THE FUTURE OF PUBLIC SECTOR WORK

Human-Centered Technology and Policy Strategies

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CITRIS AND THE BANATAO INSTITUTE | CITRIS POLICY LAB

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Executive Summary

Facing rising workload demands, labor shortages, and budget constraints, the public sector is increasingly turning to emerging technologies, such as machine learning–powered decision systems and robotic process automation, to support productivity. These public sector challenges are being compounded by job loss from the COVID-19 pandemic. Within the first three months of the pandemic, the public sector lost 1.5 million jobs nationally and will continue to see significant job loss over the months ahead.[1] Emerging technologies hold great promise to weather these uncertain times and make the future of public sector work more efficient, effective, and equitable.

This white paper explores the application of emerging technologies in three public sectors: K-12 education, social services, and law enforcement. Because the public sector has an obligation to ensure it operates in the public interest, we not only investigate the effects of emerging technologies on the efficiency and effectiveness of public sector workers, but also on equity (i.e., ensuring fairness and accountability) for those served. For each sector, we present examples of ways emerging technologies are being implemented to support these goals and provide specific technology and policy recommendations intended to maximize benefits for both workers and the public.

In addition to sector-specific recommendations, we suggest the following broad strategies:

1. **Collaborate closely with workers and the public to identify needs before implementing technology solutions.** Identifying inefficiencies and pain points for both public sector workers and beneficiaries is a critical first step in the effective development and implementation of emerging technologies. Working closely with workers and the public will better ensure that technologies will both create efficiency gains and improve service provision.

2. **Support new education and credentialing models to reskill public**

1. Sara Hinkley, "Public Sector Impacts of the Great Recession and COVID-19," UC Berkeley Labor Center, June 22, 2020. http://laborcenter.berkeley.edu/public-sector-impacts-great-recession-and-covid-19/.

sector workers. As emerging technologies become more fully integrated into public sector work, workers will need to develop digital literacy, technical, and 21st-century workforce skills—such as collaboration, creativity, critical thinking, and problem solving—to remain competitive. The public sector should partner with the private sector and educational institutions to offer workers flexible education and credentialing programs; doing so will enable workers to obtain the skills necessary to effectively develop and implement emerging technologies.

3. **Develop a procurement strategy for emerging technologies that prioritizes not only increased efficiency and effectiveness, but also equity concerns.** The technology procurement process is an optimal point at which to consider not only gains in efficiency and effectiveness from implementation, but also equity concerns. Careful evaluation of the effects of emerging technologies before adoption and implementation will better ensure technologies are applied in ways that meet workers' needs and mitigate possible harm before widescale rollout.

4. **Put in place frequent review processes, especially those that utilize "contestable design," to mitigate negative unintended consequences from implementation of emerging technologies.** Evaluation of the effects of emerging technologies on public sector work and workers should not end at the procurement stage. Ongoing review processes, especially those that utilize "contestable design" where workers are trained in how the technology works and are encouraged to "collaborate, critique, and correct" the technology as it's developed and implemented, can enable the identification and mitigation of potential negative effects.[2]

2. Daniel Kluttz, Nitin Kohli, and Deirdre K. Mulligan, "Shaping Our Tools: Contestability as a Means to Promote Responsible Algorithmic Decision Making in the Professions," in After the Digital Tornado: Networks, Algorithms, Humanity, ed. Kevin Werbach (Cambridge, UK: Cambridge University Press, 2020), 137.

01 //
INTRODUCTION

While a strong body of research has emerged on the ways new technologies, especially artificial intelligence (AI), will disrupt private sector work, less attention has been given to understanding their effects on public sector work and workers. Yet these technologies are increasingly being integrated into public sector fields as a means to reduce costs or increase productivity.[3]

In the face of increasing workloads, shortage of workers, and budget constraints, many public sector institutions, such as government agencies, nonprofits, and academic institutions, are turning to emerging technologies to increase productivity. Technologies like machine learning–powered decision systems and robotic process automation promise to increase efficiency and effectiveness through augmenting and automating repetitive

3. "Perspectives: Adopting AI, automation, and advanced analytics in government," McKinsey on Government, McKinsey & Company, May, 2019, https://www.mckinsey.com/~/media/mckinsey/industries/public%20sector/mckinsey%20on%20government%20may%202019%202/mck-on-government_5-2019_june19.ashx.

and cumbersome tasks. Accenture estimates that across 16 developed economies, emerging technologies, and AI in particular, will increase productivity in the public sector by 25 percent over the next 15 years.[4] And McKinsey estimates that integration of these technologies into core public service operations like HR, finance, and application processing can lead to less waste and error that could reduce costs by at least 30 percent.[5]

While integrating new technologies into the public sector promises to increase productivity, significant ethical challenges in implementation should be considered. Emerging technologies, especially AI-enabled tools, used in public services have been found to reinforce biases and make costly errors.[6] This is particularly problematic for the public sector, which has an obligation to operate in the public interest. Ensuring emerging technologies are implemented in ways that maximize societal benefit and mitigate unintended negative consequences is critical. Thus, we investigate not only the effects of emerging technologies on the efficiency and effectiveness of public sector work, but also effects on equity (i.e., fairness and accountability) for those served.

The public sector is at a pivotal moment in its digital transition. Integration of emerging technologies into the sector is still in its early stages, allowing for analysis of the effects of early applications and the development of appropriate technology and policy strategies to better ensure future applications maximize benefits and mitigate harms to the public sector workforce and society. We explore the applications of emerging technologies in the public sector in two ways: through automation and augmentation of human tasks. Automation occurs when the technology takes over tasks—both physical and mental—once completed by a human, and augmentation is when an emerging technology is deployed to complement human activities or decision-making. Robotic process automation, machine learning, natural language processing, robotics, and virtual/augmented reality training are among the key drivers of automation and augmentation in the workforce.

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4. “Artificial intelligence genuine impact: Public services in the era of artificial intelligence,” Accenture, 2018, https://www.accenture.com/_acnmedia/PDF-75/Accenture-AI-Genuine-Impact-Pov-Final-Us.pdf#zoom=50.

5. Accenture, “Artificial intelligence genuine impact.”

6. Virginia Eubanks, “A child abuse prediction model fails poor families,” Wired, January 15, 2018, https://www.wired.com/story/excerpt-from-automating-inequality/; Jonathan Oosting, “Justice: For victims, false fraud scandal ‘worse than going to the Secretary of State’,” The Detroit News. October 10, 2018, https://www.detroitnews.com/story/news/local/michigan/2018/10/10/michigan-supreme-court-false-fraud/1592136002/.

Our research provides insight into the effects of emerging technologies within three public service sectors: K-12 education, social services, and law enforcement. We explore implications for efficiency, effectiveness, and equity in each sector and provide specific technology and policy recommendations. We conclude with broad recommendations for the public and private sectors to guide the appropriate development and implementation of emerging technologies in public sector work, including: (1) development of processes to identify needs from the workforce and public for implementing emerging technologies, (2) development of public sector workers' skills through appropriate training and credentialing models, (3) development of procurement processes that balance efficiency and effectiveness with equity concerns, and (4) development of ongoing review processes to identify and mitigate negative effects of technology implementation on the workforce and public.[7]

7. In addition to the recommendations raised in this white paper, we also acknowledge increased data privacy and security concerns that emerge as technologies become integrated into public sector work for both workers and the public. Tracking public workers' behavior (e.g., observing teachers' adherence to online education tool recommendations, assessing how social welfare workers are interacting with ML-powered child welfare systems, or using ML to analyze data points collected to assess police officers' behavior) and gathering data on the public (e.g., collecting data on how students learn, data points for identifying social welfare eligibility, and policing data to inform community intervention strategies) creates significant privacy and security vulnerabilities for both workers and community members/end users. The increasingly invasive collection of data raises concerns, such as what data privacy and security protections should be put in place by the public and private sectors deploying technologies for use by the public sector. While important to consider, these concerns are outside of the core focus of this report and are encouraged to be considered in future research.

02 //
K-12 EDUCATION

02 //

K-12 Education

With over 4 million employees, the K-12 education sector is one of the largest in the US. Yet it faces a teacher shortage that is likely to worsen in the years ahead.[8] High-poverty school districts will be hit hardest, where lack of support and inadequate working conditions discourage many from entering the profession and may be prompting teachers to leave.[9] With student needs becoming more complex and reporting obligations for evaluation metrics increasing, teachers are working longer hours than ever before. Logging an average of 50 hours per week, less than half of which are spent in direct contact with students, teachers report increased burnout that has led many to leave the profession.[10] Indeed, K-12 systems may see a deficit of 100,000 teachers by next year.[11]

From machine learning applications intended to help teachers develop individually tailored lesson plans and identify at-risk students to the use of robots and remote teachers to address a growing workforce gap, emerging technologies are being proposed as a transformative solution to make education systems more efficient and effective with limited resources. Yet the introduction of these technologies, especially those developed by the private sector without public consultation, can spur negative effects such as displacing "professional authority, institutional accountability, and public policy making" in education as the private sector and the technologies it builds take on a

8. "Industries at a Glance: Education Services (NAICS 61)," U.S. Bureau of Labor Statistics, 2020, https://www.bls.gov/iag/tgs/iag61.htm.

9. Emma Garcia and Elaine Weiss, "The Teacher Shortage Is Real, Large and Growing, and Worse than We Thought. The First Report in 'The Perfect Storm in the Teacher Labor Market' Series," Economic Policy Institute. https://eric.ed.gov/?id=ED598211.

10. Jake Bryant, Christine Heitz, Saurabh Sanghvi, and Dilip Wagle, "How artificial intelligence will impact K-12 teachers," McKinsey & Company, January 2020, https://www.mckinsey.com/industries/public-and-social-sector/our-insights/how-artificial-intelligence-will-impact-k-12-teachers

11. Leib Sutcher, Linda Darling-Hammond, and Desiree Carver-Thomas, "A coming crisis in teaching," Teacher supply, demand, and shortages in the US (2016): 1-107, https://learningpolicyinstitute.org/sites/default/files/product-files/A_Coming_Crisis_in_Teaching_REPORT.pdf.

more central role in "set[ting] pedagogy and policy in practice."[12]

We investigate the benefits and risks of the fundamental technological transformation K-12 education is undergoing, including not only how emerging technologies will affect the education workforce, but also equity considerations for students such as disparate effects on learning outcomes that are conditional on access to these technologies. In this section we explore three application areas: use of machine learning (ML) to support administrative tasks, lesson preparation, and student evaluation; ML models to identify at-risk students; and use of robot teachers and remote instruction to supplement, tailor, and scale learning experiences.

