

DISCUSSION PAPER SERIES

IZA DP No. 13650

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Workers?**

Francine D. Blau  
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## ABSTRACT

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# Who are the Essential and Frontline Workers?

Identifying essential and frontline workers and understanding their characteristics is useful for policymakers and researchers in targeting social insurance and safety net policies in response to the COVID-19 crisis. We develop a working definition that may inform additional research and policy discussion and provide data on the demographic and labor market composition of these workers. In a three-step approach, we first apply the official industry guidelines issued by the Department of Homeland Security (DHS) to microdata from the 2017 and 2018 American Community Survey to identify essential workers regardless of actual operation status of their industry. We then use data on the feasibility of work from home in the worker's occupation group (Dingel and Neiman 2020) to identify those most likely to be frontline workers who worked in-person early in the COVID-19 crisis in March/April 2020. In a third step we exclude industries that were shutdown or running under limited demand at that time (Vavra, 2020). We find that the broader group of essential workers comprises a large share of the labor force and tends to mirror its demographic and labor market characteristics. In contrast, the narrower category of frontline workers is, on average, less educated, has lower wages, and has a higher representation of men, disadvantaged minorities, especially Hispanics, and immigrants. These results hold even when excluding industries that were shutdown or operating at a limited level.

**JEL Classification:** J15, J16, J21

**Keywords:** COVID-19, essential workers, frontline workers, gender, race differences, hispanics, immigrants

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## INTRODUCTION

The COVID-19 pandemic, and with it the lockdown and demand declines affecting major parts of the U.S. economy, has required the identification of essential workers who are vital for the core functioning of societal infrastructure. Formation of policies to protect and meet the needs of these essential workers depends on knowing their composition and characteristics. However, identifying essential workers is not straightforward. The definition of essential work may differ by state or even locality and change rapidly over time. Moreover, the risk essential workers face is influenced by whether they are frontline workers who must provide their labor in person or whether they can work from home. As some industries, even those deemed essential, may be for the most part shut down or facing steep decreases in demand, who is really at work also depends on the current shutdown or demand status of their industry.

We address these data issues to provide information on the characteristics of essential workers and, more specifically, frontline workers. We begin by applying the official industry guidelines issued by the Department of Homeland Security (DHS) Cybersecurity and Infrastructure Security Agency (CISA) on March 28, 2020 to microdata from the 2017 and 2018 American Community Survey (ACS) to identify the broader group of essential workers. We then use data on the feasibility of work from home in the worker's occupation group (Dingel and Neiman 2020) to identify those most likely to be frontline workers. We find that the broader group of essential workers comprises a large share of the labor force and tends to mirror its demographic characteristics. In contrast, frontline workers are a less educated, lower wage group, with a higher representation of men, disadvantaged minorities, especially Hispanics, and immigrants, on average. Both conclusions remain unchanged when excluding industries that

were considered shutdown/diminished demand during the early stages of the COVID crisis (Vavra, 2020).

## **DATA AND METHODS**

A common and clear-cut definition of essential workers would facilitate the rapidly evolving social science literature on COVID-19. However, the designation of “essential” requires interpretation and depends on the policy context. We propose a three-step approach narrowing from essential industries to “frontline” workers to “frontline excluding shutdown industries”, capturing those who provide their labor in person in active industries.

First, although various states and cities under lockdown have applied their own definitions of essential, the federal guidelines provide a logical starting point for an analysis of essential workers. Thus, we use the federal guidelines listing essential infrastructure workers during the COVID-19 epidemic who “protect their communities, while ensuring continuity of functions critical to public health and safety, as well as economic and national security” issued by the Department of Homeland Security (DHS) Cybersecurity and Infrastructure Security Agency (CISA) on March 28, 2020. We translate the 14 categories that are defined as essential critical infrastructure sectors into NAICS industry classification, identifying 194 out of overall 287 industry categories as essential. By matching the qualitative information from the DHS into the NAICS 2017 four-digit industry classification, we attempt to refrain from subjective decision-making to the maximum extent possible by including all DHS-designated industries regardless of actual operation. This approximation of essential workers that we proposed in an Econofact memo (Blau et al., 2020) has also been used in Montenovo et al. (2020) and Gupta et al. (2020), both studying various COVID-19 repercussions on the labor market.

