

*Predicting Where Technology
Will Impact Work*

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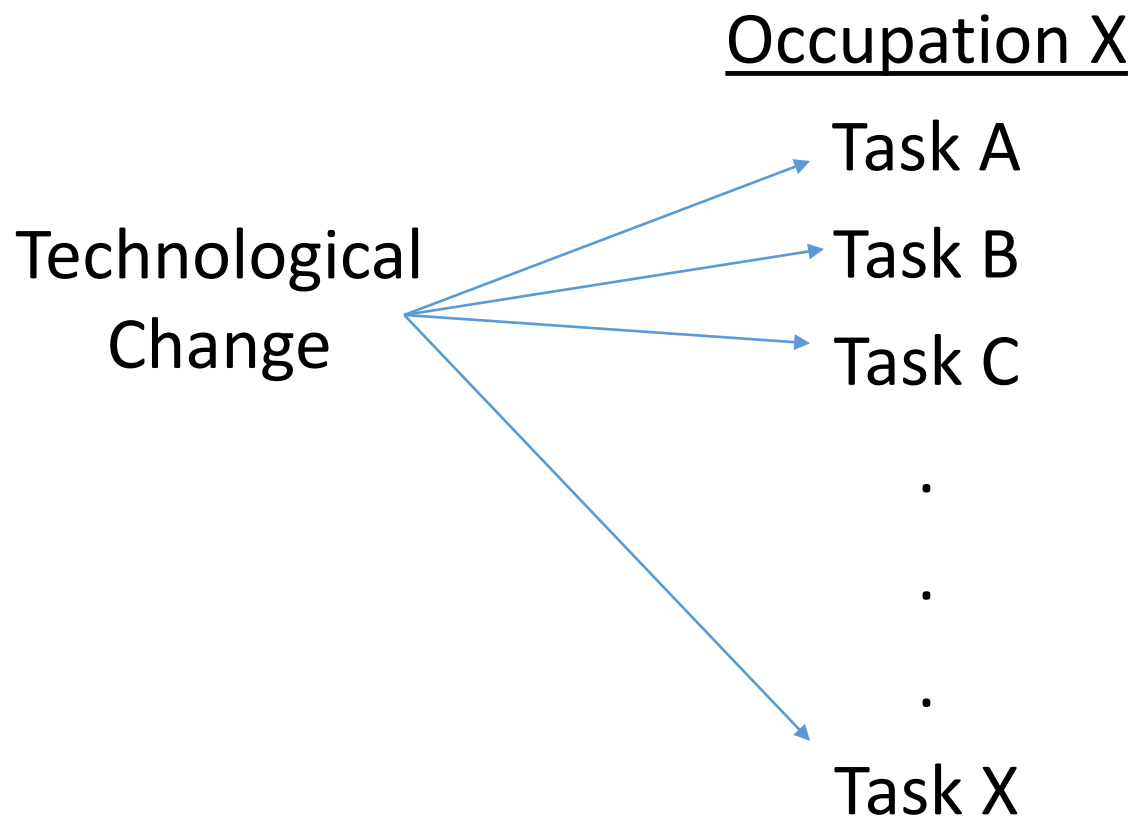
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Questions directing initial investigation

- What are the informational needs that allow us to answer the questions that best prepare us for the disruptions that automation will bring about?
 - Information on a fairly granular scale (geographic and industrial)
 - Updated cheaply, easily and frequently as circumstances change
 - Building blocks for any successful effort should be occupational
- Are there existing data sets that meet these needs?
 - The most frequently used data set (Frey & Osborne) is 7 years out of date
 - Their results also yield some dubious conclusions
 - Proprietary data sets also dated and not available in useful format
- What approach(es) make sense as method for creating our own measures of technological impact?

Occupations as Bundles of Tasks

A useful and widely accepted approach to analyzing tech impact on occupations



Tech Change may **substitute** for labor in performance of some tasks, may **complement**/augment labor in performance of other tasks

No occupation contains only tasks that can be automated, while all occupations contain some tasks that can be automated (according to MIT)

Rather than eliminating all jobs within any given occupation, jobs will be **redesigned**, tasks will be changed, eliminated, enhanced and rebundled as tech changes