Machine Learning to Streamline Administration, Preparation, & Evaluation

Teachers work an average of 50 hours per week, over half of which is spent on administrative tasks rather than in direct contact with students.[13] Emerging technologies, especially ML-enabled technologies, hold the potential to offload certain administrative tasks, class preparation, and student evaluation such as filling out data reports, preparing lessons, and providing feedback on homework.[14]

ML is increasingly being applied to increase teacher efficiency and effectiveness in lesson planning. For example, ML models may suggest lesson plan structures, including tailored lessons for each student and strategies to group students according to learning needs to better ensure they achieve core learning objectives.[15] ML models can also suggest activities and problem sets to develop new skills.[16] Collaborative platforms could speed teachers' efficiency by allowing them to share these ML-generated materials and their assessments of the effectiveness of different lesson plans.[17] While ML

12. Elana Zeide, "Robot Teaching, Pedagogy, and Policy," forthcoming in the Oxford Handbook of Ethics of AI, Oxford University Press, 2019, https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3441300.

13. Jake Bryant et al., "How artificial intelligence will impact K-12 teachers."

14. Ibid.

15. Ibid.

16. Paul Rad et al., "AI thinking for cloud education platform with personalized learning," In Proceedings of the 51st Hawaii international conference on system sciences (January 2018).

17. Jake Bryant et al., "How artificial intelligence will impact K-12 teachers."

applications promise to enable tailored education, they also pose risks to teacher autonomy and students' development. Under pressure to follow the model's recommendations, teachers may go against their professional training and implement inappropriate strategies that harm students.[18]

Use of ML models to grade students' work is becoming more advanced and seamlessly integrated into the classroom. While these models were initially applied to subjects in which answers are often clear-cut, such as mathematics, advancements in natural language processing (NLP) and deep learning have led to their introduction into more "creative" subjects like writing. In 2018, China began piloting a ML model in over 60,000 schools that uses NLP with deep learning to correct and grade thousands of essays.[19] While its use has surely increased efficiency, there are drawbacks. Many of the students were unaware whether their essays were graded by their instructor or the ML model and teachers identified high-quality essays that were graded poorly by the model.[20] This happens because feedback is generated from generalizable insights gleaned across thousands of essays in the model, disproportionately punishing unique essays and limiting personalized feedback that can enrich students' development.

While using ML models to develop tailored feedback to the unique needs of each student remains a challenge, recent research has produced promising results.[21] One of the largest time commitments for teachers is ensuring that lesson materials are available to students in formats that fit their particular learning preferences and accessibility needs. Blackboard, the largest online education platform company in the world, has developed a tool called Ally that can reformat digital course content into alternative formats to address a student's individual needs.[22] Ally uses ML algorithms to automatically create formats of course materials such as translating a text PDF into HTML, audio, or electronic braille. Tools like Ally have the potential to not only free up teachers' time, but empower students to access content in ways best suited for them.

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18. Elana Zeide, "Robot Teaching, Pedagogy, and Policy."

19. Stephen Chen, "China's schools are quietly using AI to mark students' essays... but do the robots make the grade?" South China Morning Post, May 27, 2018, https://www.scmp.com/news/china/society/article/2147833/chinas-schools-are-quietly-using-ai-mark-students-essays-do.

20. Ibid.

21. Xinfeng Ye and Sathiamoorthy Manoharan. "Providing automated grading and personalized feedback," Proceedings of the International Conference on Artificial Intelligence, Information Processing and Cloud Computing (December 2019): 1-5. https://dl.acm.org/doi/pdf/10.1145/3371425.3371453.

22. Blackboard, Blackboard Ally for LMS, 2020, https://www.blackboard.com/teaching-learning/accessibility-universal-design/blackboard-ally-lms.

Effects & Recommendations

By offloading some administrative tasks, preparation, and evaluation to emerging technologies, teachers can shift their focus to students and development of their 21st-century skills: critical and creative thinking, collaboration, and communication. Because such skills are difficult to automate, it is unlikely ML tools will fully supplant the role of the teacher any time soon. However, as ML tools become more complex in their capabilities they could potentially take on instructional roles once considered impervious to automation. As many of these tools rely on teachers' data to learn, teachers could in effect be training their future replacements or offloading their skills in ways that could lead to deskilling and lowering pay as core tasks are moved to their technological counterparts. **The need to develop emerging technologies to enhance and augment instructional labor should be carefully balanced with ensuring that their development reduces conditions for burnout while limiting widespread harms to employment and employability of workers.**

Use of ML models to grade and assess student work can risk homogenizing education and punishing outliers. Because ML models build their features from aggregated insights, students who display similar model characteristics are likely to be rewarded whereas students with unique characteristics may be viewed negatively by the model. **ML grading and evaluation models must be continuously assessed to identify assumptions that are being ingrained for what constitutes the quality of students' work. Teachers will play a pivotal role in performing these assessments.**

In the example provided earlier of the use of ML essay graders in China, students were uninformed whether their essay was evaluated by their teacher or the ML model. This lack of transparency is problematic if the models are biased or produce spurious results. Students will lack knowledge and recourse and instructors will be caught in the middle. Of course, teachers themselves may also be biased in their evaluation of students' work; the key is for institutions to have policies regarding the transparency of the evaluation process and a method of recourse for disputes. **Students and teachers should always be informed when emerging technologies, especially those powered by AI, are used to enhance or augment the educational experience. Further, mechanisms should be put in place to ensure transparency and accountability in the use and effects of these technologies, such as audits of their effectiveness and procedures that enable remedy for negative effects.**

Machine Learning to Identify At-Risk Students

In many schools across the US, the student-teacher ratio has been widening in recent years.[23] As teachers spread their attention across greater numbers of students, the risk of students falling behind becomes significant. In response, ML models developed to identify and predict such students may help teachers better identify them and target interventions.

The use of ML models to predict student performance and likelihood to graduate is on the rise. Deployed in one of every five schools across 47 states, the BrightBytes Clarity Platform is one of the largest platforms for capturing student data to inform performance evaluations and predict risk of under-performing.[24] Using data from the Clarity Platform on attendance, prevalence of disciplinary incidents, general academic performance, as well as specific performance metrics in math, science, reading, and social studies, researchers have developed a highly predictive model for identifying students at risk of not graduating.[25] In Des Moines, Iowa, teachers are partnering with BrightBytes to develop a tiered low-, medium-, and high-risk model for students in grades K-12, allowing administrators and teachers to gain a better understanding of class composition and needs in order to improve resource allocation and provide timely interventions.[26]

In 2010, the Tacoma, Washington Public School District had a graduation rate of 55 percent, well below the national average of 79 percent.[27] In order to improve student outcomes and retention, the school piloted a predictive analytics platform that utilized data collected on student performance in the classroom, attendance, and disciplinary incidences.[28] The model gave teachers powerful foresight into students who were at risk of not graduating and suggested appropriate intervention strategies. By 2016, the district had in-

23. “Fast Facts.,” National Center for Education Statistics [NCES], 2019, https://nces.ed.gov/fastfacts/display.asp?id=28.

24. “K12 analytics solutions: Easy-to-use platform to improve student outcomes,” BrightBytes, 2020, Retrieved from https://www.brightbytes.net/k12-analytics-solutions.

25. Chad Coleman, Ryan S. Baker, and Shonte Stephenson, “A Better Cold-Start for Early Prediction of Student At-Risk Status in New School Districts,” International Educational Data Mining Society, 2020. https://files.eric.ed.gov/fulltext/ED599170.pdf.

26. “The early insights suite: Iowa’s largest district identifies at-risk students more accurately and ensures targeted resource allocation,” BrightBytes, (n.d.), https://drive.google.com/file/d/1IoFKV8NvRLVxG08IPSUyehEe5m0dOYkf/view.

27. “The Condition of Education: A Letter From the Commissioner,” National Center for Education Statistics [NCES], 2019, https://nces.ed.gov/programs/coe/indicator_coi.asp.

28. “Educators use predictive analytics to help at-risk students,” Microsoft Education Blog, April 24, 2017, https://educationblog.microsoft.com/en-us/2017/04/educators-use-predictive-analytics-to-help-at-risk-students/.

creased graduation rates to 85 percent, better than the national average. [29]

As online and blended education—the combination of in-person instruction with the aid of technology—become more prevalent, capturing data for student assessment will likely become more pervasive and invasive. Data from facial recognition, eye tracking, and wearable technologies to measure biometric responses such as heart rate during instruction and testing are all being captured to inform sophisticated ML models intended to improve teacher effectiveness and student success.[30] Online learning environments can capture data for a variety of applications, including detection of students who are bored or cheating, as well as those who are effectively using online education tools to achieve learning objectives.[31] While new technologies hold great potential to collect new forms of data to improve students' education, this collection comes with increased risks to privacy.

The use of ML models to identify at-risk students is also promising, but at the same time their use poses risks for teachers and students. The use of ML models raises challenges for teachers such as time-consuming manual data entry, inability to separate signals from noise in data analysis and results, inefficiencies from incompatible and contradictory assessment tools, delays between identifying at-risk students and implementing instructional changes, decreased autonomy in decision-making over students' instruction, and risks to reputation and effectiveness from overreliance on models that may inadvertently ingrain biased or false assumptions. For students, reliance on inaccurate, discriminatory, or biased ML models to identify at-risk students can reinforce inequalities that will be difficult to overcome and, if implemented without transparency, will undermine accountability and opportunities for recourse.

Effects & Recommendations

Demands for increased data collection and manual entry are likely to

29. "The Condition of Education: A Letter From the Commissioner," NCES

30. Marguerite McNeal, " Wearable tech weaves its way into learning," EdSurge, November 17, 2016, https://www.edsurge.com/news/2016-11-17-wearable-tech-weaves-its-way-into-learning.

31. Sidney D'mello et al., "Automatic detection of learner's affect from conversational cues," User Modeling and User-Adapted Interaction, 18(1–2), (2008): 45–80, doi:10.1007/s11257-007-9037-6; Drew Harwell, "Mass school closures in the wake of the coronavirus are driving a new wave of student surveillance," The Washington Post, April 1, 2020, https://www.washingtonpost.com/technology/2020/04/01/online-proctoring-college-exams-coronavirus/; Cristóbal Romero, "Predicting students' final performance from participation in on-line discussion forums," Computers & Education, 68 (2013): 458-472.

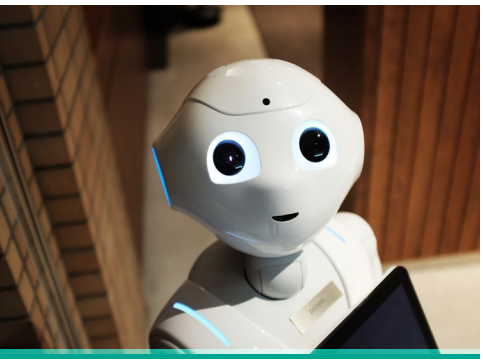
place additional strain on teachers. Burnout from extensive data entry requirements among teachers can become a financial and legal liability for schools. In 2013, thousands of teachers in New York City successfully sued the Department of Education for overtime and back pay from hours of mandated data entry that were cumbersome and inefficient due to complicated software and insufficient broadband availability.[32] **Overly burdensome data entry requirements should be minimized and teachers should have access to the broadband capacity necessary to use these tools efficiently and effectively.**

Overreliance on ML models can also affect teacher autonomy. While the use of such models may help teachers more efficiently identify at-risk students and intervention strategies, models that produce false-positives and false-negatives can undermine and weaken teacher effectiveness. Teachers may feel pressure to follow the decision of a ML model rather than their lived observation, training, and experience. Models built on underrepresented, biased, or flawed data, pose serious equity risks by further ingraining inequalities. If the algorithm is wrong, they may endanger a student's progress and teachers' reputations. **Teachers and administrators should be encouraged to question ML model outputs and evaluate their accuracy. Transparency and evaluation mechanisms, such as the ability to test the model's accuracy on sample data, should be put in place to better ensure accuracy and accountability of ML models used to predict student risk.**

The use of ML models to identify at-risk students raises significant ethical issues, including privacy and security concerns from invasive data collection, such as the collection of data on students' mental health or biometrics to identify whether a student is cheating or paying attention. **Due to the sensitivity of data, education systems and those developing educational technologies must implement robust data security standards in alignment with the Family Educational Rights and Privacy Act (FERPA) and minimize the collection of personally identifiable information and utilize anonymization whenever possible.** The increased need for cybersecurity safeguards for education systems could create new employment opportunities in education-focused cybersecurity.