In a second step, we identify frontline workers by focusing on a subcategory of essential workers; those in occupation groups where a third or less of workers can feasibly work from home based on analysis by Dingel and Neiman (2020). They construct a work-from-home measure using pre-pandemic surveys from the Occupational Information Network that describe the typical experience of US workers to classify occupations at the major group (2 digit) level as able or unable to be done entirely from home. They report high correlations of their measure with early estimates of the share of workers who actually worked from home during the early stage of the crisis. Making use of this measure allows us to focus on the composition and characteristics of frontline workers, a subset of essential workers who arguably face a higher level of risk of infection by providing their labor in person.

For the larger group of essential workers as well as the narrower subset of frontline workers, in a third step we additionally exclude industries that were shutdown or running under limited demand at the initial COVID-outbreak in March 2020 as identified by Vavra (2020), e.g. restaurants and other food services, traveler accommodation, air transportation, or a number of manufacturing industries.

## **FINDINGS**

Tables 1 and 2 show our results for essential and frontline workers at the aggregate level and, for frontline workers (our primary focus), separately at the major (2-digit) occupation level. Table 1 reports demographic characteristics and Table 2 reports labor market characteristics.

As may be seen in the tables, essential workers, using our definition, comprise a large and varied group. Overall, they are nearly 70 percent of all workers (see Panel A in Tables 1 and 2). Women are well represented, although the female share (44%) is somewhat lower than for the labor force as a whole (47%). The other demographic characteristics of essential workers are

also very similar to the general labor market on the aggregate level, although they are slightly more likely to be disadvantaged minorities or immigrants (foreign born) and have somewhat lower educational attainment (see Panel A in Table 1). The share of workers in predominantly (70%+) female and predominantly (30%-) male occupations (as classified based on 4 digit occupational categories) is broadly similar between essential and all workers, although a somewhat larger share of essential workers are in predominantly male occupations. Average wages of essential workers are virtually the same as for all workers and about the same share of essential workers as all workers earn low wages (in the bottom quartile of the overall wage distribution) and high wages (in the top quartile of the overall wage distribution) as shown in Panel A of Table 2. Taking into account the shutdown in the early stage of the crisis by excluding workers in affected industries does substantially reduce the estimated number of essential workers — to 59% of all workers; with average wages somewhat higher at \$27.25 (compared to \$25.65 for all workers). However, the demographic characteristics of essential workers are almost identical when excluding shutdown and limited demand industries.

Frontline workers also vary but come disproportionately from socio-economically disadvantaged groups compared to the overall workforce (see Panel A in Table 1) and receive lower wages on average (Panel A in Table 2). Frontline workers include (but are not limited to) health care workers, protective service workers (police and EMS), cashiers in grocery and general merchandise stores, production and food processing workers, janitors and maintenance workers, agricultural workers, and truck drivers. Such workers constitute 42% of all workers (and 60% of essential workers). While women are overly represented in a number of specific frontline occupations, the average female share of frontline workers (39%) is lower than for essential workers as a whole. Frontline workers are on average less well educated than all

workers, with a higher share comprised of high school dropouts and a lower share having a college degree or higher. They also have a considerably higher share of Hispanics and a somewhat higher share of Blacks. Immigrants are also disproportionately represented. Average wages of frontline workers (\$21.85) are lower than those of all workers and essential workers. A higher share of frontline workers earn low wages (in the bottom quartile) and a smaller share earn high wages (in the top quartile).