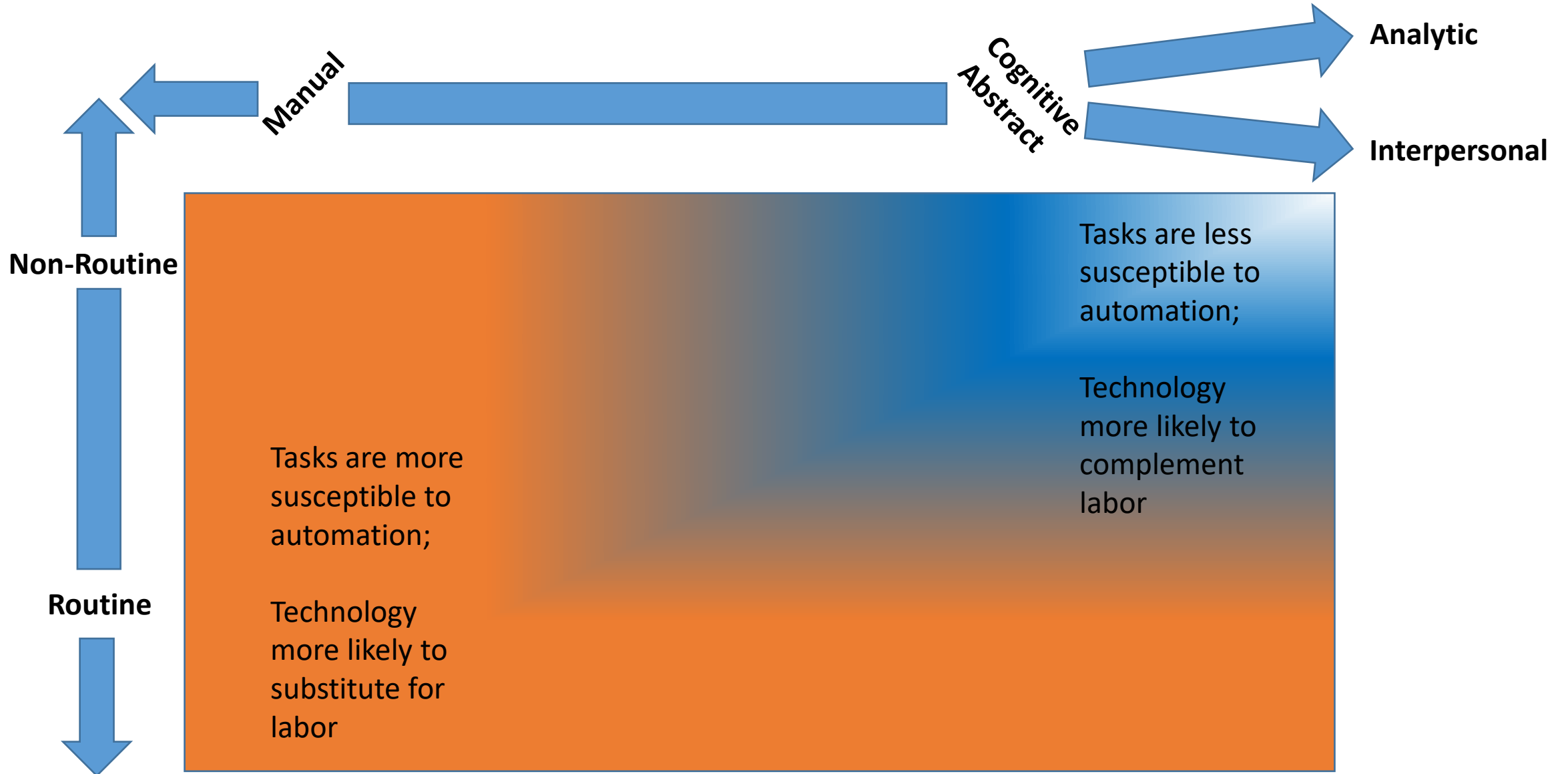
Example – Tasks of Pharmacy Aides from O*Net

- Greet customers and help them locate merchandise.
- Accept prescriptions for filling, gathering and processing necessary information.
- Operate cash register to process cash or credit sales.
- Answer telephone inquiries, referring callers to pharmacist when necessary.
- Receive, store, and inventory pharmaceutical supplies or medications, check for out-dated medications, and notify pharmacist when inventory levels are low.
- Unpack, sort, count, and label incoming merchandise, including items requiring special handling or refrigeration.
- Restock storage areas, replenishing items on shelves.
- Maintain and clean equipment, work areas, or shelves.
- Prepare prescription labels by typing or operating a computer and printer.
- Compound, package, and label pharmaceutical products, under direction of pharmacist.
- Provide customers with information about the uses, effects, or interactions of drugs.
- Process medical insurance claims, posting bill amounts and calculating copayments.
- Calculate anticipated drug usage for a prescribed period.
- Perform clerical tasks, such as filing, compiling and maintaining prescription records, or composing letters.
- Prepare, maintain, and record records of inventories, receipts, purchases, or deliveries, using a variety of computer screen formats.
- Deliver medication to treatment areas, living units, residences, or clinics, using various means of transportation.
- Operate capsule or tablet counting machine that automatically distributes a certain number of capsules or tablets into smaller containers.