32. Camille Crittenden, "The kids are online—and alright," Issues in Science and Technology, 36 no 1 (2019): 43–47, https://issues.org/the-kids-are-online/; Benjamin Herold, "NYC tech shortcomings prompt big payout for educators," Education Week, October 8, 2013, https://www.edweek.org/ew/articles/2013/10/09/07overtime_ep.h33.html.

Robots, Remote Teachers, & Online Education



Robots are taking on numerous roles in the classroom: (1) robot as a peer, (2) robot as a care-eliciting companion, (3) robot as a teacher, and (4) telepresence robot.[33] Peer and companion robots do not involve replacing a teacher but instead serve to supplement the work of the teacher by reinforcing key learning objectives. Alternatively, a robot as a teacher would serve to fully replace the human teacher, and telepresence robots—a mobile robot that includes a video camera, screen, microphone, and speaker controlled by a remote individual—could supplement or replace a classroom teacher.[34]

While many seriously question the likelihood that robots will replace teachers in the near future, pilot studies are underway to evaluate their effectiveness at mitigating the effects of teacher shortages. To deal with its shortage of teaching assistants in mathematics and science, UK primary schools are piloting integration of a humanoid robot in the classroom that can provide lessons and correct students.[35] Piloted in Boston-area schools among three- to five-year-olds, the Tega robot developed by researchers at the MIT Media Lab uses affective computing—use of computer vision to identify the emotional features of a child's facial expressions—to provide tailored English-language training to non-native speakers.[36] In China, thousands of kindergarteners are taking some of their first classroom lessons from Keeko, a humanoid robot that tells stories and serves up logic questions.

Robot and remote teaching will likely become more common as teacher shortages increase and as students and teachers continue to shelter in place as a consequence of the COVID-19 pandemic. Telepresence robots and online education platforms provide opportunities to scale and tailor remote education. In South Korea, telepresence robots bring experienced English-language teachers from other countries into the classroom.[37] In Lewisville, Texas, a STEM-focused private charter school uses telepresence robots to bring leading STEM experts to provide lectures and assist stu-

33. Amanda J.C. Sharkey, "Should we welcome robot teachers?" Ethics and Information Technology, 18 no. 4 (2016): 283-297, https://link.springer.com/article/10.1007/s10676-016-9387-z.

34. Ibid.

35. "British schools test 'robot teachers' to tackle staff shortages," The Telegraph, October 23, 2019, https://www.telegraph.co.uk/technology/2019/10/23/british-schools-test-robot-teachers-tackle-staff-shortages/

36. "Robot learning companion offers custom-tailored tutoring," National Science Foundation [NSF], March 14, 2016, https://www.nsf.gov/news/news_summ.jsp?cntn_id=137895

37. Jung Ha-Won, "S. Korea schools get robot English teachers," Phys.org, Dec. 28, 2010, https://phys.org/news/2010-12-skorea-schools-robot-english-teachers.html.

dents in group projects.[38] While telepresence robots risk displacing local talent, they can also help to expand the labor pool of qualified teachers who may be priced out of geographic areas with expensive costs of living.

Online education platforms such as Blackboard, Canvas, Coursera, and Khan Academy, have also created new educational opportunities at unprecedented scale. Reaching millions worldwide, these platforms address a critical need for alternative models that can scale to meet ever-increasing educational demands. This demand became clear during the COVID-19 pandemic where in the United States alone over 124,000 schools suspended in-person instruction by May 2020, resulting in over 55 million students who had to turn to online education methods.[39] While the primary goal of online education has always been to provide a "facsimile of face-to-face instruction at a fraction of the cost" to the masses, the high cost of the necessary technologies and broadband access required to fully engage continues to create barriers for low-income and rural populations.[40]

Effects & Recommendations

While researchers have identified the potential for increased equity benefits of online education, lack of access to high-speed broadband and devices poses risks for low-income and rural teachers and students who will be left behind.[41] For K-12 schools, teachers unions are already working with lawmakers to ensure that the development of online education is beneficial for teachers and their students. **At the top of their list is the requirement to ensure teachers maintain autonomy in their virtual classrooms—allowing them control over the content and structure—and that teachers and students have access to the broadband speeds necessary for online education.**[42]

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38. "Bringing experts to the classroom via telepresence robots," OhmniLabs, May 31, 2019, https://ohmnilabs.com/content/bringing-experts-to-the-classroom-via-telepresence-robots/.

39. "Map: Coronavirus and School Closures," Education Week, April 20, 2020, https://www.edweek.org/ew/section/multimedia/map-coronavirus-and-school-closures.html.

40. Jonathan Zimmerman, "Will shift to remote teaching be boon or bane for online learning?" Interview by Doug Letterman, Inside Higher Ed., March 18, 2020, https://www.insidehighered.com/digital-learning/article/2020/03/18/most-teaching-going-remote-will-help-or-hurt-online-learning; Brandie Nonnecke, "As millions of students turn to online education, the FCC must implement bold changes to close the digital divide," Protego Press, April 1, 2020, https://protegopress.com/as-millions-of-students-turn-to-online-education-its-time-the-fcc-implements-bold-changes-to-close-the-digital-divide/.

41. Brandie Nonnecke, "Students turn to online education."

42. Dana Goldstein and Eliza Shaprio, "Online school demands more of teachers. Unions are pushing back," The New York Times, April 21, 2020, https://www.nytimes.com/2020/04/21/us/coronavirus-teachers-unions-school-home.html; Brenda Álvarez, "COVID-19 and the impact on communities of color," NEA Today, April 24, 2020, http://neatoday.org/2020/04/24/covid-19-and-communities-of-color/?_ga=2.251069894.1968709274.1587940987-355434369.1587940987.

While emerging technologies are becoming more integrated into the classroom, the full displacement of teachers by robots is unlikely in the foreseeable future. Instead, a hybrid model is much more likely where robots are deployed in ways that collaborate with and enhance teachers. It is unclear whether integration of robots will actually serve to make teachers more efficient as their introduction into the classroom will require significant planning and preparation. Teachers will be required to develop new skills in "co-teaching" with robots, identifying appropriate lessons and skills to offload to their robot counterparts. **To better ensure teachers are equipped for these hybrid classroom models, teacher training programs should include specialized training for how to effectively integrate robot teachers into the classroom and evaluate their effects on students' development.**

The move to online and blended education is also changing the future of the education workforce. In the aftermath of the COVID-19 pandemic, online and blended education is expected to surge, especially in higher education.[43] Demand for course designers, IT support staff, and teachers to develop online education content is projected to increase. **Online teacher training and recruitment programs should be established to reskill teachers for online education models and train the large number of skilled laborers (e.g., course developers, programmers, IT support staff) who will be necessary to support the burgeoning sector.**

The growing fear of telepresence robots replacing teachers is not unfounded. While telepresence robots can better ensure students' access to high-quality teachers, their use can have a negative effect on local labor markets if teachers are tapped from other areas. In South Korea, for example, telepresence robots used to teach foreign languages are controlled by experienced teachers in the Philippines, who are far cheaper to employ than their local counterparts.[44] **To mitigate negative effects on local labor markets, policies should be put in place to better ensure local teachers are seriously considered before positions are made available to telepresence robots and remote instructors.**

43. Joshua Kim,"Teaching and learning after COVID-19," Inside Higher Ed, April 1, 2020, https://www.insidehighered.com/digital-learning/blogs/learning-innovation/teaching-and-learning-after-covid-19.

44. Jung Ha-Won, "S. Korea schools get robot English teachers," Phys.org, Dec. 28, 2010, https://phys.org/news/2010-12-skorea-schools-robot-english-teachers.html.

03 //
SOCIAL SERVICES

03 //

Social Services

State and local governments in the United States face a challenging fiscal environment over the next few decades. Government analysts estimate that without revenue increases, state and local governments may need to cut their expenditures by over 20 percent annually over the foreseeable future.[45]These tight government budgets are caused by rising health insurance costs, as well as an impending pension crisis set to hit most states and municipalities.[46] Since state and local governments play a critical role in the distribution of social welfare programs in the United States—including Medicaid, unemployment insurance, and local general assistance funds—the administration of social services may also face steep budget reductions in years to come.

With these tight budgets, many state and local governments have turned to technological solutions to help social service caseworkers expedite and improve the quality of their services. In this section, we explore three emerging technologies that may transform such services in the near future: the use of machine learning and predictive analytics in targeting social services; the use of robotic process automation to offload paperwork and other routine tasks required of caseworkers; and the use of chatbots to answer constituent questions when completing benefits applications.

45. "State and Governments' Fiscal Outlook," U.S. Government Accountability Office (December 2019): 4, https://www.gao.gov/assets/710/703475.pdf.

46. Ibid.

Robotic Process Automation Bots to Expedite Social Service Applications

The COVID-19 pandemic has brought to light how inflexible and outdated government software systems are when faced with an increased workload. In the early weeks of the crisis, states around the country were forced to process unemployment and other claims at alarmingly high rates. However, many of these state and local governments were equipped with antiquated software systems that did not allow for such a dramatically increased pace. In addition, government agencies are often staffed with an insufficient number of caseworkers to handle a sudden surge of cases, and they were unprepared to hire additional temporary staff on short notice. Consequently, tens of millions of workers did not receive unemployment benefits in a timely manner during the first few months of the crisis.[47]

One challenge for government employees processing benefits claims is that the significant volume of administrative work is hard to expedite using manual labor. For example, the federal government estimates the public spends $69 billion, or 11.5 billion hours, on government paperwork each year.[48]

To accelerate some of these administrative processes, governments have been turning to robotic process automation, or RPAs, to assist with workload. RPAs are "software tools that can replicate and automate transactional processes while improving process accuracy and speed."[49] Essentially, RPAs emulate the actions of human workers and can manipulate data and applications. They serve as a "digital human," and conduct activities like logging into software systems, moving files, and filling out forms just like a human worker would. The benefit of RPAs is that they accelerate bureaucratic processes without having to overhaul entire software systems. RPAs are usually not AI-based, since they are programmed only to complete repetitive tasks.