As would be expected, health care workers comprise an important share — 20% of frontline workers (see Panel B in Tables 1 and 2). A majority of health care workers is female. A sizable share of health care workers (72%) are in practitioners and technical occupations, including doctors, registered nurses and pharmacists (among others). This is a relatively highly educated, high paying group. Although doctors are still majority male, women comprise a majority of health care practitioners (75%). Health support workers such as nursing assistants and home health aids constitute the remainder of health care workers. They are an even more heavily female group (86%). In contrast to health care practitioners, they are a relatively less well educated and low wage group. Additionally, this group is majority non-white (54%, including 25% Black and 19% Hispanic), immigrants are heavily represented, and a substantial share are single mothers (23% compared to 8% of frontline workers and all workers), suggesting they may face greater childcare burdens.

Essential sales and related occupations also constitute a large share of frontline workers, 15%. Women constitute a little under half of all workers in this occupation group, with a quarter of workers employed in predominantly female occupations. Overall, the average wage is about the same as that for all workers, but an above average share earn wages in the bottom quartile. Almost a quarter of workers in this group are cashiers at essential retailers such as grocery stores



and general merchandise stores. Cashiers are 71% female, 51% non-white, and 60% earn wages in the lowest quartile of all workers.

A number of heavily male, blue collar categories together constitute a large share of the frontline occupations, including transportation and material moving occupations (13%), production occupations (11%), construction and extraction (10%), building and grounds cleaning and maintenance (6%), installation maintenance and repair (6%), as well as farming, fishing and forestry occupations (2%). Average wages for workers in these occupation groups are substantially below the average for all workers.

Protective service occupations constitute another crucial component of the frontline workforce, accounting for 4% of frontline workers. This is a primarily male category that earns about the same wage as the average for all workers.

Excluding industries that were basically shutdown or had drastically reduced demand in the early stages of the pandemic, frontline workers remain disproportionately less educated; disproportionately minority workers, and earned below average wages (see Panel A in Tables 1 and 2). If we take the estimates of closures and greatly reduced demand into account in measuring the frontline workforce, the estimated number of frontline workers is substantially reduced—to 34% of all workers. The percent female in the occupation declines slightly to 37% and average wages rise somewhat to \$23.15. However, our basic conclusion that the frontline group is disproportionately comprised of less educated and minority workers, earning below average wages and with a substantial share of workers in the bottom quartile, remains unchanged. Considering shutdown industries is of particular relevance for food preparation and serving occupations which potentially comprise a substantial share of frontline workers (11%), but the smallest share (1.6%) when taking shutdown into account (see Panel C in Tables 1 and

2). While some were working and taking the risk of exposure to clients at the early stage of the pandemic, the majority were unemployed. For both definitions this is a majority female and very a low wage occupation group on average.

## **DISCUSSION AND CONCLUSION**

During the course of COVID-19, we have relied on a subset of essential workers to meet our basic needs while significant portions of the population have isolated at home. While some essential workers can themselves work from home, this is not feasible for a significant portion, whom we designate as frontline workers, who must take on considerable risk to do their jobs. Although there is variation within this group, we have found that frontline workers are disproportionately comprised of less educated and minority workers, especially Hispanics, and immigrants, and earn below average wages, with a substantial share of workers in the bottom wage quartile. These workers, even healthcare workers, now face much higher risks than traditionally incurred in these occupations. Identifying essential and frontline workers and understanding their characteristics is useful for policymakers in targeting social insurance and safety net policies in response to the COVID-19 crisis and researchers estimating the impact of the pandemic on different groups.

## **References**

Blau, F.D., Koebe, J., and Meyerhofer, P. (2020). Essential and Frontline Workers in the COVID-19 Crisis. Econofact. <https://econofact.org/essential-and-frontline-workers-in-the-covid-19-crisis> Last accessed: August 24, 2020

Department of Homeland Security (DHS, 2020). Identifying Critical Infrastructure during COVID-19” [electronic resource]. <https://www.cisa.gov/identifying-critical-infrastructure-during-covid-19> Last accessed: August 24, 2020

Dingel, J. I., and Neiman, B. (2020). How Many Jobs Can be Done at Home?, NBER Working Paper 26948.

Gupta, S., Montenegro, L., Nguyen, T.D., Rojas, F.L., Schmutte, I.M., Simon, K.I., Weinberg, B.A., and Wing, C. (2020). Effects of Social Distancing Policy on Labor Market Outcomes. NBER Working Paper 27280.