Applying Task-based Approach

- There are 18,300 tasks across 800+ occupations, too many to accurately review and characterize in ongoing basis
- Further complicated when we consider that tasks are constantly evolving as technological change occurs
- Need a more manageable set of occupational characteristics that 'predict' whether an occupation's tasks are susceptible to technological impact
- More precisely, are there occupational characteristics that suggest if technological change will substitute for or complement workers performing an occupation's tasks?

Autor, Levy and Murnane (2003) Approach



Sixteen O*Net Work Characteristics Used to Categorize Occupational Tasks

1. Cognitive/Abstract

A. Analytical

- Analyzing data/information
- Thinking creatively
- Interpreting information for others

B. Interpersonal

- Establishing and maintaining personal relationships
- Guiding, directing, and motivating subordinates
- Coaching and developing others

2. Routine

A. Cognitive

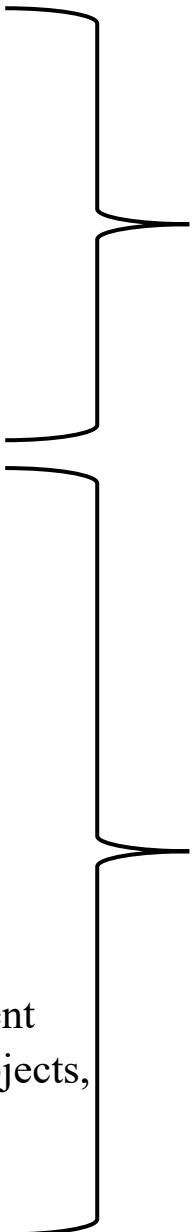
- Importance of repeating the same tasks
- Importance of being exact or accurate
- Structured versus unstructured work

B. Manual

- Controlling machines and processes
- Keeping a pace set by machinery or equipment
- Time spent making repetitive motions

3. Nonroutine Manual

- Operating vehicles, mechanized devices, or equipment
- Time spent using hands to handle, control, or feel objects, tools, or controls
- Manual dexterity
- Spatial orientation



High O*Net “Importance” scores imply occupations requiring attributes like **creativity, empathy, strategy, complexity** where workers have a comparative advantage over machines

High O*Net “Importance” scores imply occupations that involve **repetition, physical motion and activity, lack of interaction** where machines often have a comparative advantage over machines

