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UC Berkeley San Francisco Ergonomics Program

COVID19 Janitor Project
Time & Motion Study Proposal

Presented by: Melissa Afterman MS-HFE, CPE & Meg Honan MS, PT, CPE
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Agenda

- UC Ergonomics team
- What is a Time & Motion Study
- Research questions
- Study design/outcomes
- Methods: data collection devices/exposures measured
- Sample results
- Estimated timeline and costs
- Discussion

Our Team

UC Berkeley San Francisco Ergonomics Program

Onsite consulting
Data collection, processing, analysis & interpretation
Supervising associate consultants
Main point of contact for consulting projects

Melissa Afterman
Senior Consultant

Meg Honan
Senior Consultant

Associate consultants

Study design, data collection, analysis & interpretation

Dr. Carisa Harris
Lab Director

Advisor to the study

Dr. Fadi Fathalluh
Director Agriculture Safety and Health Program (UC Davis)

Center for Occupational & Environmental Health (COEH)

Alan Barr
Senior Lab Engineer

Manage instrumentation
Assist with data processing

Post doctoral fellows

Assist with data collection & processing

Graduate Students

Assist with video digitization

Undergraduates

Center for Occupational & Environmental Health

COEH

Protecting Workers and Communities from Occupational and Environmental Health Hazards through Teaching Research and Service

Academic

Research

Outreach

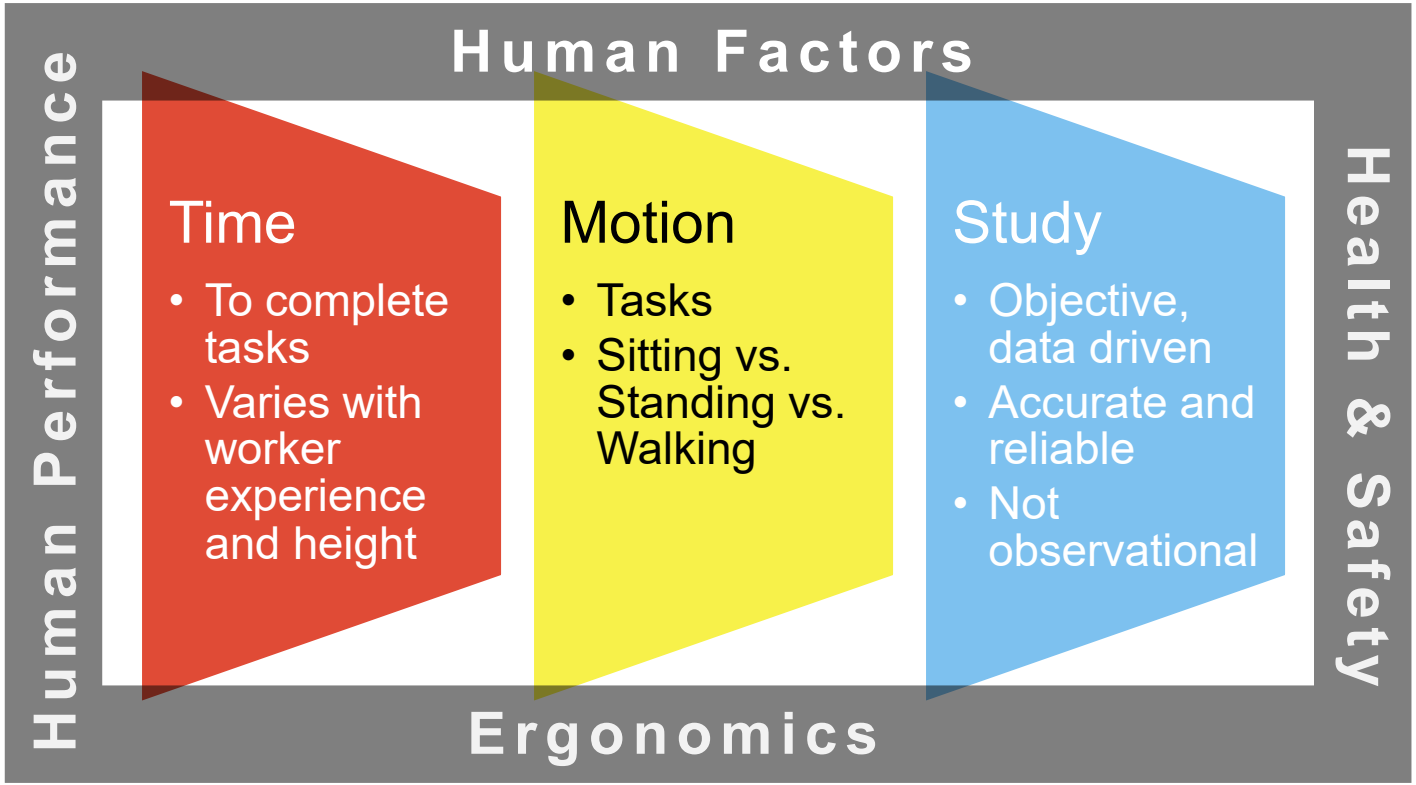
COEH faculty on Janitor's Project:

Carisa Harris, PhD, CPE
COEH Deputy Director
Ergonomics Program Director

Laura Stock, MPH
Labor Occupational Health
Program Director

Fadi Fathallah, PhD
Agricultural Safety and
Health Program Director

Time & Motion Study with Human Factors Framework



Study questions

- What are the tasks per square foot (density) while cleaning/disinfecting the 5 typical workspaces?