The private sector has been utilizing RPAs for years, and the technology has recently been introduced into government agencies. The UK government has been a leader in using RPAs to enhance the efficiency of benefits offices. For example, their largest government department—the Department of Work and Pensions—has been piloting the use of RPAs in numerous

47. Tony Romm & Heather Long, "Out of work—and cash—millions of Americans are still waiting for their first unemployment check," The Washington Post, April 23, 2020, https://www.washingtonpost.com/business/2020/04/23/unemployment-benefits-backlog-coronavirus/.

48. Max Galka, "Quantifying the Government Paperwork Burden," Metrocosm, February 23, 2016, http://metrocosm.com/government-paperwork-burden/.

49. "The new machinery of government: Robotic Process Automation in the public sector," Deloitte, LLP, https://www2.deloitte.com/content/dam/Deloitte/uk/Documents/Innovation/deloitte-uk-innovation-the-new-machinery-of-govt.pdf.

processes. One of their early experiments was to use RPAs to help the manual processing of pension claims. At the time, the Department was experiencing a backlog of more than 30,000 pension cases and a shortage of staff to file the claims. Within two weeks of the RPA installation, the backlog was cleared.[50] The Department has since piloted RPAs to assist with benefits claims in other settings.

The US federal government and state governments have also piloted the use of RPAs. Perhaps the best-known use cases have been with the Ohio Department of Administrative Services and Ohio Department of Medicaid. The Ohio Disability Alert Onset Bot (Disability Bot) has been used to help county governments clear backlogs for disability benefit applications. A Disability Bot that operates for 15 hours a week is said to be able to clear a backlog of 3,000 cases over five weeks.[51] Most of the Disability Bot's work has been relatively seamless, with over 90 percent of cases processed by the RPA bot and not needing any additional caseworker attention.[52] Though the Disability Bot has been piloted in just a few counties, the success of the system has led the state to implement it in all 88 counties. The state has also piloted RPAs with two new use cases: adding newborns eligible for Medicaid to existing cases and linking residents' Ohio Benefits Self-Service Portal accounts to their public assistance case in the Ohio Benefits Worker Portal, which allows the individual to receive benefit updates, report changes, and submit documents online.[53]

Effects & Recommendations

At their core, RPA bots reduce the clerical burden for public assistance case workers and allow them to focus on more complicated tasks that are harder to automate. In Ohio, for example, Medicaid case workers were spending an average of seven minutes entering a newborn's information into the Ohio Benefits system to add the child to Medicaid.[54] This work was mostly administrative—it required copying identification information from one database system to another. Because of this workload and additional competing priorities, caseworkers took almost a week to add newborns to

50. "The UK's largest government department transforms business processes with RPA." UiPath Case Study, https://www.uipath.com/solutions/customer-success-stories/dwp-government.

51. GCN Staff, "Accelerating benefit requests with RPA," GCN, November 1, 2008, https://gcn.com/articles/2018/11/01/psi_ohio-benefits-process-automation-pilot-project.aspx.

52. Ibid.

53. Ibid.

54. "ACT-IAC: Advancing government," released May 9, 2019, State of Ohio Intelligent Process Automation—Ohio Department of Administrative Services., YouTube video, https://www.youtube.com/watch?v=ZiyeMKcYM5w.

the Medicaid case. With the introduction of an RPA bot (the "Baby Bot"), caseworkers reduced the time spent on repetitive administrative tasks, and instead focused on higher impact tasks, such as direct contact with clients.[55] This sentiment was seconded in Ohio's Hamilton County, where the implementation of the bots saved the county one full-time staff member across all 88 county agencies, and allowed the department to take on additional work.[56] **Governments should consider implementing RPA bots to offload government workers from having to spend a disproportionate amount of their workday on mundane, repetitive tasks.**

RPA bots could also potentially reduce the number of workers in some government agencies. The entire state of Ohio has estimated that the "Baby Bot" saved the state 42 work weeks of time in a year and a half.[57] In fact, some analysts predict that technologies like RPA bots could "automate away" jobs.[58]

As alarming as this might sound for some, the automation of tasks may not result in uniformly negative effects for workers. Caseworkers in some states are overburdened with paperwork and find these time-saving technologies necessary and beneficial to make their jobs more manageable, unless additional staff are hired to cover the work.[59] This may be especially true in crisis situations like COVID-19, where caseworkers are experiencing a surge of new applicants and there is inadequate time or resources to bring on additional staff. In addition, federal, state, and local governments are well aware that a large portion of their workforce is slated to retire in the next ten years, and it may be difficult to fill the vacant positions left behind.[60] Workforce automation may be beneficial for agencies that find it difficult to recruit qualified replacements for their retiring workforce. **As such, governments need to work closely with workers to assuage their concerns about technology replacement of jobs and focus on specific use cases where caseworkers are overburdened, or positions that are difficult to fill.**

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55. GCN Staff, "Accelerating benefit requests with RPA," GCN, November 1, 2008, https://gcn.com/articles/2018/11/01/psi_ohio-benefits-process-automation-pilot-project.aspx.

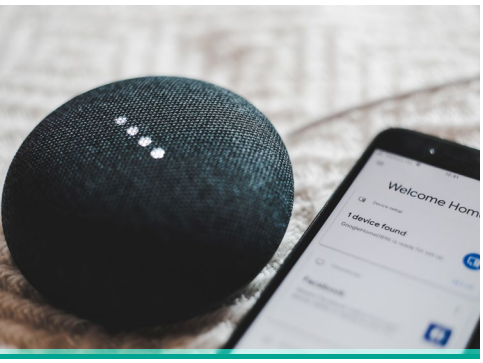
56. Hamilton County staff at Jobs & Family Services, Personal interview, May 1, 2020.

57. Ohio Department of Medicaid, Personal interview, May 29, 2020.

58. Brandon Vigliarolo, "Robotic process automation: A cheat sheet" TechRepublic, May 29, 2020, https://www.techrepublic.com/article/robotic-process-automation-a-cheat-sheet/.

59. Hamilton County, Ohio did not have any union issues with the implementation of these bots because caseworkers were overburdened. As such, the union was actually enthusiastic about the use of this technology.

60. Courtney Bublé, "The aging federal workforce needs 'new blood,' experts say," Government Executive, August 30, 2019, https://www.govexec.com/workforce/2019/08/aging-federal-workforce-needs-new-blood-experts-say/159585/.



Chatbots to Improve Service Delivery

Chatbots also hold great potential for productivity gains for the social service sector. At their core, chatbots are "computer programs that simulate and process human conversation (either written or spoken), allowing humans to interact with digital devices as if they were communicating with a real person."[61]

The term "chatbot" is a relatively broad term and can incorporate a broad range of sophistication. Rudimentary chatbots use natural language processing (NLP), but very little (if any) machine learning, to generate a set of automated responses to user questions. Most current deployments of chatbots fall into this category. Predictive chatbots, on the other hand, incorporate both machine learning and NLP to enable personalization in responses. Amazon Alexa and Apple Siri are examples of personalized chatbots and likely show what the future of chatbots will hold.[62]

Chatbots are being introduced to increase efficiency, effectiveness, and equity for social services. First, chatbots can theoretically reduce response times and save employee staff time by automating mundane and routine tasks. In addition, chatbots can be used to answer common questions and to gather feedback from constituents in order to deliver appropriate services.[63] Since chatbots can also answer questions in a variety of languages and assist those who are hearing impaired, they can provide more equitable service delivery. As such, a few California counties have begun to implement chatbots to assist constituents when filling out applications for various public assistance programs.

To date, two counties in California, Ventura and San Bernardino, have utilized chatbots to help constituents fill out applications for the state's Supplemental Nutrition Assistance Program, CalFresh. In addition, Code for America, a nationally recognized non-profit in human-centered design and civic technology, has built a "digital assistance" application titled GetCalFresh which uses live chat and chatbot technology to help answer client questions as they apply for CalFresh benefits, encounter difficulties in the enrollment process, or submit their semi-annual report.

Ventura County's chatbot system is a fully-automated system that uses Amazon's Lex bot system as the base for its platform. Ventura was one

61. "What is a Chatbot?" Oracle website, https://www.oracle.com/solutions/chatbots/what-is-a-chatbot/.

62. Ibid.

63. Kevin Desouza & Rashmi Krishnamurthy, "Chatbots move public sector towards artificial intelligence," TechTank at The Brookings Institution, June 2, 2017, https://www.brookings.edu/blog/techtank/2017/06/02/chatbots-move-public-sector-towards-artificial-intelligence/.

of the first counties in the United States to implement a fully-automated chatbot system.[64] Constituents who visit the county's CalFresh webpage can ask questions via the chatbot. They can also download an Amazon Alexa application package on the Ventura County website and ask questions through their Amazon Echo, which makes services more accessible to older and hearing-impaired populations. As of April 2020, Ventura County's chatbot has over 2,000 questions in its database, with 11 specifically related to the CalFresh application. These include inquiries about eligibility criteria for the program, average application processing times, and verification requirements for the application. Approximately 100-150 CalFresh questions are answered by the Ventura County chatbot weekly.

In comparison, San Bernardino's chatbot system is barely automated. Though it has a few automated responses, the chatbot system is largely run with a full-time staff person manually answering queries. Similarly, Code for America's live chat feature on GetCalFresh is staffed by two full-time, multilingual workers who answer questions in real-time, and trigger automated responses to common questions like "How do I submit documents to the county?"

Effects & Recommendations

Similar to RPA bots, automated chatbots are intended to reduce the workload for caseworkers and allow them to focus on "higher-skill" tasks. However, it remains to be proven that chatbots significantly reduce workloads. Most CalFresh caseworkers at the County of Ventura, for example, are unaware whether their client has interacted with the chatbot system prior to meeting in person.[65] In addition, the chatbot functionality does not seem to have changed the level of client-caseworker interaction—every client is still required to meet with a caseworker at least once when they submit a CalFresh application to answer further questions. As of July 2020, the chatbot system appears not to have replaced caseworker jobs.

Some at Code for America are skeptical of implementing automated chatbots in the social service sector. According to their research, 40 percent of GetCalFresh clients use their live chat system because of administrative burdens in the application process. Some critics believe that automating answers through chatbot systems will raise rather than reduce barriers to public assistance by making it more difficult for constituents

64. The Ventura County chatbot system is built for the whole county, and not just the CalFresh system. CalFresh represents a subset of questions that the county-wide chatbot system can answer.