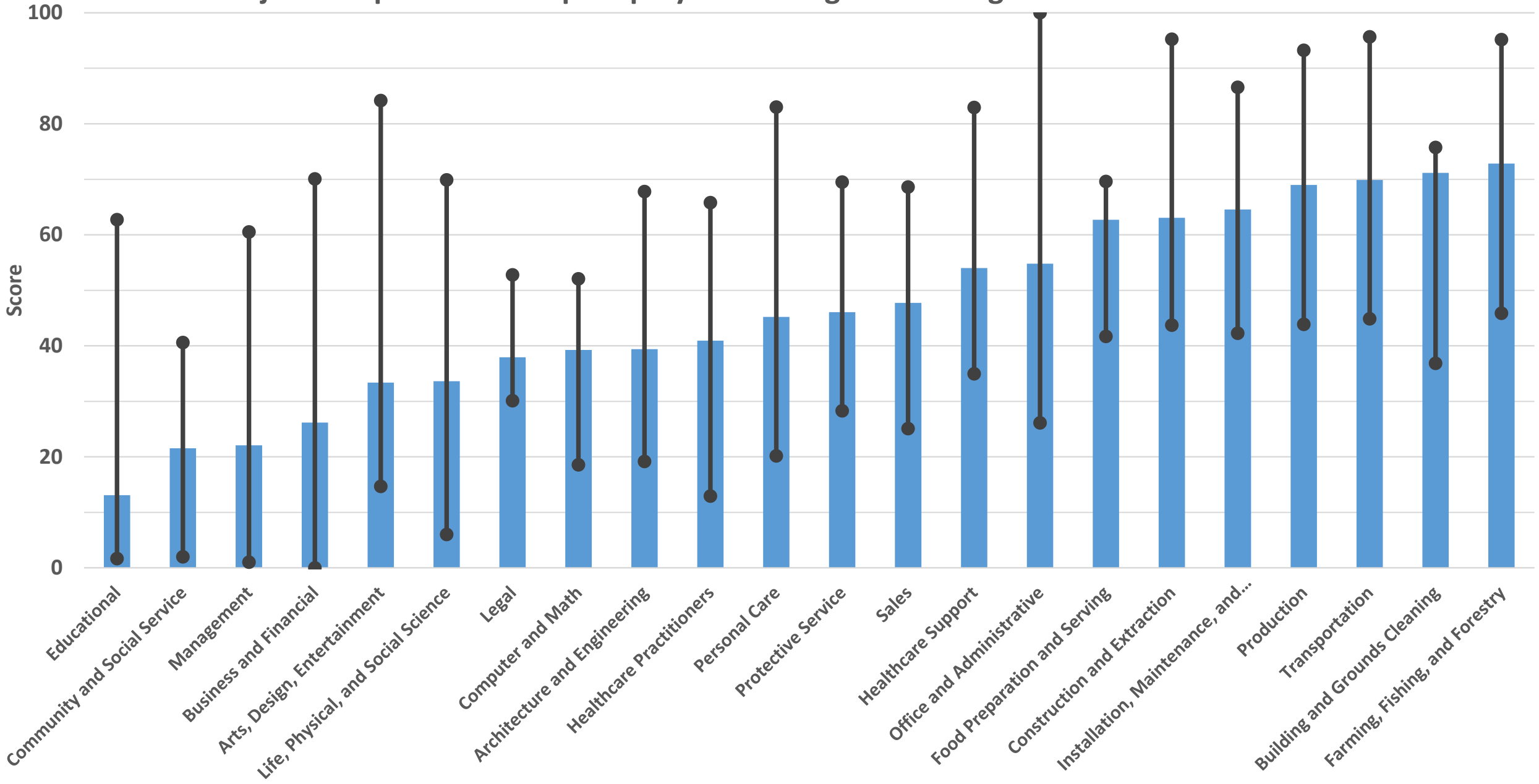
Occ Code	Occupational Title	Score	Element Category
43-5052	Postal Service Mail Carriers	100.00	Routine Cognitive
53-4041	Subway and Streetcar Operators	95.68	NonRoutine Manual
47-5043	Roof Bolters, Mining	95.25	Routine Manual
45-4021	Fallers	95.18	NonRoutine Manual
51-7042	Woodworking Machine Setters, Operators, and Tenders, Except Sawing	93.26	Routine Manual
53-7063	Machine Feeders and Offbearers	89.84	Routine Manual
51-4081	Multiple Machine Tool Setters, Operators, and Tenders, Metal and Plastic	88.91	Routine Manual
51-6064	Textile Winding, Twisting, and Drawing Out Machine Setters, Operators, and Tenders	88.65	Routine Manual
53-7081	Refuse and Recyclable Material Collectors	88.09	NonRoutine Manual
51-9124	Coating, Painting, and Spraying Machine Setters, Operators, and Tenders	87.41	Routine Manual
51-9191	Adhesive Bonding Machine Operators and Tenders	87.37	Routine Manual
51-7041	Sawing Machine Setters, Operators, and Tenders, Wood	87.22	Routine Manual
51-6063	Textile Knitting and Weaving Machine Setters, Operators, and Tenders	87.04	Routine Manual
47-5044	Loading and Moving Machine Operators, Underground Mining	86.98	NonRoutine Manual
51-6021	Pressers, Textile, Garment, and Related Materials	86.64	Routine Manual
49-9091	Coin, Vending, and Amusement Machine Servicers and Repairers	86.58	NonRoutine Manual
51-6042	Shoe Machine Operators and Tenders	86.24	Routine Manual
51-6052	Tailors, Dressmakers, and Custom Sewers	86.13	Routine Manual
47-5071	Roustabouts, Oil and Gas	85.63	Routine Manual
53-7061	Cleaners of Vehicles and Equipment	85.51	NonRoutine Manual

