that we see around the country in terms of how many patients, say, a critical care nurse typically takes care of, typically one-to-one or one-to-two care for a critical care situation for a nurse. Yes, there are situations where you have multiple nurses for one patient, but a typical ICU is staffed at a one-to-one or a one-to-two.

John Hansmann: Similarly, in med-surg floor, the non-critical care areas, it's a one-to-five to one-to-six model, one nurse to five or six patients in med-surge. In step-down units or telemetry type units, sometimes those are one to three, one to four. Those are pretty typical standard numbers that fit across the country. Your hospital may be very different from that in terms of being richer staffing or not as rich staffing based upon lots of different parameters, patient types, financial situations, etc. But those numbers that we fed are typical ratios across the country, but they're all changeable by you to put in your numbers that you need to that make them more real for your situation.

Jason Jones: And the only thing I'll add, because we do get these questions periodically is, what John just said is generally true of everything on this left-hand side. We've provided some defaults, but they... Please don't interpret them either as specific guidance, or certainly not hopes, right? We would hope that we would have no COVID-19 patients who would require hospitalization or critical care.

Jason Jones: Really, those data, and it was a point John really early on, are highly variable across time and space. So, please don't take these as our recommendations for how many nurses should be required to take care of a COVID-19 patient. We've

just provided some defaults so that you can get some baseline data out, and then please modify it as you know best for your local area.

John Hansmann: And there's a follow-up to that question by the same person. Are those guidelines available for us to send out and share? Yeah. We'll send those with the documents that you can get for the slides in the Excel document itself, too.

John Hansmann: Let's talk about a couple technical questions, Jason. And this goes back, I think, to our conversation from last week, but can you discuss... Sorry. Can you talk about the parameters for the severity parameters of the inputs into there? In the critical care side and the non-critical care side, how does that affect the graph? And where are those numbers? What intent or purpose are those numbers doing? The same with ventilators.

Jason Jones: Sure. So, let's start with the basic foundation of the model. The basic foundation was looking out of the total population, how many people could possibly get COVID-19? And then, the blue line here represents the number of people who have actually now gotten COVID-19. And then, the orange line is the number of people who now had COVID-19, but have recovered. So, that's the sort of underlying epidemiology for everything, this chart that you see right here.

Jason Jones: But then what we do is we take it and the first thing that we figure out, and again, this is thanks to Penn Medicine is, "Okay. So, how many people are going to get hospitalized? How many people get admitted to the hospital on any given day, based on the number of people who so far have been infected?" And it's split into three groups. One is how many people are going to require non-ICU care. So, this is saying two and a half percent of the people who have gotten infected are going to require non-ICU care. And that's how we get this blue admission line there.

Jason Jones: And then, the next thing is, "Okay. Of the total infections, what percentage are going to need critical care?" And that represents the orange line. The blue and the orange lines are not independent of each other because they're both being driven under the hood by the number of people who are getting infected. But if you wanted to understand how many total people are in the hospital, or how many total people have been admitted today, you would need to sum the orange and the blue, and that's what gives you the black line here.

Jason Jones: So, you have non-critical care admissions, critical care admissions, and you put the two together and you get your total hospital admissions. Then, there are a percentage of people, again, driven by the infections who are going to need mechanical ventilator support. So, that is represented here in the red line. So, that's how we get to the admissions.

Jason Jones: Once we have somebody getting admitted, then when you specify the length of stay, we can then calculate, "Okay. So, how long does someone who got

admitted during their stay in the hospital?" And we can just modify the blue line by tacking on their length of stay, similarly, for the people who are in critical care. The one number in here that I didn't cover is the infectious days. And the infectious days are how long somebody stays, able to infect other people. And that plays out also in this curve at the bottom.

Jason Jones: So, you'll see that there's a gap between how many people have been infected and how many people have recovered, and that gap is driven by how long somebody stays infected. And it also relates to the overall virulence of the disease, and to be able to contact in social distancing parts, change the nature of the shapes of the infection and recovery curves, which in turn, again, drive the admissions, which then drives the census. So, hopefully that helps.

John Hansmann: Well, we are out of questions.

Jason Jones: Okay.

John Hansmann: So, Sarah, do you want to summarize? And then I have one last thing I want to add to it.

Sarah Stokes: Sure. Yeah. For anybody who's still on the line, just a reminder that we did record today's session, and we will be emailing you, with links to the recording, the slides as well as a transcript. And we will also include a link to last week's recording so that you can catch up on that if you weren't able to attend. That's all I have.

John Hansmann: Thanks.

Jason Jones: Again, it will show up. It will be posted here in the recent webinars. This is, again, last week's webinar, and probably early next week, we'll show up this week's webinar. Go ahead, John.

John Hansmann: I was just going to say, well, thank you, everybody, for your time today and in spending an hour or so with us this morning or afternoon, depending upon what part of the country you're in. Hopefully, this has been valuable to you, and you use this to help identify your particular situation, using the generic models that are coming in, and then applying some of the math to get down to your individual hospital and hospital situation, staffing, PPE, etc.

John Hansmann: So, thanks for your time. And again, as Jason said, if you know any of the individuals on the left-hand side of the screen, please let them know the accolades for this. They put in a lot of time and effort to get to where we are. So, thanks for your time. And stay safe, everybody.