65. County of Ventura Information Technology staff member, Personal interview, April 2020.

to get questions answered. Surveys have found that over 80 percent of respondents prefer to interact with a human agent rather than a chatbot.[66] If true, then chatbot systems may not actually reduce worker burden since in-person caseworkers may still be needed for questions beyond what chatbots are able to answer. For this reason, Code for America's chat system is not automated and is actually operated by two full-time staffers who answer all GetCalFresh applications. San Bernardino has also followed this route; their chat system is operated by one full-time staffer. **As such, governments interested in utilizing automated chatbot systems in social service settings should think carefully about the tradeoff between client experience and cost savings. Governments need to assess whether replacing caseworkers with automated chatbots will worsen the client experience and overburden remaining personnel.**

In addition, most effective chatbot systems will require additional staff for maintenance of the system. The County of Ventura, for example, was maintaining its chatbot system with one full-time developer responsible for troubleshooting and maintaining the bot system. The staffer aggregated all new questions asked every week and added them to the bot system with approval from each agency. This is critical to making an effective social service chatbot since policy changes may require the chatbot questions and answers to be updated. The cost of this full-time staffer, in addition to the cost of the base Amazon technology and the additional work required to install the system, makes it unclear whether this technology actually saves costs.

One benefit of this technology, however, is that it allows governments to analyze data from public questions in real-time, and enables them to redesign systems to be more efficient, effective, and equitable. Code for America conducts sentiment analysis on all questions asked on its chat system. If they spot a pattern, they will relay this information to county governments to update their processes. For example, if they identify an increase in questions related to CalFresh eligibility because of COVID-19, they will relay this to county governments to help redesign services or websites. This may also ease workload for certain workers, if websites are better designed such that constituents do not need to call with questions. **Social service agencies that administer automated chatbots should work closely with social service caseworkers to constantly update and modify the system.** IT departments and caseworkers should be engaged in a feedback loop, where caseworkers give developers input on chatbot questions and answers, and developers give social service caseworkers information on the types of questions being asked.

66. Gil Press, " AI stats news: 86% of consumers prefer humans to chatbots," Forbes, October 2, 2019, https://www.forbes.com/sites/gilpress/2019/10/02/ai-stats-news-86-of-consumers-prefer-to-interact-with-a-human-agent-rather-than-a-chatbot/#295f100c2d3b.

Lastly, chatbots may be especially helpful in localities where constituents speak a variety of languages. Ventura County's chatbot, for example, can answer questions in five languages. GetCalFresh's live chat system, on the other hand, has hired two workers who can speak three languages. It is of course much easier to offer new language options with automated chatbot systems. **Chatbots should integrate multiple languages to help caseworkers do their job in more equitable, efficient, and effective ways, by enabling them to better serve clients who may not speak English and focus more time on providing services rather than translating their work.**

Predictive Analytics to Improve Social Services

With researchers now understanding the power of government administrative datasets, many agencies have turned to using ML and predictive analytics tools to improve social services. ML has been used widely in social services, from helping state health departments predict adverse birth outcomes in order to better target prenatal case management, to helping social workers determine which domestic violence calls require in-person follow up.[67] These tools solve two common problems within social service agencies: they help understaffed agencies to automate tasks, while also allowing governments to target their limited services to those most in need. Governments are interested in using ML to improve case management and to better "understand patterns of behavior, manage caseload dynamics, and target individuals for interventions."[68]

One of the most common uses of ML in social services is for risk assessment. Social service agencies have long been using risk assessment tools to determine what services should be assigned to clients. Child welfare agencies, for example, commonly use surveys or other tools to assess the risk levels of children being harmed.[69] However, manual risk assessments can vary even among professionals using the same tool, and many worry about the potential for racial and socioeconomic bias.[70] Others worry about the accuracy of these assessments when conducted by caseworkers who

67. Ian Pan, et al.,. "Machine learning for social services: A study of prenatal case management in Illinois," American Journal of Public Health, 107, no.6 (June 2017): 938-944, https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5425855/.

68. Kristin, Porter, Rekha Balu, & Richard Hendra, " MDRC's approach to using predictive analytics to improve and target social services based on risk," MDRC: Reflections on Methodology, September 2017, https://www.mdrc.org/sites/default/files/Methods_1_Predictive%20Analytics_0.pdf.

69. "Safety and Risk Assessment," Information webpage of the Child Welfare Information Gateway, Children's Bureau, U.S. Department of Health and Human Services, https://www.childwelfare.gov/topics/systemwide/assessment/family-assess/safety/#state.

70. "Racial disproportionality and disparity in child welfare," Child Welfare Information Gateway, Children's Bureau, U.S. Department of Health and Human Services, November 2016, https://www.childwelfare.gov/pubpdfs/racial_disproportionality.pdf.

are often overworked. Some child welfare officers, for example, are asked to render decisions on whether child welfare hotline calls should warrant a follow-up visit within an hour if not sooner.[71]

To improve the accuracy of risk assessment tools and government service delivery, agencies have turned to ML and predictive analytics. In 2014, the Alleghany County Department of Human Services (DHS) in Pennsylvania partnered with academics from California and New Zealand to create a predictive model—the Allegheny Family Screening Tool (AFST)—that would help workers assessing child abuse and neglect make more data-informed decisions during screening calls. The previous system, which placed significant onus on both the caller and the DHS call screeners, would be supplemented with a ML-based recommendation to rate the likelihood that a child is at risk of serious abuse. The ML model utilizes data from the Department of Human Services, along with local housing authority, criminal justice, and school district data. Though DHS hotline screeners and their supervisors still have the authority to make the final say on a formal investigation, they would be provided with the algorithm's recommendation before doing so.[72]

The AFST received much media attention, as it was one of the first ML tools to be implemented in a child welfare service setting where the code and findings were made public. Critics of the tool worried about fairness and bias in its recommendations. The tool was featured in Virginia Eubanks' *Automating Inequalities*, where Eubanks alleged that AFST was discriminatory to poor and working-class families.[73] That is, because the data fed into the algorithm derives mostly from low-income families' interaction with public agencies, these families may be more likely to be flagged as high-risk. The parameters the AFST takes into consideration include utilization of county health, mental health treatment, or other services, which are disproportionately used by low-income people. The AFST is only one of many ML-based child welfare and domestic violence tools used in the United States. Similar tools have been implemented in social service departments in Wisconsin, New York, and the District of Columbia.[74]

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71. Dan Hurley, "Can an algorithm tell when kids are in danger?" The New York Times, January 2, 2018, https://www.nytimes.com/2018/01/02/magazine/can-an-algorithm-tell-when-kids-are-in-danger.html.

72 "Child Protection: The Allegheny Family Screening Tool," Case Study, Centre for Public Impact: A BCG Foundation, (October 2018): https://resources.centreforpublicimpact.org/production/2019/01/CPI-AI-Case-Study-Child-Protection.pdf.

73. Virginia Eubanks, " A child abuse prediction model fails poor families," Wired, January 15, 2018, https://www.wired.com/story/excerpt-from-automating-inequality/.

74. Devansh Saxena & Shion Guha, "Designing for human-centered AI in the US child welfare system," CHI 2020 Conference Paper, (April 2020): https://static1.squarespace.com/static/5dce0b39788bf4243921b9c1/t/5e892e3ce83f5a00464adbb8/1586048572567/CHI2020+FairAI.pdf; "Using machine learning to identify high-risk domestic violence offenders in New York City," National Institute of Justice Grant Award, 2017, https://nij.ojp.gov/

Effects & Recommendations

Preliminary analyses of AFST and similar tools suggest their relatively wide adoption by social service caseworkers. Surveys with AFST hotline workers, for example, find that 70 percent claim to use the tool at least occasionally.[75] Surveyors also cite that more than half of participants believe the tool has facilitated more data-driven decisions in the workplace. In addition, though hotline screeners were first afraid that this tool was the first step to automating their jobs, some staff now feel the tool empowers them and validates their ultimate decision.[76]

On the other hand, concerns have emerged in the implementation of these tools. Some workers state that these types of ML tools may supplant a worker's decision-making, as caseworkers question their decisions when faced with an algorithmic risk score that differs from their own assessment.[77] These technologies could reinforce prevailing power dynamics in the office if workers lose agency to make decisions. Caseworkers may also face an additional burden to document and convey the algorithmic assessment and their own assessment to decision makers.[78] With AFST, for example, supervisors who want to override the algorithm's risk assessment for high-risk cases must submit formal documentation for the override. Sometimes these algorithms omit variables that caseworkers consider key for an accurate assessment, such as whether clients are already receiving services or new indicators that the child is experiencing trauma.[79] These complicated design features can lead to frustration for caseworkers, who sometimes feel as though their decisions are more uncertain and unreliable because of the AFST.[80] **Thus, ML tools need to be created in close consultation with service workers.** This will allow the tools to better

funding/awards/2017-va-cx-0033; Matthew Katz, "Big problems, big solutions, big data: A defense of the use of predictive analytics in child welfare," The New Social Worker, https://www.socialworker.com/feature-articles/practice/big-problems-big-solutions-big-data-defense-of-predictive-analytics-child-welfare/.

75. "Allegheny County Predictive Risk Modeling Tool Implementation: Process Evaluation," Hornby Zeller Associates, Inc., (January 2018): http://hornbyzeller.com/wp-content/uploads/2018/03/Predictive%20Analytics%20Process%20Evaluation%20Allegheny%20County.pdf#zoom=100.

76 "Child Protection: The Allegheny Family Screening Tool," Case Study, Centre for Public Impact: A BCG Foundation, (October 2018): https://resources.centreforpublicimpact.org/production/2019/01/CPI-AI-Case-Study-Child-Protection.pdf.

77. Virginia, Eubanks, " A child abuse prediction model fails poor families," Wired, January 15, 2018, https://www.wired.com/story/excerpt-from-automating-inequality/

78. Devansh Saxena & Shion Guha, "Designing for human-centered AI in the US child welfare system," CHI 2020 Conference Paper, (April 2020): https://static1.squarespace.com/static/5dce0b39788bf4243921b9c1/t/5e892e3ce83f5a00464adbb8/1586048572567/CHI2020+FairAI.pdf.

79. Ibid.

80. Ibid.

meet the needs of social service case workers and will mitigate potential harm. Involving service workers from the beginning of development will also increase user trust and buy-in.

One reason for high adoption of AFST versus other tools is likely due to the preservation of worker autonomy, given appropriate guidelines. Screeners are able to override AFST's recommendation if they receive approval from their supervisors. This often occurs in situations where children have a long history of juvenile probation or interactions with mental health agencies, where the AFST automatically flags them as "high-risk" cases while screeners and their supervisors take a more nuanced approach to determine whether a formal investigation is warranted. This override function seems to be critical for worker buy-in. **ML-powered assessment tools will not be perfect in all cases, and an override function may mitigate concerns from caseworkers that these tools will be used to replace their jobs. ML-powered analytics tools should incorporate an override function to empower case workers and mitigate false positives that could be harmful to people being classified by these algorithms.**

The effect of these tools on the workload of caseworkers, including whether they are increasing the efficiency and effectiveness of services, remains unclear. Evaluations have shown mixed results of these ML tools in better targeting services than non-ML risk assessment procedures. As such, it does not seem like these tools are yet automating jobs or making work more efficient. **Governments should exercise caution when considering whether to replace caseworkers with these automated tools until it is clear that they actually improve social service provision.**

04 //
LAW ENFORCEMENT

04 //

Law Enforcement

Beginning with the budget constraints following the 2008 economic recession through to periods of greatly expanded budgets in the last decade, police departments across the country are increasingly incorporating emerging technologies into their practices.[81] While these technologies have the potential to offload workload demands and make policing safer for both officers and the communities they serve, they also pose concerns regarding equity and fairness due to heightened surveillance and automated decision-making with little accountability.[82] Analyzing the way these technologies are adopted by the law enforcement labor force is essential when assessing their effect on police jobs and policed communities.