Occ Code	Occupational Title	Score	Element Category
13-1111	Management Analysts	0.00	Abstract Analytical
11-9032	Education Administrators, Kindergarten through Secondary	1.03	Abstract Interpersonal
25-1066	Psychology Teachers, Postsecondary	1.66	Abstract Interpersonal
21-2021	Directors, Religious Activities and Education	1.99	Abstract Interpersonal
25-1043	Forestry and Conservation Science Teachers, Postsecondary	2.45	Abstract Analytical
25-1123	English Language and Literature Teachers, Postsecondary	2.47	Abstract Analytical
13-1151	Training and Development Specialists	2.87	Abstract Interpersonal
11-3131	Training and Development Managers	3.05	Abstract Interpersonal
25-1062	Area, Ethnic, and Cultural Studies Teachers, Postsecondary	4.40	Abstract Interpersonal
11-1011	Chief Executives	4.87	Abstract Interpersonal
19-3032	Industrial-Organizational Psychologists	6.03	Abstract Interpersonal
11-3121	Human Resources Managers	6.33	Abstract Interpersonal
25-1082	Library Science Teachers, Postsecondary	6.66	Abstract Analytical
19-3051	Urban and Regional Planners	6.78	Abstract Interpersonal
11-2022	Sales Managers	7.02	Abstract Interpersonal
11-9033	Education Administrators, Postsecondary	7.03	Abstract Interpersonal
25-1193	Recreation and Fitness Studies Teachers, Postsecondary	7.87	Abstract Interpersonal
25-9031	Instructional Coordinators	7.93	Abstract Interpersonal
25-1041	Agricultural Sciences Teachers, Postsecondary	8.09	Abstract Interpersonal
25-1065	Political Science Teachers, Postsecondary	8.79	Abstract Analytical

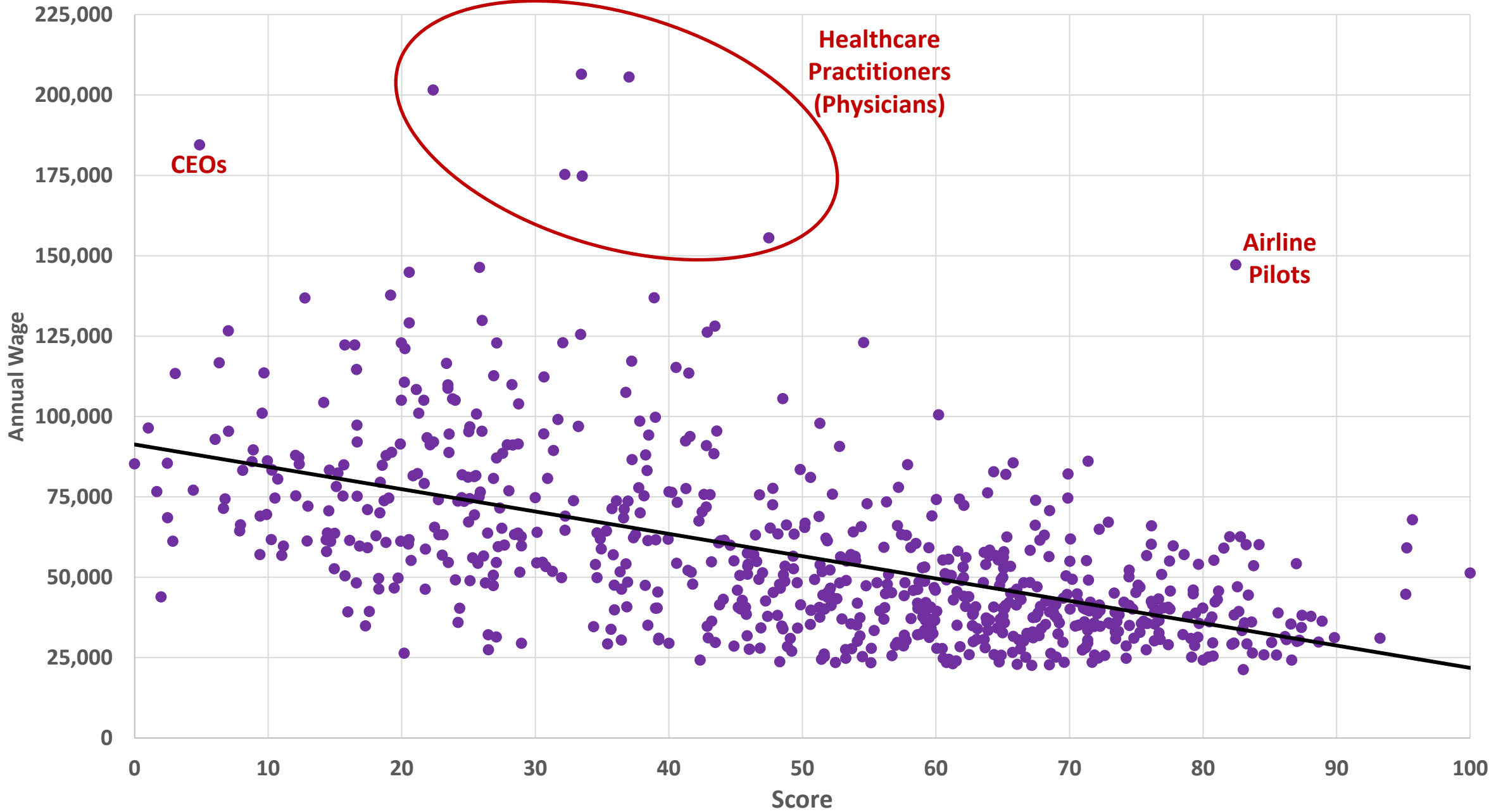
Points on Covid as they relate to this work