- What are the task durations (rate) while cleaning/disinfecting these 5 typical workspaces?

- What are the durations, frequency and magnitudes of physical exposures* while cleaning/disinfecting these 5 typical workspaces?

- What is the physiological workload** and risk of lumbar spine disorder while cleaning then disinfecting the 5 typical workspaces.

** shoulder elevation/frequency/duration, forward bend magnitude, frequency/duration*

***Heart Rate, number of steps and METS*

Examples of "tasks":
- Clean under/around urinals and toilet bowls
- Backpack vacuums
- Lifting trash bags to throw into dumpsters

Study design

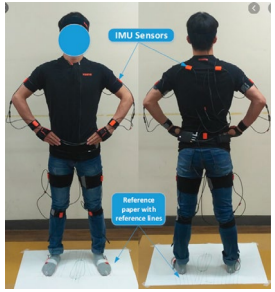
Workers	Workspaces (5)	Data collected	Total
3 subjects 2 shift 5 workspaces (3 trials each)	1. Office settings 2. High tech/R&D settings 3. Airports 4. Retail(big box/malls 5. High Traffic Buildings/Public Venues*	**Full Analysis** • LMM • Xsens (IMUs) • Video (MVTA) • activPal • HR monitor	N=30 6 subjects per workspace 5 workspaces
5 subjects 2 shift 5 workspaces (3 trials each)	Same as above	**Partial Analysis** • Video (MVTA) • activPal • HR monitor	N=50 10 subjects per workspace 5 workspaces

*Transport Stations/Convention Centers/Stadiums/Theaters

** Bathrooms/Kitchen/Breakroom/Elevators/Lobbies/Entrance Doors/Shared Equipment

Methods: data collection exposures measured

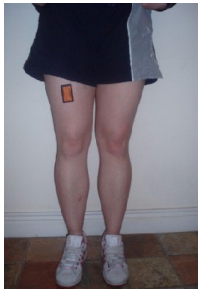
Lumbar Motion Monitor (LMM)
- ❑ Risk of low back injury



Xsens (IMU*)
- ❑ Postures
  - Shoulder
  - Back

* Inertial Measurement Units

Hear Rate Monitor(HR)
- ❑ Physiological workload
  - ○ *Worn for 24-48 hrs*



activPAL™
- ❑ Steps
- ❑ Time in postures
  - sitting
  - stand
  - walking
  - ○ *Worn for 24-48 hrs*

Multimedia Video Task Analysis (MVTA)
- ❑ Time on task
- ❑ Time in awkward postures
  - ○ *Integrated with IMU system*

How data analysis answers study questions

- Video data
  Baseline of time required to complete COVID19 disinfecting procedures and cleaning tasks for use in determining time allotted to the tasks/job

- LMM
  Do cleaning and disinfecting tasks result in an unacceptable/excessive risk of injury to the low back?

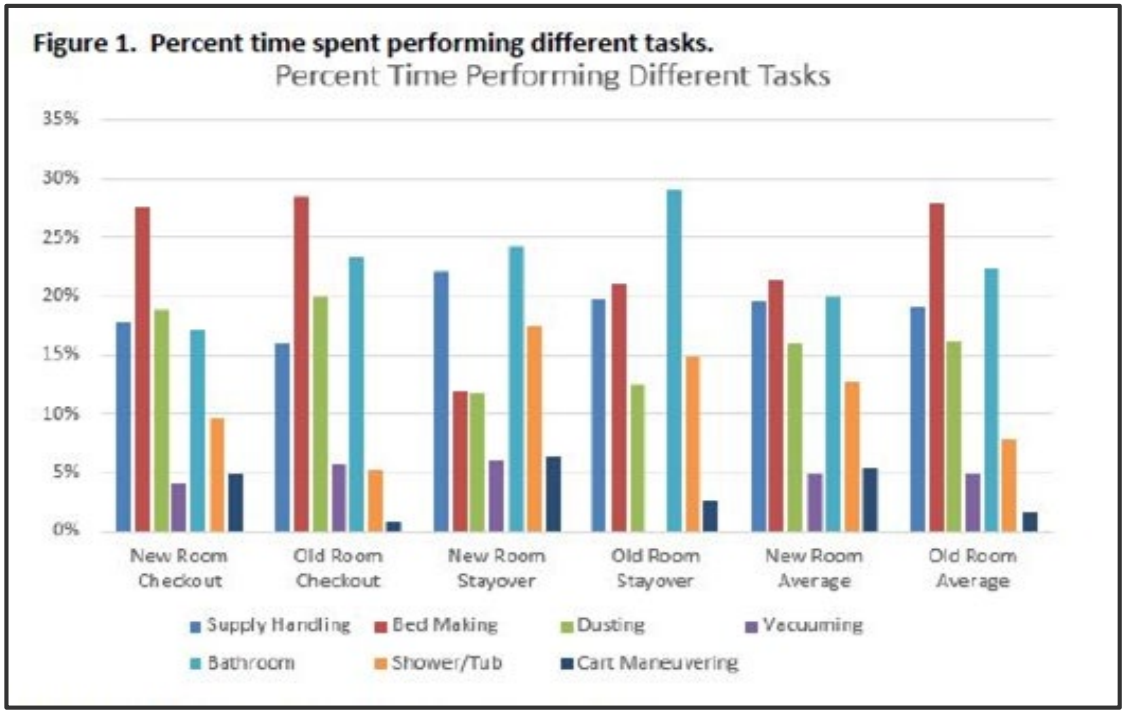
- Heart Rate data
  Do COVID cleaning and disinfecting tasks performed at the rate observed require an acceptable level of physiological workload?