We analyze three technologies—predictive policing algorithms, police robots, and virtual reality for empathy and de-escalation training—and their effects on the police workforce and public, using the criteria of efficiency, effectiveness, and equity. Given current movements and renewed conversations around racial discrimination in policing, it is important to define these criteria in our analysis. While "efficiency" and "effectiveness" for those who work in law enforcement could mean keeping crime rates low given available staffing and resources, there is conflicting evidence whether increasing or reducing policing leads to this goal.[83] Instead, we define the goals of policing as keeping community members safe and building trust between community members and law enforcement. Our criteria will center around this definition of policing while analyzing the role these technologies play in policing practices, labor, and community effects.

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81. "The Impact of the Economic Downturn on American Police Agencies," Office of Community Oriented Policing Services—U.S. Department of Justice, October 2011, http://www.ncdsv.org/images/COPS_ImpactOfTheEconomicDownturnOnAmericanPoliceAgencies_10-2011.pdf. Niall McCarthy, "How much do U.S. cities spend on policing?"Statista, June 12, 2020. https://www.statista.com/chart/10593/how-much-do-us-cities-spend-on-policing/.

82. Xavier Pickett, "Policing Black Communities," Public Justice Report, 2007, https://www.cpjustice.org/uploads/Policing_Black_Communities.pdf.

83. Matthew Yglesias, "The case for hiring more police officers," Vox, February 13, 2019, https://www.vox.com/policy-and-politics/2019/2/13/18193661/hire-police-officers-crime-criminal-justice-reform-booker-harris; Gary Kleck, and J.C. Barnes, "Do More Police Lead to More Crime Deterrence?" Crime & Delinquency 60, no. 3 (2014), https://www.researchgate.net/publication/274453022_Do_More_Police_Lead_to_More_Crime_Deterrence.

Predictive Models to Identify Crime Hot Spots

Predictive policing is the use of algorithms to inform police decisions based on historical data about a given community's crime statistics and in some cases, an individual's crime history or association with the criminal justice system.[84] Many police departments across the country have attempted to use these algorithms to increase efficiency and deal with staffing limitations.[85] Much has been written on the potential discriminatory effects of predictive policing as well as the challenges they pose regarding transparency and accountability.[86] While harmful effects on communities will be mentioned in this section, we also focus on how predictive policing may affect the police workforce and police departments' decision-making regarding crime.

One type of predictive policing algorithm is location-based predictions, which use geographic data points of previously reported crimes to inform where police officers should patrol. We focus our analysis on a widely used platform, PredPol. Developed from a research project at UCLA and with the Los Angeles Police Department (LAPD), PredPol creates a daily map of 500-feet-by-500-feet crime "hot spots" that suggest where on-duty officers should patrol during their uncommitted time (i.e., when they are not responding to radio calls).[87] According to PredPol, this prediction is based on a mathematical model that incorporates three variables: the type of crime and where and when it was committed.[88] However, use of these data points has been criticized as reinforcing biased decisions about where to patrol.[89]

84. "Overview of Predictive Policing," National Institute of Justice, June 9, 2014, https://nij.ojp.gov/topics/articles/overview-predictive-policing.

85. Eyragon Eidam, "The Role of Data Analytics in Predictive Policing," Government Technology, September 2016, https://www.govtech.com/data/Role-of-Data-Analytics-in-Predictive-Policing.html; Gregory Borromeo (traffic sergeant, Los Gatos-Monte Sereno Police Department), in discussion with the author, April 2020.

86. "Statement of Concern about Predictive Policing by ACLU and 16 Civil Rights, Privacy, Racial Justice, and Technology Organizations,"American Civil Liberties Union, August 31, 2016, https://www.aclu.org/other/statement-concern-about-predictive-policing-aclu-and-16-civil-rights-privacy-racial-justice; Renata M. O'Donnell, "Challenging Racist Predictive Policing Algorithms Under the Equal Protection Clause" NYU Law Review 94, no 3 (2016): 1.

87. Mark Puente, "LAPD Moving Away Data-Driven Crime Programs over Potential Racial Bias," Los Angeles Times, April 10, 2019, https://www.latimes.com/local/lanow/la-me-lapd-data-policing-20190410-story.html; Ali Winston and Ingrid Burrington, "A Pioneer in Predictive Policing Is Starting a Troubling New Project," The Verge, April 26, 2018, https://www.theverge.com/2018/4/26/17285058/predictive-policing-predpol-pentagon-ai-racial-bias.

88. "About PredPol," PredPol, https://www.predpol.com/about/.

89. Kristian Lum and Isaac, William. "To predict and serve?" Royal Statistical Society 13, no. 5 (2016). https://rss.onlinelibrary.wiley.com/doi/full/10.1111/j.1740-9713.2016.00960.x.

Effects & Recommendations

While intended to assist overburdened police departments, the use of location-based predictive algorithms has given police departments minimal advantages for effective prediction of crime hot spots and deterrence of crime. In response, many departments have discontinued their contracts with PredPol due to a lack of gains in efficiency or effectiveness.[90] According to Sarah Brayne, a professor of sociology at the University of Texas, Austin, who studied the LAPD's usage of PredPol (which ended in April 2020), the captains recommended that their officers visit PredPol-identified hot spot areas on their uncommitted time.[91] Sergeant Gregory Borromeo of the Los Gatos/Monte Sereno Police Department (LGMSPD), which also recently ended its use of PredPol, indicated the software sometimes displayed hot spots that were surprising to many officers' intuition about where higher crime-rate areas were located.[92] His officers generally found no activity when they went to check the areas, but they could not determine whether police presence in the area actually deterred crime or if the area was falsely designated as a hot spot by the algorithm.[93] Brayne confirmed in her research a shared skepticism among both management and patrol officers since many felt that predicted hot spots did not provide new information regarding where crimes occur most frequently compared to the areas that they already patrolled often.[94] While LAPD management did see crime reduced broadly during the study period, they were unable to attribute it solely to the use of predictive software.[95] **Rather than adopting prediction algorithms to determine patrolling during uncommitted time, officers' time may be better spent engaging with the community in trust-building activities.**

There is significant concern that predictive policing technologies disproportionately target communities of color.[96] Predictive policing tools may create a reinforcement loop where communities that are heavily policed have greater reported incidences of police intervention that lead

90. Caroline Haskins, "Dozens of Cities Have Secretly Experimented With Predictive Policing Software." Vice, February 6, 2019. https://www.vice.com/en_us/article/d3m7jq/dozens-of-cities-have-secretly-experimented-with-predictive-policing-software.

91. Sarah Brayne (assistant professor of sociology, University of Texas, Austin), in discussion with the author. March 2020; Caroline Haskins, "The Tool Was Supposed To Predict Crime. Now Los Angeles Police Say They Are Dumping It," BuzzFeed News, April 22, 2020, https://www.buzzfeednews.com/article/carolinehaskins1/los-angeles-police-department-dumping-predpol-predictive.

92. Gregory Borromeo, in discussion with the author, April 2020.

93. Ibid.

94. Sarah Brayne, in discussion with the author. March 2020.

95. Ibid.

96. Andrew D. Selbst, "Disparate Impact in Big Data Policing." Georgia Law Review 52 (2017). https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2819182.

to more "hot spot" predictions and policing.[97] Police departments should take into account the possibility of discriminatory targeting and accordingly be transparent with the public on how these tools have changed policing practices and outcomes. This includes identifying whether these tools are actually making police officers more efficient and effective and contribute to a decrease in crime, or whether they are reinforcing or exacerbating existing biases and equity issues in policing. In June 2020 the mayor of Santa Cruz, California, PredPol headquarters, introduced a law that will ban predictive policing in the city due to the technology "reinforcing racist patterns of policing."[98] **Due to their documented discriminatory targeting and lack of evidence to support more efficient and effective policing, we discourage police departments from adopting predictive policing tools. If police departments continue to use these tools, we recommend they carefully document and make public the ways in which this technology is being incorporated into their workflow and its confirmed effects on patrolling patterns and crime rates, if any.**

Police Robots for Community Surveillance

A robot is generally understood to be "a machine that resembles a living creature in being capable of moving independently (as by walking or rolling on wheels) and performing complex actions (such as grasping and moving objects)" guided either by an external control device or performed autonomously.[99] In this section we focus on police departments' integration of robotic land rovers (i.e., robots that use wheels to navigate terrain either autonomously or by remote control) that incorporate surveillance technologies such as video cameras and microphones in their operations.

The use of robots in police patrolling threatens to make surveillance even more pervasive and potentially displace jobs. Police departments' use of robots to monitor public areas is not yet widespread in the United States. However, the Huntington Park Police Department (HPPD) in California has piloted use of a land-rover robot on a trial-basis since June 2019 to patrol their local Salt Lake Park. Coined the "HP Robocop," the robot was designed and produced by Knightscope, a California-based security camera company that has provided

97. Ezekiel Edwards, "Predictive Policing Software Is More Accurate at Predicting Policing Than Predicting Crime," American Civil Liberties Union, August 31, 2016, https://www.aclu.org/blog/criminal-law-reform/reforming-police/predictive-policing-software-more-accurate-predicting.

98. Avi Asher-Schapiro, "In a U.S. first, California city set to ban predictive policing," Thomas Reuters Foundation News, June 18, 2020, https://news.trust.org/item/20200617163319-tib7v/.

99. Merriam-Webster, s.v. "robot," https://www.merriam-webster.com/dictionary/robot.

similar robots to serve as private security for office spaces and malls.[100] The HPPD has emphasized that use of these robots is not meant to displace police officers but rather to augment their patrolling activities.[101]

The "HP Robocop" promises super-human features that will decrease the need for the department to appoint a dedicated police officer to patrol the park, instead freeing officers to attend to more critical tasks. The robot has wheels that allow it to glide around relatively smooth cemented areas and cameras to capture video footage 24 hours a day. It also has a call button for civilians to raise an alarm if they see a crime or disturbance and has pre-programmed messaging that plays throughout the day, such as "please keep the park clean."[102] The specific model employed in Huntington Park has a "360-degree high-definition live video stream, a license plate reader, a two-way intercom, and the ability to track cell phone use in the vicinity," although the city claims not to have utilized these features.[103] While Huntington Park is using their police robot to monitor parks, other police departments across the country have begun integrating robots into their special operations teams, primarily to provide safety to officers in potentially dangerous situations.