Montenegro, L., Jiang, X., Rojas, F.L., Schmutte, I.M., Simon, K.I., Weinberg, B.A., and Wing, C. (2020). Determinant of Disparities in COVID-19 Job Losses. NBER Working Paper 27132.

Ruggles, S., Flood, S., Goeken, R., Grover, J., Meyer, E., Pacas, J., and Sobek, M. IPUMS USA: Version 10.0 American Community Survey 2017-2018. Minneapolis, MN: IPUMS, 2020.  
<https://doi.org/10.18128/D010.V10.0>

Vavra, J.S. (2020). Shutdown Sectors Represent Large Share of All US Employment. Becker Friedman Institute. <https://bfi.uchicago.edu/insight/blog/key-economic-facts-about-covid-19/#shutdown-sectors> Last accessed: August 24, 2020

Table 1: Demographic Characteristics of Essential and Frontline Workers

	% Female	% White	% Black	% Hispanic	% Asian	% Other Race	% Immigrant	% Single Mother	% < HS	% HS	% Some College	% BA or higher	N	% All	% Frontline	% Frontline excl. Shutdown
<i>Panel A: Group Averages</i>																
All	0.47	0.62	0.11	0.17	0.06	0.03	0.19	0.08	0.09	0.24	0.32	0.35	2,998,078			
Essential	0.44	0.61	0.12	0.18	0.06	0.03	0.20	0.08	0.10	0.27	0.33	0.30	2,086,801	69.6%		
Essential excluding Shutdown	0.43	0.63	0.12	0.18	0.06	0.03	0.19	0.08	0.09	0.26	0.33	0.32	1,774,909	59.2%		
Frontline	0.39	0.57	0.13	0.22	0.05	0.03	0.22	0.08	0.15	0.32	0.34	0.19	1,260,383	42.0%		
Frontline excluding Shutdown	0.37	0.59	0.12	0.21	0.05	0.03	0.22	0.08	0.13	0.32	0.34	0.21	1,025,969	34.2%		
<i>Panel B: Frontline by Occupation Group</i>																
Healthcare Practitioners and Technical Occupations	0.75	0.68	0.11	0.09	0.10	0.02	0.17	0.11	0.01	0.07	0.34	0.59	179,678		14.3%	
Healthcare Support	0.86	0.46	0.25	0.19	0.06	0.03	0.24	0.23	0.09	0.31	0.48	0.12	68,893		5.5%	
Sales and Related Occupations	0.47	0.66	0.10	0.16	0.06	0.03	0.15	0.08	0.09	0.26	0.35	0.30	188,093		14.9%	
Transportation and Material Moving Occupations	0.17	0.54	0.18	0.22	0.04	0.03	0.22	0.04	0.15	0.44	0.31	0.10	163,391		13.0%	
Construction and Extraction Occupations	0.03	0.56	0.06	0.34	0.02	0.02	0.30	0.01	0.24	0.43	0.27	0.06	134,990		10.7%	
Production Occupations	0.26	0.58	0.13	0.21	0.06	0.02	0.22	0.06	0.15	0.43	0.32	0.09	134,149		10.6%	