- Pandemic has shown that adopting technology can be done quickly with the right “incentive”
- It has illustrated how technology can impact tasks performed in any given job without necessarily eliminating that job
- Highlighted the important distinction between jobs that require interpersonal interactions from those that can be done remotely
- Shown that the application of technology to tasks can and will impact jobs across all segments of the workforce

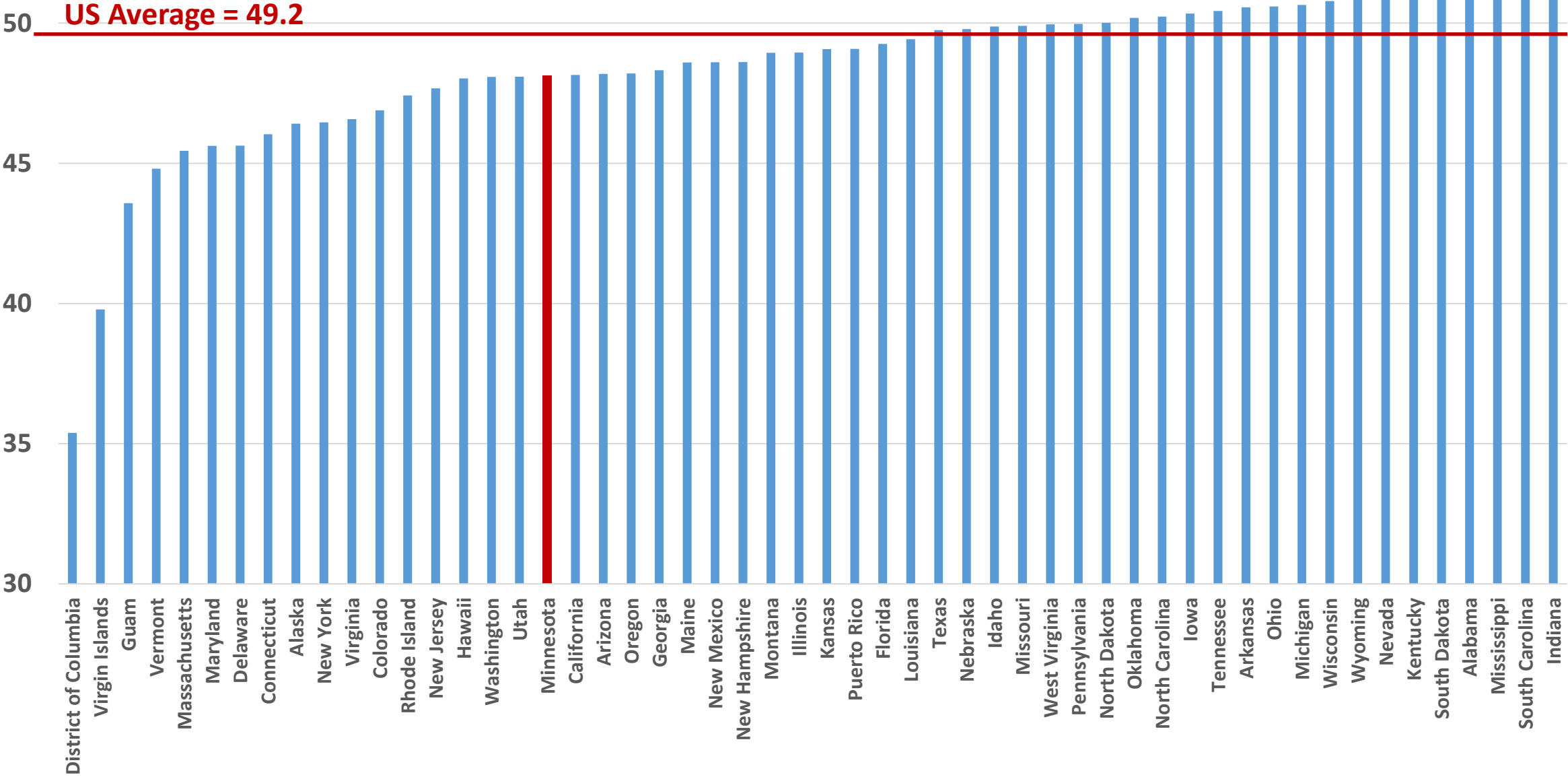
Major Occupational Group Employment-Weighted Average Score with Min and Max