Departments around the country have begun using land-rovers as part of their SWAT (Special Weapons and Tactics) teams. One study conducted in Starkville City, Mississippi, observed how members of the city's SWAT team reacted to the use of robots in various roles during operations. They used a robot that was essentially a camera on wheels to act as a member of the SWAT team during high-risk operations. They found that officers felt the "robot could be perceived as a SWAT team member and not merely a piece of equipment."[104] Team members also found that placing the robot in the Point role (first "person" into a potentially dangerous situation) provided a distraction and cover, as well as gave the team a better view of the threat before the human team members followed behind.[105] Robots such as this could potentially contribute to increased safety for officers performing dangerous tasks and potentially decrease use of force by allowing them to

100. Katie Flaherty, "A RoboCop, a Park and a Fight: How Expectations about Robots Are Clashing with Reality." NBC News, October 11, 2019, https://www.nbcnews.com/tech/tech-news/robocop-park-fight-how-expectations-about-robots-are-clashing-reality-n1059671.

101. JPat Brown, "Huntington Park's new 'RoboCop' stores pedestrians' faces, scans license plates, and costs $8000 a month to run," Muckrock, August 5, 2019, https://www.muckrock.com/news/archives/2019/aug/05/california-hp-robocop/.

102. Katie Flaherty, "RoboCop."

103. Ibid.

104. Cindy L. Bethel, Daniel Carruth, and Garrison Teena. "Discoveries from integrating robots into SWAT team training exercises," 2012 IEEE International Symposium on Safety, Security, and Rescue Robotics (SSRR), IEEE, November 2012, https://www.researchgate.net/publication/257298875_Discoveries_from_Integrating_Robots_Into_SWAT_Team_Training_Exercises.

105. Cindy L. Bethel, "SWAT Robots."

identify a threat and gather information to inform an appropriate response.

Effects & Recommendations

While the implementation of police robots is currently uncommon, these technologies may become a more permanent fixture of policing.[106] The robots could reduce the need for police officers to perform more easily automated tasks like monitoring public areas. Delegating these tasks to robots could free up officers to spend more time responding to emergency situations or interacting with the community in more positive and meaningful ways.

While robots present potential benefits to increase the effectiveness of police departments, the increased data collection and surveillance is concerning. In addition, the collection, analysis, and storage of data gathered by these robots raises significant concerns for privacy and data governance, including determining policies for data ownership and use. Often, technology vendors that store collected data on their servers are the owners or co-owners of that data. Unless a police department leasing or purchasing the technology from a vendor negotiates a contract about data ownership and usage, there is little accountability in the case of a breach or poor data management.[107]

Most of the data collected by the "HP Robocop" deployed in Huntington Park is currently only accessible by the company and not the police department.[108] Lack of access to the data could prevent the police department from being able to use it to better understand community needs. Alternatively, increased data collection by law enforcement could lead to further policing of already over-policed areas due to biases regarding predicted locations where crimes are likely to occur, which are generally skewed toward lower-income communities or communities of color. **Given the increased surveillance imposed by robots, we recommend police departments carefully weigh the effects of replacing police officers with robots, consider data ownership and access agreements, and consult the public in deciding whether and where to deploy police robots.**

According to Sgt. Borromeo, the benefit of LGMSPD's SWAT robot is that it allows officers to communicate with a potential threat without getting

106. Katie Flaherty, "RoboCop."

107. David Howell, "The cloud conundrum: who actually owns your data?" TechRadar, September 7, 2014, https://www.techradar.com/news/internet/cloud-services/the-cloud-conundrum-who-actually-owns-your-data-1260464; Jason Tashea, "Should the public have access to data police acquire through private companies?" ABA Journal, December 1, 2016, https://www.abajournal.com/magazine/article/public_access_police_data_private_company.

108. Katie Flaherty, "RoboCop."

physically close, which could cause confrontation and use of force.[109] It is still unclear whether these SWAT robots have taken over certain roles during operations (like the Point role) or whether they are supplementing existing personnel in the police departments in which they are in use. However, these robots can be used to keep police officers and the public safe (e.g., responding to bomb and biohazard threats). **If departments choose to adopt robots, we recommend narrowed application to specific domains such as to aid SWAT teams and not for applications that would result in excessive or discriminatory public surveillance.**

Virtual Reality for Empathy Training

Individuals with disabilities, including those with mental illness, are five times more likely to be incarcerated than the general population and have higher rates of injuries and fatalities during police interactions.[110] A significant reason for these disparities is that many law enforcement officials are insufficiently trained on how to interact with people with mental disorders. Some have mistaken those on the autism spectrum, for example, to be acting suspiciously or under the influence of an illegal substance, sometimes leading to violent confrontations.[111] Many police departments around the country have implemented Crisis Intervention Training (CIT), a specialized curriculum that attempts to reduce the injuries and fatalities that result from encounters between officers and people with mental disorders. CIT consists of officer instruction by community mental health workers and can include simulations in which the officer must interact with an actor playing someone under mental distress, or immersive simulations with recorded actors displayed on screens that wrap up to 300 degrees around the officer.[112] The curriculum also consists of bringing in individuals who suffer from mental disorders, along with their family members, who can offer insight to police officers about their lived experiences and feedback on how to improve CIT training.[113]

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109. Gregory Borromeo, in discussion with the author, April 2020

110. Robin S. Engel, "Police Encounters with People with Mental Illness," Criminology & Public Policy 14, no. 2 (2015). https://heinonline.org/HOL/LandingPage?handle=hein.journals/crpp14&div=22&id=&page=; Michele C. Hollow, "When the Police Stop a Teenager With Special Needs," The New York Times, February 27, 2020, https://www.nytimes.com/2020/02/27/well/family/autism-special-needs-police.html?searchResultPosition=1.

111. Michele C. Hollow, "When the Police Stop a Teenager With Special Needs."

112. Stephen Eide and Carolyn Gorman. "CIT and Its Limits," City Journal, 2017, https://www.city-journal.org/html/cit-and-its-limits-15329.html; Jonathan Edwards, "Norfolk Police Unveil Simulator That Trains Officers on When to Use Force," The Virginian-Pilot, October 6, 2015, https://www.pilotonline.com/news/crime/article_1ac69b06-4110-57bd-9f9c-9e4c480ec814.html.

113. "CIT Program Overview," CIT International, Inc., https://www.citinternational.org/resources/Documents/CIT%20Program%20Overview.2017.pdf.

Police departments across the country are increasingly turning to virtual reality (VR) training on how to better and more empathetically identify and interact with this population. Some studies claim use of VR has the potential to improve the effectiveness of retraining officers to respond to these situations because the simulations feel more realistic compared to other training methods.[114] VR generally consists of a headset that completely obstructs the wearer's vision from their surroundings. A screen contained within the headset takes up the majority of the field of view, acting as an alternative visual reality. Earpieces may provide audio, placing the individual into full visual and auditory immersion. Axon, a major company in police technology, has been developing VR training that uses Oculus Go headsets. With this technology, trainees can experience various situations in which they interact with people with neurological disorders like autism and schizophrenia, and will theoretically learn to be more empathetic and de-escalate tense situations verbally rather than using force.[115]

In 2019 the Chicago Police Department (CPD) partnered with Axon to establish a pilot program that integrates VR simulation technology into their CIT training. Laura Brown, Axon's Senior Director of Training, said the company worked with law enforcement, clinicians, and practitioners and people with autism and/or schizophrenia to design the trainings. The resulting scenarios presented to officers attempt to replicate what it feels like to have one of these conditions. The scenario is then switched to the officer's point of view and they are given a list of options for how to respond. Officers have the ability to replay scenarios and try different responses to observe varying outcomes.[116]

The use of VR training techniques showing multiple perspectives could also be used for improving interpersonal exchanges in other situations. One company, UTURN VR, has developed VR simulations to address the gender gap and sexism issues in the technology industry. It shows multiple perspectives of a situation, from both men's and women's point of view in a conversation, to illustrate the subtleties of microaggressions in various episodes that tell stories set in the tech industry and startup world.[117] This

114. Richard A. Wright, "Effects of Virtual Reality on the Cognitive Memory and Handgun Accuracy Development of Law Enforcement Neophytes," University of South Florida Scholar Commons, January 2013, http://scholarcommons.usf.edu/etd/4966.

115. Peter Holley, "The Latest Tool to Help Police Develop Empathy for the Public: Virtual Reality Headsets," The Washington Post, September 20, 2019, https://www.washingtonpost.com/technology/2019/09/20/latest-tool-help-police-develop-empathy-public-virtual-reality-headsets/; Lucas Ropek, "Can VR Change How Police Respond to Mental Health Crises?" Government Technology, June 12, 2019, https://www.govtech.com/public-safety/Can-VR-Change-How-Police-Respond-to-Mental-Health-Crises.html.

116. Laura Brown (senior director of training, Axon), in discussion at press conference recorded by ABC 7 Chicago, May 22, 2019, https://www.youtube.com/watch?v=SkvHTr3o8WU.

117. "Synopsis," UTURN VR, http://www.uturnvr.com/index.php/about/synopsis/.

kind of exposure to different perspectives for training and informative purposes, including the empathy training for police officers mentioned above, is still being tested in terms of its effectiveness for reducing conflicts and civilian injuries and fatalities. However, significant work remains on testing the efficacy of VR-enabled training to address the racial disparities in policing and in de-escalation training in particular.

Effects & Recommendations

Since VR training is still relatively new to police training, evidence of its effect on the workforce is limited. Former CPD Superintendent Eddie Johnson emphasized the need for more realistic training for police officers: "I've been doing this a long time and lecture-style training in the classrooms doesn't work. We have to be more scenario-based to put these officers in the moment. When I went through that scenario it gave choices, and that person who was in a mental health crisis responded to the choices that [I] made and… that's cutting-edge stuff."[118] The LGMSPD is also starting to roll out the technology, with Sgt. Borromeo stating that empathy training "gets officers to think and talk a little bit more… it teaches you how to take your time so you have the opportunity to talk with folks, and not get too close too soon, which could lead to violent confrontations."[119] VR simulations would likely be incorporated as part of use-of-force, defensive tactics and de-escalation training. While data on the effectiveness of VR for CIT is still limited, **we recommend that departments using VR carefully document how they are implementing it in such training and whether it is making CIT more effective. In addition, departments should perform randomized control trials to measure outcomes. If successful, it may be advantageous to repurpose funding from other parts of the police budget to fund implementation of emerging technologies, such as VR, for de-escalation training.** If there are indeed benefits in terms of de-escalation, other departments with the ability and resources could use these processes as a model for implementation.

It is also important to note that it is unlikely VR will contribute to the elimination of police officers' jobs since its goal is to improve relationships between officers and those with mental disorders rather than automate officers' duties. However, if proven successful, it could greatly change the structure of CIT programs and potentially allow for more simulations than can be provided by paid actors and facilitators. **We recommend that due to the extra costs of VR systems and limited studies on their effectiveness,**

118. Eddie Johnson (superintendent, Chicago Police Department), in discussion at a press conference recorded by ABC 7 Chicago, May 22, 2019, https://www.youtube.com/watch?v=SkvHTr3o8WU.

