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Authors

Rodier, Caroline, PhD
Zhang, Yunwan
Horn, Abigail, PhD
et al.

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POLICY BRIEF

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Preparing for Future Airborne Pandemics: Lessons Learned from a Los Angeles Travel Case Study

Caroline Rodier, Ph.D., Yunwan Zhang, M.S. - Institute of Transportation Studies, University of California Davis

Abigail Horn, Ph.D. - Daniel J. Epstein Department of Industrial and Systems Engineering, University of Southern California

Ihab Kaddoura, Ph.D., Sebastian Müller, M.Sc., Technical University of Berlin

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Issue

The onset of the COVID-19 pandemic in 2020 sparked conversations about how to best avoid large waves of airborne infections. A solution could save lives and avert an overwhelmed hospital system. Nonpharmaceutical interventions (NPIs) may be implemented early-on to reduce infections before pharmaceutical interventions such as vaccines are available. This study evaluated the effectiveness of NPIs including cloth masks, N95 masks, antigen testing, and reductions in contact intensities. It also compared the effectiveness of interventions implemented during all activities to only high-risk work activities.

Effectiveness was simulated by integrating a dynamic agent-based travel model with an infection dynamic model. Both models were developed with, and calibrated to, local data from Los Angeles County (LAC). They featured a synthetic population of 10 million "agents" with detailed socio-economic and activity-based characteristics representative of the county's population. The study focused on the second wave of COVID-19 in LAC, from November 1, 2020, to February 10, 2021, before vaccines were introduced. The model accounted for mandated and self-imposed interventions by incorporating mobile device data showing reduced activity patterns from pre-pandemic norms. Multiple employment categories with literature-informed contact distributions were represented.
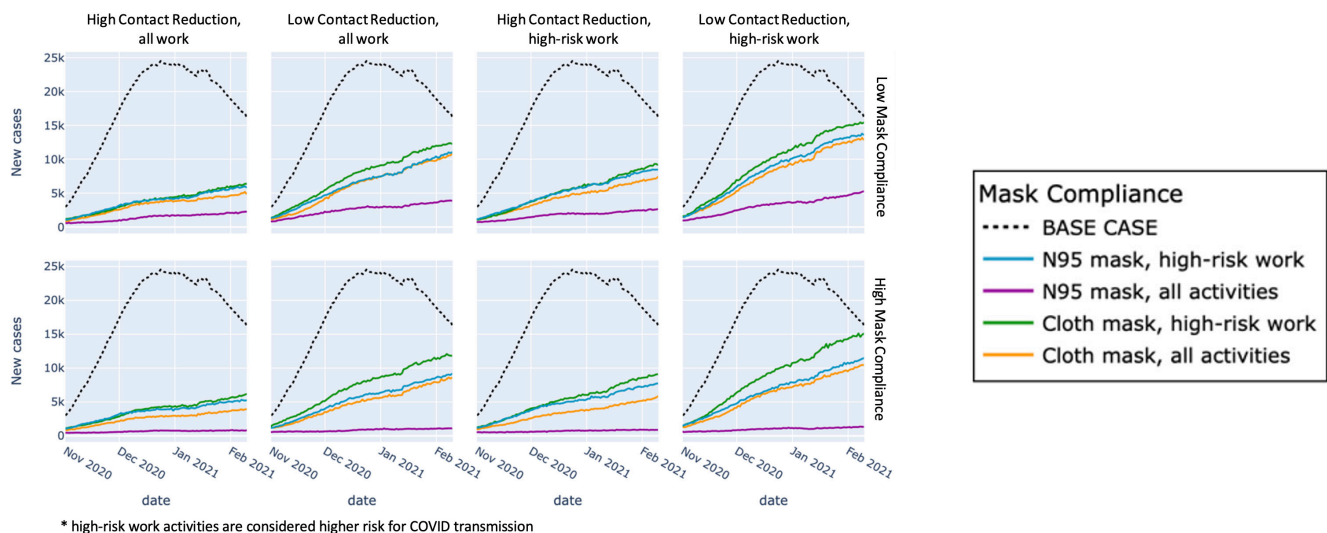

* high-risk work activities are considered higher risk for COVID transmission

Figure 1. Combined interventions of contact reduction and mask compliance.

Key Research Findings

Combining NPIs is the most effective way to reduce infections with the least restrictive interventions. Pairing N95 masks with shutdown and capacity restrictions adopted during the second COVID-19 surge in LAC was very effective even without increasing baseline masking levels (i.e., 65%). For example, an 80% decrease in cumulative infections can be achieved by combining a 50% reduction in contact in high-risk work categories with 65% of people masking.

Small increases in the proportion of people using N95 masks reduces spread, even without increasing overall masking. For example, substituting 25% or 50% of the baseline cloth mask for N95 masks results in an almost 60% or more than 85% reduction in cumulative infections, respectively. These results cover the modeled epidemic period across all workplace and community categories.

Some interventions may exacerbate health inequities in specific groups. Infections in younger and older populations benefit less from interventions implemented in high-risk workplace and community activities . These populations are less likely to be in the workforce and involved in community activities such as shopping, personal care, and other errands. Thus, workplace-specific interventions must be combined with effective home- and visitation-level interventions targeted at youth and elderly populations for better reach.

N95 masks are cost-effective. At $1 to $2 each, N95 masks cost less than antigen tests at $10 each or the enormous costs of enforcing contact reduction across communities and in workplaces. A shift by those people already using cloth masks to more effective N95 respirators could be a low-threshold policy intervention. This would be less intrusive than mandatory masking and thus would more likely be adopted.
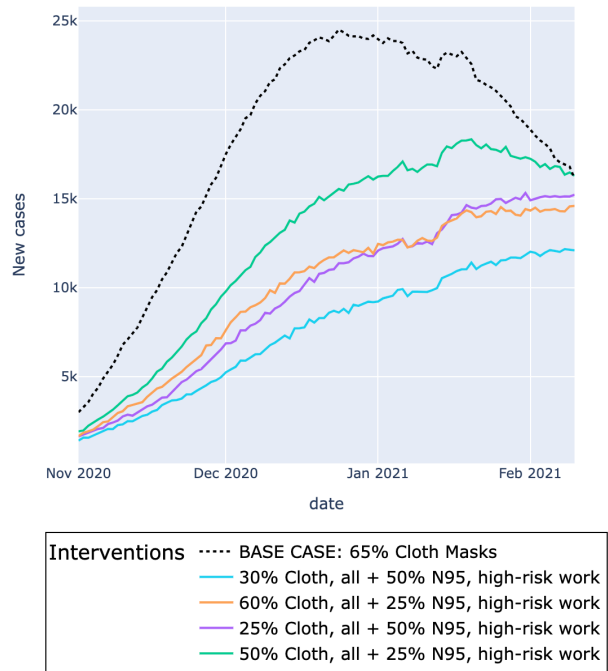

Figure 2. Combined interventions of cloth and N95 mask compliance.

Stockpile N95 masks for future airborne pandemics. The results of this study suggest that stockpiling N95 masks, rather than cloth (or surgical) masks, would be enable an effective nonpharmaceutical intervention for future airborne viral pandemics.

More Information

This policy brief summarizes the report "Effectiveness of Nonpharmaceutical Interventions to Avert the Second COVID-19 Surge in Los Angeles County: A Simulation Study," prepared by researchers from the University of California, Davis, the University of Southern California, and the Technical University of Berlin. The full report can be found here: https://www.ucits.org/research-project/2021-19/.

For more information about findings presented in this brief, please contact Caroline Rodier at cjrodier@ucdavis.edu.