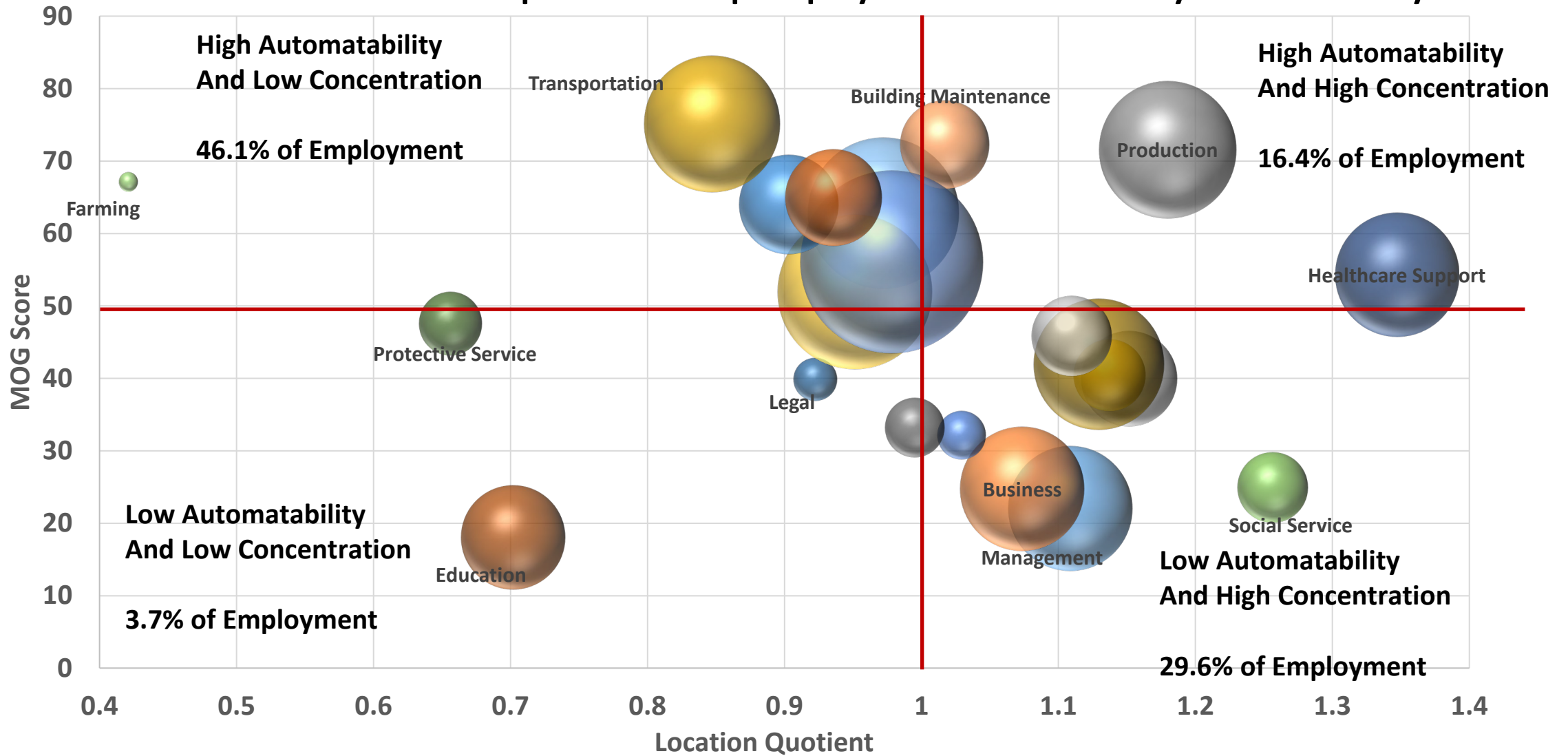
Average Annual Occupational Wage by Automation Score