Food Preparation and Serving Occupations	0.52	0.51	0.13	0.26	0.07	0.04	0.23	0.10	0.23	0.33	0.35	0.09	132,333		10.5%	
Installation, Maintenance, and Repair Workers	0.04	0.67	0.08	0.20	0.03	0.02	0.17	0.01	0.11	0.40	0.41	0.08	74,359		5.9%	
Building and Grounds Cleaning and Maintenance Occupation	0.38	0.43	0.14	0.38	0.03	0.03	0.37	0.11	0.29	0.41	0.24	0.07	74,246		5.9%	
Protective Service Occupations	0.21	0.59	0.20	0.15	0.02	0.03	0.10	0.05	0.03	0.23	0.46	0.28	54,090		4.3%	
Personal Care and Service Occupations	0.81	0.52	0.18	0.21	0.06	0.03	0.23	0.18	0.13	0.31	0.40	0.16	35,248		2.8%	
Farming, Fishing, and Forestry Occupations	0.24	0.43	0.03	0.50	0.02	0.02	0.44	0.05	0.44	0.31	0.17	0.08	20,913		1.7%	
<i>Panel C: Frontline excluding Shutdown by Occupation Group</i>																
Healthcare Practitioners and Technical Occupations	0.75	0.67	0.11	0.09	0.10	0.03	0.17	0.11	0.01	0.07	0.34	0.59	171,958			16.8%
Healthcare Support	0.85	0.45	0.27	0.19	0.06	0.03	0.24	0.24	0.10	0.31	0.47	0.12	63,409			6.2%
Sales and Related Occupations	0.46	0.69	0.09	0.14	0.06	0.03	0.14	0.08	0.07	0.25	0.35	0.33	165,867			16.2%
Construction and Extraction Occupations	0.03	0.56	0.06	0.35	0.01	0.02	0.30	0.01	0.24	0.43	0.27	0.06	133,218			13.0%
Transportation and Material Moving Occupations	0.15	0.55	0.17	0.23	0.03	0.03	0.20	0.04	0.17	0.46	0.30	0.07	125,149			12.2%
Production Occupations	0.25	0.58	0.12	0.22	0.06	0.02	0.23	0.06	0.16	0.43	0.32	0.09	112,494			11.0%
Installation, Maintenance, and Repair Workers	0.04	0.68	0.08	0.20	0.03	0.02	0.17	0.01	0.11	0.41	0.40	0.08	66,244			6.5%
Building and Grounds Cleaning and Maintenance Occupation	0.34	0.45	0.13	0.38	0.02	0.02	0.36	0.09	0.28	0.41	0.24	0.07	64,050			6.2%
Protective Service Occupations	0.21	0.60	0.20	0.15	0.02	0.03	0.10	0.05	0.03	0.23	0.46	0.28	52,833			5.1%
Personal Care and Service Occupations	0.83	0.52	0.18	0.21	0.06	0.03	0.23	0.18	0.13	0.31	0.40	0.16	33,392			3.3%
Farming, Fishing, and Forestry Occupations	0.24	0.43	0.03	0.50	0.02	0.02	0.44	0.05	0.44	0.31	0.17	0.08	20,891			2.0%
Food Preparation and Serving Occupations	0.62	0.53	0.19	0.19	0.06	0.03	0.20	0.13	0.19	0.39	0.34	0.08	16,464			1.6%