119. Gregory Borromeo, in discussion with the author, April 2020.

police departments should not prioritize implementing VR trainings at the expense of other methods that have proven effective (such as police officer/community interaction during CIT training) that help de-escalate interactions between officers and those with mental disorders. Many police departments are already at their financial limits in terms of implementing CITs and prioritizing this technology over existing training methods may lead to less effective outcomes for the community.[120]

However, if this technology proves successful in promoting safer interactions between those with mental disorders and police officers, there are other ways that VR training could be put to good use by police departments. According to Superintendent Johnson, "I think using these headsets for CIT training could be just a start. I could really envision additional scenarios that could be built to train officers on the appropriate use of force, procedural justice, and more."[121] **We recommend that police departments with sufficient resources look into other applications in which VR-enabled training could be useful, including to reduce racial profiling and support de-escalation tactics during protests or police/community interactions.**

120. Michael S. Rogers, Dale E. McNiel and Renée L. Binder. "Effectiveness of Police Crisis Intervention Training Programs." The Journal of the American Academy of Psychiatry and the Law 48, no. 1 (2020), http://jaapl.org/content/early/2019/09/24/JAAPL.003863-19.

121. Eddie Johnson (superintendent, Chicago Police Department), in discussion at a press conference recorded by ABC 7 Chicago, May 22, 2019, https://www.youtube.com/watch?v=SkvHTr3o8WU.

05 // RECOMMENDATIONS

As the public sector increasingly turns to emerging technologies as a means to improve productivity, a number of considerations must be taken into account to mitigate negative effects of their implementation on the workforce and the public. The following are suggestions for the private and public sectors seeking to develop and implement emerging technologies in this work.

1. Collaborate closely with the public and workers to identify needs before implementing technology solutions

The government tech movement is rife with examples of technologies being deployed without consulting workers or the public closely about the problems they face. When this occurs, technology solutions can be unnecessary, needlessly expensive, or burdensome. Identifying inefficiencies and pain points for both public sector workers and the public itself is a critical first step in the effective evaluation, development, and implementation of emerging technologies. The RPA bots implemented in Ohio serve as an example of an agency identifying a specific need from overburdened workers and successfully developing a technology solution to assist them in their work. Working closely with employees and the public will ensure that technologies will both create efficiency gains for workers and ensure more effective and equitable services for the public.

Collaborating closely with workers also better ensures successful adoption of these technologies. Employees who may not be familiar with the inner workings of new technologies such as machine learning algorithms may be skeptical to utilize them. When governments closely collaborate with workers so that technologies solve identified problems and are implemented transparently, as was done with the AFST, workers will likely be more open to adopting such tools.

Close collaboration with public sector workers can also mitigate concerns raised by labor unions. By partnering with unions and workers, the public sector can prioritize implementation of technologies in ways that address the needs of employees. In the Ohio example, implementing emerging technologies only where workers were overburdened assuaged concerns from the unions about potential job loss. Governments can then promote solutions that assist workers and the public, while also garnering support from unions. We note, however, that using technology to assist overburdened workers is only one potential solution to the problem—governments could certainly hire additional workers or resist reductions to the current workforce rather than solely looking at technology solutions.

2. Support new education and credentialing models to reskill public sector workers

In the wake of the COVID-19 pandemic, the need for robust and affordable reskilling in the public sector has become clear. As of June 2020, the public sector lost 1.5 million jobs since the start of the pandemic with an expectation that this number will increase over the months ahead.[122] At the same time, the public sector has been deploying new technologies and software systems during the pandemic that will likely remain for years to come, including new unemployment insurance systems, online learning platforms, and contact-tracing tools.[123] Re-entering the workforce after the pandemic will thus require public sector workers to develop new skills to meet this new technology-enabled reality.

Public sector workers will need to develop digital literacy, technical, and 21st-century workforce skills, such as collaboration, creativity, critical

122. Sara Hinkley, "Public Sector Impacts of the Great Recession and COVID-19," UC Berkeley Labor Center, June 22, 2020. http://laborcenter.berkeley.edu/public-sector-impacts-great-recession-and-covid-19/.

123. "Governor Lamont Announces Implementation of System That Will Significantly Speed up Unemployment Claims During COVID-19 Emergency," State of Connecticut Press Release, April 15, 2020, https://portal.ct.gov/Office-of-the-Governor/News/Press-Releases/2020/04-2020/Governor-Lamont-Announces-System-That-Will-Significantly-Speed-up-Unemployment-Claims; Cathy Li & Farah Lalani, "The COVID-19 pandemic has changed education forever. This is how," World Economic Forum Blog, April 29, 2020, https://www.weforum.org/agenda/2020/04/coronavirus-education-global-covid19-online-digital-learning/; "Digital Contact Tracing Tools," Centers for Disease Control and Prevention's COVID-19 site, https://www.cdc.gov/coronavirus/2019-ncov/php/contact-tracing/contact-tracing-plan/digital-contact-tracing-tools.html.

thinking, and problem solving.[124] Not only will workers need these skills to appropriately develop and use emerging technologies as an integral part of their daily work activities, they will also need to strengthen translational capabilities to effectively communicate with third-party developers. By improving such skills, public sector workers can gain a deeper understanding of these technologies, provide effective feedback, and identify when a system goes awry. This is especially important in the case of ML-powered decision systems that can have deleterious effects without human oversight. Having this training will better ensure workers can spot when a technology is performing improperly and identify potential strategies to mitigate harms.

To support the development of these skills, new education and credentialing models will be necessary. To deal with the significant job loss experienced from the pandemic, online education platforms and tech companies have taken a lead on initiating new programs to support flexible retraining and credentialing. Platforms like Coursera are offering free access to thousands of online courses; tech companies like Microsoft are offering free access to their suite of learning tools, such as the GitHub Learning Lab and LinkedIn Learning, and subsidized credentialing programs; and internet service providers are providing free and subsidized internet access to ensure workers can access these resources from home.[125] The public sector should partner with industry and educational institutions to offer workers flexible education and credentialing programs; doing so will better ensure public sector workers can acquire the necessary skills to effectively evaluate, develop, and implement emerging technologies.

3. Develop a procurement strategy for emerging technologies that not only prioritizes increased efficiency and effectiveness, but also equity concerns

Procurement processes should consider not only the efficiency and effectiveness gains of new technologies, but also potential effects on equity. Implementation of equity standards as criteria to evaluate vendors and platforms in the procurement process holds great potential to minimize negative effects. The World Economic Forum (WEF) recently released its “AI Procurement in a Box” toolkit to aid governments in procuring AI-enabled technologies by guiding them through ethical considerations that should be

124. “13 Essential 21st Century Skills for Todays Students,” Envision, https://www.envisionexperience.com/blog/13-essential-21st-century-skills-for-todays-students.

125. Kim Lyons, “Coursera to give unemployed workers free access to 3,800 online courses,” The Verge, April 25, 2020, https://www.theverge.com/2020/4/25/21236679/coursera-free-unemployed-workers-coronavirus; Brad Smith, “Microsoft launches initiative to help 25 million people worldwide acquire the digital skills needed in a COVID-19 economy,” Official Microsoft Blog, June 30, 2020, https://blogs.microsoft.com/blog/2020/06/30/microsoft-launches-initiative-to-help-25-million-people-worldwide-acquire-the-digital-skills-needed-in-a-covid-19-economy/.

satisfied before adopting third-party tools.[126] Example equity guidelines in WEF's toolkit include conducting risk assessments; working with diverse, multidisciplinary teams; and highlighting the limitations of data use.

In order to adequately use these guidelines, the public sector will need to ensure its personnel have the necessary training in technical and ethical skills to evaluate the technologies and provide guidance on risk mitigation strategies. This will require hiring personnel with these skills and, when possible, retraining their workforce to develop them.

The procurement process should also integrate feedback from members of the public who will be affected. By gathering widespread feedback early and often, development and implementation decisions can be tailored more rapidly to not only match workers' needs but also better ensure the mitigation of public harm before widescale rollout.

4. Establish frequent review processes, especially those that utilize "contestable design," to mitigate negative unintended consequences from implementation of emerging technologies

Evaluating the effects of emerging technologies on public sector workers and the public should not end at the procurement stage. To mitigate harm, these technologies should be challenged on a regular basis. Implementation of "contestable design" holds great promise by engaging workers who utilize emerging technologies, especially machine learning tools, in "contesting" the technology in order to identify and remedy harms. In "contestable design" workers are trained in how the technology works and, especially for those who have professional expertise in the area where the technology is being applied, are encouraged to "collaborate, critique, and correct" the technology.[127] This process can better enable frequent reviews of the effects of implementation of emerging technologies on efficiency, effectiveness, and equity by workers—those with the deepest knowledge of how the technology will affect the sector and appropriate strategies to mitigate harm.

It is critical that workers be empowered to provide feedback on the design and implementation of emerging technologies in their work. Gathering this feedback will improve the development of tools and processes and identification of potential negative spillover effects of implementation, such as overly burdensome data entry demands and clunky interfaces or insufficient models that can reduce workers' efficiency or effectiveness and harm the public.

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126. "AI Procurement in a Box: Project Overview," World Economic Forum, June 2020, http://www3.weforum.org/docs/WEF_AI_Procurement_in_a_Box_Project_Overview_2020.pdf.

127. Daniel Kluttz, Nitin Kohli, and Deirdre K. Mulligan. "Shaping Our Tools: Contestability as a Means to Promote Responsible Algorithmic Decision Making in the Professions," in After the Digital Tornado: Networks, Algorithms, Humanity, ed. Kevin Werbach (Cambidge, UK: Cambridge University Press, 2020), 137.

06 //
CONCLUSION

Our research provides insight into the effects of emerging technologies on the public sector workforce and those served within three sectors: K-12 education, social services, and law enforcement. While implementation of emerging technologies such as machine learning and robotic process automation promise to increase efficiency and effectiveness in public sector work, their applications also pose equity concerns in the ability to use and benefit from these technologies. For workers, deployments can risk financial and job security, reduce autonomy, and threaten workers' sense of fulfillment and dignity as tasks become automated and offloaded to technological counterparts. For the public, ill-considered implementations, especially those that perpetuate biases and discrimination, will lead to the disproportionate distribution of benefits and risks.

To mitigate these risks, the private and public sectors must develop robust processes to identify the workforce needs for implementing emerging technologies; identify skills required to adequately implement and assess these technologies, and appropriate training mechanisms to support these skills; develop procurement processes that ensure gains in efficiency and effectiveness from implementation do not outweigh equity concerns; and implement ongoing review processes to identify and mitigate negative effects of technology implementation on the workforce and public.

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ABOUT THE CITRIS POLICY LAB

The CITRIS Policy Lab is a sub-organization of the Center for Information Technology Research in the Interest of Society and the Banatao Institute (CITRIS), headquartered on the UC Berkeley campus. Founded in 2001, CITRIS leverages expertise on the campuses of UC Berkeley, UC Davis, UC Merced, and UC Santa Cruz to develop technology applications with societal and economic benefits. The CITRIS Policy Lab was established in 2018 to support interdisciplinary technology policy research analyzing technology capabilities and their implications for society. Through its collaboration with public and private sector stakeholders, the CITRIS Policy Lab addresses core questions regarding the role of formal and informal regulation in promoting innovation and amplifying its positive effects on society.