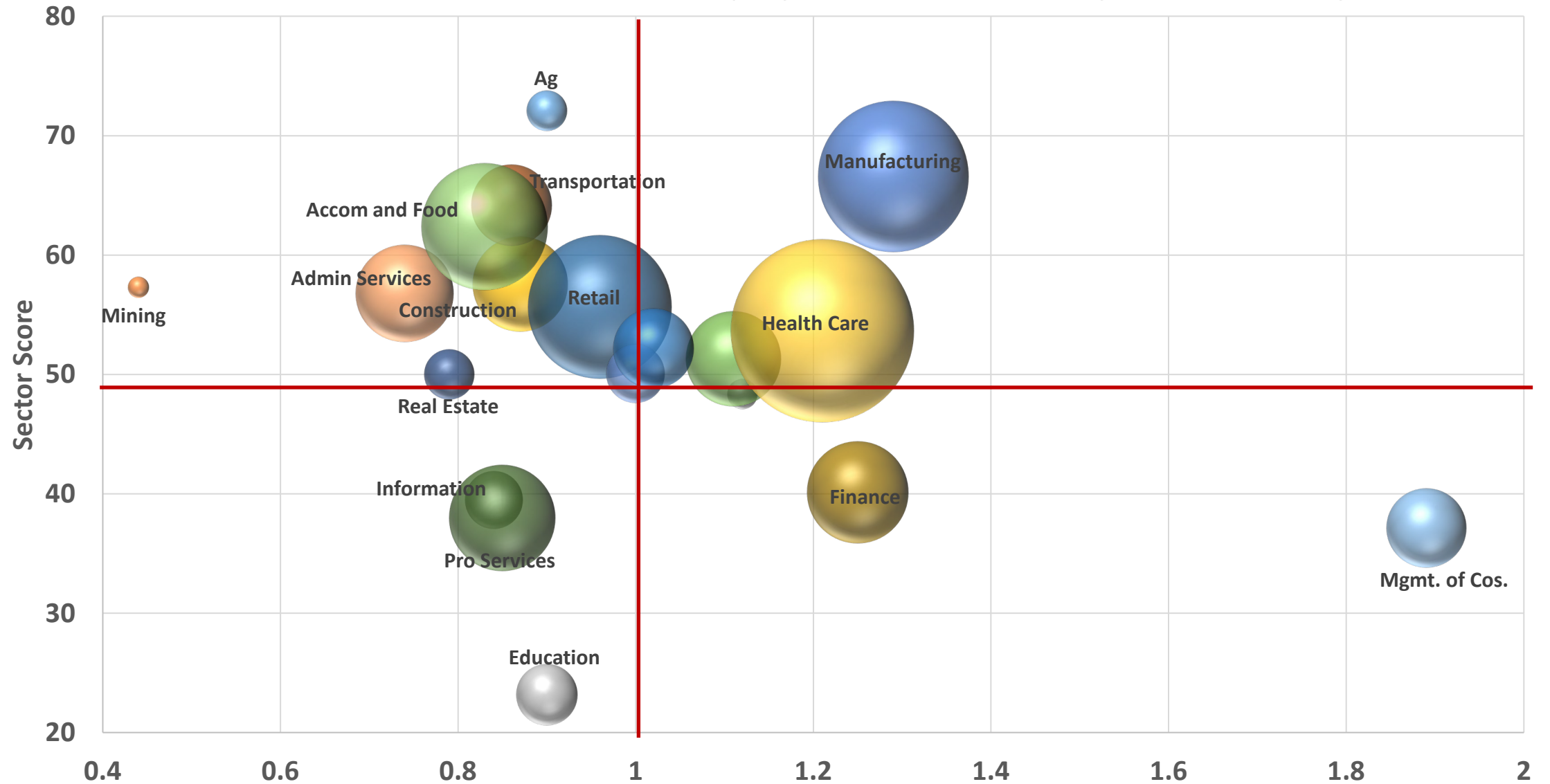
State employment-Weighted Average Scores



Minnesota's Occupational Group Employment Distribution by Automatability



Minnesota's Industrial Sector Employment Distribution by Automatability



31-9095 Pharmacy Aides 55.16%	Abstract Analytical	-0.45
	Abstract Interpersonal	0.16
	NonRoutine Manual	-0.001
	Routine Cognitive	0.57
	Routine Manual	0.28

Importance of Being Exact or Accurate	0.70
Importance of Repeating Same Tasks	0.84
Structured versus Unstructured Work	-0.15

- Receive, store, and inventory pharmaceutical supplies or medications, check for out-of-date medications, and notify pharmacist when inventory levels are low.
- Unpack, sort, count, and label incoming merchandise, including items requiring special handling or refrigeration.
- Prepare prescription labels by typing or operating a computer and printer.
- Compound, package, and label pharmaceutical products, under direction of pharmacist.
- Process medical insurance claims, posting bill amounts and calculating copayments.
- Calculate anticipated drug usage for a prescribed period.