- ActivePAL data
  Analyze balance of activity intensity

- Xsens data
  physical exposures (shoulder/back/wrist)
  durations-frequency-magnitudes

Results - Percent time spent on each task

(for similar study of hotel housekeeping workers)



Results - Summary of time per task

(hotel housekeeping workers study)

Table 1a. Duration to complete cleaning of new versus old check out and stay over room and tasks.

	Supply Handling	Bed Making	Dust	Vacuum	Bathroom	Shower/ Tub	Cart Maneuver	Total
New Room Checkout	10.5	16.3	11.2	2.4	10.2	5.9	3.0	59.5
New Room Stayover	7.1	3.8	3.5	1.9	7.2	5.5	2.1	31.0
New Room Average	9.1	11.3	8.1	2.2	9.0	5.8	2.6	48.1
Old Room Checkout	8.4	14.3	9.8	2.9	11.3	2.5	0.3	49.6
Old Room Stayover	8.1	10.4	4.7	2.6	6.2	2.3	0.5	34.8
Old Room Average	8.2	12.7	7.8	2.8	9.2	2.5	0.4	43.7
Additional Duration to Clean New Rooms (Min)								
Check out	2.2	2.1	1.4	-0.6	-1.1	3.4	2.6	10.0
Stay over	-1.0	-6.6	-1.2	-0.7	1.0	3.2	1.5	-3.8
Overall	0.9	-1.4	0.3	-0.6	-0.2	3.3	2.2	4.5

Table 1b. Impact of increased duration required to clean new versus old rooms on a workshift given different numbers of checkout and stayover rooms being cleaned.

	Example 1	Minutes	Example 2	Minutes	Example 3	Minutes
Check Out Rooms (#)	10	99.6	6	59.7	3	29.9
Stay Over Rooms (#)	2	-7.6	7	-26.7	9	-34.3
Workshift Impact		92.0		33.1		-4.4

Estimated Time & Cost for Janitor Time and Motion Study

	Project Step	Estimated Time	Estimated Cost
	1. Study Design & Prep Study Advisor (Fadi Fathallah)	15 hours 8 hours	$225/hr. x 15 hrs. = $3,375 $225/hr. x 10 hrs. = $1,800
	1B. Procure Equipment	2-3 weeks	$45,000
			Step 1 total = **$ 50, 175**
Per Work Venue	2. Data Collection	• **Full Analysis-** (1 day, 2 researchers per subject) for LMM, Xsens and Video, HR, activPAL • **Partial Analysis**- (1 day, 1 researcher per 1 subject) for Video*, activPAL, HR	• Full: $225/hr. x 6 hours per worker x 2 researchers x 3 workers x 2 shifts = $16,200 • Partial: $225/hr. x 6 hours per worker x 5 workers x 2 shifts = $13,500 **Data collection Total = $29,700**
	3. Data Processing & Analysis	MVTA = 2 x #Video hrs (for all workers) HR/AP = 1.5 x #Workers (for all workers) Xsens/LMM = 2 x Video hrs (for FULL analysis only)	$85/hr. x 4hrs video/worker x 2 x 16 workers = $10,880 $85/hr. x 1.5hrs/worker x 16 workers = $2,040 $85/hr. x 4hrs video/worker x 2 x 6 workers = $4,080 **Total Data processing and analysis = $17,000**
	4. Interpretation & Report	25 hours	$225/hr. x 25 hrs. = **$5,625**
	SUBTOTAL PER VENUE	*All Venues in the San Francisco Bay Area*	$ 102,500 for first venue (office setting) + $52,325 for each of 4 additional venues = $209,300
	TOTAL	**$311,800 for all five venues** **$259,475 for four venues total**	2. high tech/R&D settings, 3. airports, 4. retail (big box/malls), 5. high traffic/public venues (i.e. convention centers)

Discussion/questions