Notes: This table lists demographic characteristics of essential and frontline workers. Essential workers are identified by mapping official industry guidelines issued by the Department of Homeland Security (DHS) to microdata from the 2017 and 2018 American Community Survey. Frontline workers are approximated by their feasibility of work from home in the worker's occupation group (Dingel and Neiman 2020). Shutdown adjusts for industries that were shutdown or running under limited demand early in the COVID crisis (Vavra 2020). Group averages are shown in Panel A. Panel B reports demographic characteristics at the major (2-digit) occupation group level for frontline workers, while Panel C additionally excludes shutdown industries. Demographic characteristics consist of the share of females, racial background (White, Black, Hispanic, Asian, Other Race), immigrant status (foreign born), single mother, and highest educational attainment (less than High-School (HS), HS degree, some college, higher than Bachelor Degree (BA)).

Table 2: Labor Market Characteristics of Essential and Frontline Workers

	Female Dominated Occ	Male Dominated Occ	Hourly wages (\$)	% Low Wage	% High Wage	N	% All	% Frontline	% Frontline excl. Shutdown
<i>Panel A: Group Averages</i>									
All	0.28	0.30	\$25.65	0.25	0.25	2,998,078			
Essential	0.26	0.35	\$25.96	0.24	0.25	2,086,801	69.6%		
Essential excluding Shutdown	0.26	0.37	\$27.25	0.21	0.27	1,774,909	59.2%		
Frontline	0.26	0.45	\$21.85	0.30	0.18	1,260,383	42.0%		
Frontline excluding Shutdown	0.25	0.50	\$23.15	0.26	0.21	1,025,969	34.2%		
<i>Panel B: Frontline by Occupation Group</i>									
Healthcare Practitioners and Technical Occupations	0.71	0.03	\$39.21	0.09	0.48	179,678		14.3%	
Healthcare Support	0.99	0.00	\$15.88	0.33	0.06	68,893		5.5%	
Sales and Related Occupations	0.25	0.14	\$26.08	0.33	0.23	188,093		14.9%	
Transportation and Material Moving Occupations	0.01	0.83	\$18.99	0.29	0.12	163,391		13.0%	
Construction and Extraction Occupations	0.00	1.00	\$19.57	0.29	0.17	134,990		10.7%	
Production Occupations	0.00	0.64	\$20.47	0.20	0.14	134,149		10.6%	
Food Preparation and Serving Occupations	0.31	0.09	\$12.57	0.53	0.04	132,333		10.5%	
Installation, Maintenance, and Repair Workers	0.00	1.00	\$22.44	0.18	0.22	74,359		5.9%	
Building and Grounds Cleaning and Maintenance Occupation	0.24	0.31	\$13.66	0.47	0.06	74,246		5.9%	
Protective Service Occupations	0.00	0.93	\$26.49	0.14	0.31	54,090		4.3%	
Personal Care and Service Occupations	0.79	0.03	\$12.35	0.56	0.05	35,248		2.8%	
Farming, Fishing, and Forestry Occupations	0.00	0.93	\$13.28	0.48	0.05	20,913		1.7%	
<i>Panel C: Frontline excluding Shutdown by Occupation Group</i>									
Healthcare Practitioners and Technical Occupations	0.72	0.01	\$38.60	0.09	0.47	171,958			16.8%
Healthcare Support	0.99	0.00	\$15.63	0.34	0.06	63,409			6.2%
Sales and Related Occupations	0.19	0.16	\$27.84	0.29	0.25	165,867			16.2%
Construction and Extraction Occupations	0.00	1.00	\$19.48	0.29	0.17	133,218			13.0%
Transportation and Material Moving Occupations	0.00	0.85	\$18.21	0.28	0.10	125,149			12.2%
Production Occupations	0.00	0.67	\$20.44	0.20	0.14	112,494			11.0%
Installation, Maintenance, and Repair Workers	0.00	1.00	\$22.07	0.19	0.21	66,244			6.5%
Building and Grounds Cleaning and Maintenance Occupation	0.18	0.36	\$13.61	0.47	0.06	64,050			6.2%
Protective Service Occupations	0.00	0.94	\$26.68	0.13	0.31	52,833			5.1%
Personal Care and Service Occupations	0.83	0.03	\$12.12	0.57	0.05	33,392			3.3%
Farming, Fishing, and Forestry Occupations	0.00	0.93	\$13.29	0.48	0.05	20,891			2.0%
Food Preparation and Serving Occupations	0.04	0.09	\$13.37	0.47	0.03	16,464			1.6%

*Notes: This table lists labor market characteristics of essential and frontline workers. Essential workers are identified by mapping official industry guidelines issued by the Department of Homeland Security (DHS) to microdata from the 2017 and 2018 American Community Survey. Frontline workers are approximated by their feasibility of work from home in the worker's occupation group (Dingel and Neiman 2020). Shutdown adjusts for industries that were shutdown or running under limited demand early in the COVID crisis (Vavra 2020). Group averages are shown in Panel A. Panel B reports labor market characteristics at the major (2-digit) occupation group level for frontline workers, while Panel C additionally excludes shutdown industries. Labor market characteristics consist of the share of females, share of workers that work in predominantly female 4-digit occupations (70 percent or more of workers are female) or predominantly male 4-digit occupations (30 percent or less of the workers are female), hourly wages (income in 2018 dollars using the CPI divided by the product of usual hours worked per week and the mid-point of usual weeks worked per year), share of workers earning low wages (in the bottom quartile of the overall wage distribution) and high wages (in the top quartile of the overall wage distribution).*