

[COVID Information Commons \(CIC\) Research Lightning Talk](#)

[Transcript of a Presentation by Justin J. Boutilier \(University of Wisconsin - Madison\), JApril 15, 2022](#)



[Title: Investigating Performance of an Online Platform for Matching Supply and Demand for Medical Equipment During the COVID-19 Pandemic](#)

[Kelly Dunning CIC Database Profile](#)

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[Transcript Editor: Saanya Subasinghe](#)

Transcript

Justin J. Boutilier:

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Thank you very much for the introduction. And then welcome everyone who's here this afternoon. So my name is Justin Boutilier. I'm an Assistant Professor in the Department of Industrial and Systems Engineering at UW-Madison and I'm going to be presenting some work titled 'Shield-Net: Matching Face Shields During COVID-19.'

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And this project is a collaboration between myself, Professor Auyon Siddiq from UCLA and Rebecca Alcock who is a Ph.D. student in my lab here at UW-Madison. And she was the lead on this project.

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So for some context about the problem, the COVID-19 pandemic, as many of us know, led to unprecedented and widespread supply chain disruptions. And, you know, one, you know, very acute area where these disruptions were particularly impactful was PPE. And within the first month of the pandemic, the United States had actually used over 90 percent of the strategic national stockpile of PPE. And, you know, in response to this shortage of PPE there were, you know, new strategies put out by medical practitioners for rationing and reusing existing PPE that we do have.

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And we know now that many of these strategies and shortages put first responders and healthcare workers at increased risk of infection. And there's been several studies that have, you know, followed up,

showing the magnitude of this increased risk. And, you know, at the time when this was happening, this was quite popular in the mainstream media. And there were two, you know, very famous hashtags which is, “#WheresMyPPE” and “#GetMePPE”, trying to bring people together and get PPE into the hands of healthcare workers.

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And at the same time as we were experiencing these supply chain disruptions and shortages in PPE, we were also experiencing closures of non-essential businesses. And this led to a surplus of manufacturing capacity in other industries. And so we called this, or we coined this, a ‘pop-up supply chain’. And effectively what a pop-up supply chain is, it's when a non-traditional manufacturer pivots its production processes from whatever they used to produce to producing PPE. Now certain types of PPE, especially face shields which are quite simple to produce, are very well suited to something like a pop-up supply chain, because almost anyone, whether you're a mom and pop, you know, small manufacturing organization or a very large industrial manufacturer, can pivot their production lines to making face shields.

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Now this pop-up PPE supply chain is different from the conventional PPE supply chain in two important ways. And so first, the conventional PPE supply chain is dominated by large players, right? So think 3M, Honeywell, companies like these. And so there's very, you know, it's challenging to enter this market. It's dominated by a small number of large companies, whereas this pop-up supply chain has very little barriers to entry, and as a result we see a wide range of manufacturers who enter the market, all the way from very small ones to very large ones. The second big difference is the distribution channels. So traditional PPE supply chains, the products are distributed during disasters in a very formal way. Typically, through the federal government, the Federal Emergency Management Agency (FEMA) and then, the local state or county agencies, from there. And this process is effective, but in some cases it may actually leave behind small medical facilities like dentists or family doctors who, you know, aren't quite on the radar of these federal and state emergency management agencies. And so a PPE supply chain has this ability to sell directly to these consumers and create, you know, more connections. And then lastly, you know the biggest challenge perhaps is just procurement. Because many of these manufacturers are new to the marketplace, they're not on the radar of medical facilities and they may not know how to get in contact with facilities that do need PPE.

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And so this is where we came in. And so the goal of our project was to develop a platform that could match manufacturers of face shields with requesters and to collect data on the performance of this platform. So we could study its effectiveness as well as its potential, the potential of this type of pop-up supply chain in future disasters. So we coined our website Shield-Net. This is the landing page of that website and you'll see there's two buttons here. And so you can click, if you're a manufacturer, “I Make Face Shields” or if you are a requester, like a hospital or other medical organization “I Need Face Shields”.

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And based on whichever link you click, you're taken to a supplier or a requester form, where we collect some basic information from you like, what your production capacity is, lead times, location, and things

like that on the supplier side, as well as information about the size of your request, urgency, and location, on the requester side. And we use this information as input to a linear programming model. So this is a prescriptive analytics or optimization model that produces matches everyday between requesters and suppliers. And I've given you an idea of what the model does here. Essentially, we prioritize urgent requests and minimize shipping distance. And we have constraints, you know, to make sure that we're not exceeding capacity of suppliers or requesters as well as keeping track of any shortfall that needs to be carried over from prior days.

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So without further ado I'll tell you a bit more about how this actually went and what we learned from this process.

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So during its operations, Shield-Net produced 390 matches and these were produced between March, the middle of March, and September 2020. The website was launched the week of March 21st, so not long after the pandemic began. We received over 340 requests from 43 states, Puerto Rico and we had 373 suppliers join the program from over 40 states.

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And we followed up - so, as Shield-Net produced matches we followed up with the matches manually and inquired whether or not the match was successful. Meaning how much product was actually shipped, if any, what the price was paid for that product, how long it took to get there, and things like - as well as other more qualitative questions like, how satisfied they were with the service and whether they would return. We similarly interviewed those who had unsuccessful matches. And then you'll see the gray area here is unclassified. Those were institutions that we just weren't able to follow up with, either they were too busy or we weren't able to get in contact with anyone. And so throughout the Shield-Net's operation, we were able to deliver over 50,000 face shields to 68 unique organizations across the country.

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And then we used this follow-up data to investigate the match success rate of the platform and reasons why the platform might have been successful or unsuccessful. And so, overall, our match success rate was 27%, which in the context of other online matching platforms like dating or vacation rental booking or job searching is sort of within the ballpark. And then, interestingly, we found that more than half of the unsuccessful matches were able to fulfill orders elsewhere. And many of them told us that they were using Shield-Net as a backup plan, basically, which was good for us. The second thing we learned is that more than half of the successful matches ended up being repeat customers, meaning that those individuals actually ordered shields again from the same manufacturer but offline from our platform. And we consider that a success because it created the connection that led to procurement of this PPE. And then finally, we looked at what factors may have influenced whether or not a match was successful. And by far the most significant factor we found was proximity. So the closer the location between the manufacturer and the requester, the more likely they were to have a successful match. And we believe this might be true for a couple of reasons. One, shipping times and lead times would be generally quite short. If that was the case, you could have an in-person delivery which gives you some, you know, sense

of like community and altruism and, you know, actually seeing this person face to face rather than just ordering everything online. So we believe that, you know, played a factor into this.

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And then I think the most interesting to me was that, Shield-Net also allowed several suppliers to continue operating during the early economic shutdown from COVID-19. And in fact this is a quote from one of our manufacturers who said that their transition to PPE production allowed them to keep their regular staff of 40 employees working, as well as hire eight new additional employees to help with the PPE business. That was essentially you know going well, in part because of Shield-Net. So to us this was a really great outcome of this project, being able to have, you know, eight additional employees, potentially families employed during this time is certainly not worth overlooking.

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And then lastly, I'll give you a sense of some of the broader impacts of this project and this is in part because my research program focuses primarily on global health projects. And so I have a big interest in international research and international development.

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And my Ph.D. student Rebecca shares these interests and has done prior work with Engineers without Borders. And so the success of Shield-Net caught their eye and led to a collaboration with Engineers without Borders here at UW as well as the United Nations Development Programme more broadly. And this engagement led to us, you know, having assistance and playing a small role in community-centered PPE production in 13 different countries around the world. You know, basically, others saw the success of this sort of local, you know, crowdsourced PPE production and felt that they could replicate it in these other locations. And so we helped them do this. And the countries with the biggest impact in terms of numbers of PPE being produced were actually Yemen and Kyrgyzstan in Asia.

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So that's all I'll say for today. Thank you very much for attending and for listening. Of course this work was supported by an NSF RAPID grant in the early part of the pandemic and we have a publication out which is on screen now if you're curious to learn more about the work. So thank you very much.