Accelerometer-Based Work Activity in Florida Agricultural Workers

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Introduction

- Agricultural workers frequently perform intense labor in hot environmental conditions and have a risk of heat related-illness (HRI) that is 20 times greater than the general workforce population[1]
- To date, there has been no quantification of the work intensity and patterns of work among Florida agricultural workers in the field setting

Methods

Study Design and Population

- The *Girasoles ("Sunflower")* study is a longitudinal study of agricultural workers in 5 Florida communities aimed to characterize physiologic response to working in hot conditions
- Workers were recruited during the 2015-2017 summer work seasons by trained *promotoras*
- Inclusion criteria: (1) age 18-54, (2) worked in U.S. agriculture for at least 1 month
- Exclusion criteria: (1) history of diabetes type I, (2) current pregnancy

Data Collection

- A total of 252 agricultural workers were monitored by wearing a highly validated Actigraph GT3X+ accelerometer positioned at the hip, which recorded acceleration counts on 3 individual planes of motion (vertical, antero-posterior, and medio-lateral) every 30 seconds
- Workers completed a baseline survey and were monitored for up to 3 workdays
- Baseline survey included sociodemographic variables, work characteristics, and usual agricultural activities performed
- Environmental conditions during the time of data collection (6am to 6pm) were derived from the Florida Automated Weather Network (FAWN) which records data every 15 minutes; a monitoring station was present in each agricultural community under study

Activity Variables

- Vector magnitude (VM3): a composite activity count measure incorporating all three planes of motion
- Time spent in moderate to vigorous activity (MV): calculated by summing the minutes reaching a VM3 count of ≥ 2690[2]
- Usual work activities: bending, walking, standing, cutting, twisting, lifting, sitting, kneeling, reaching, squatting

Statistical Analysis

- Demographic and work characteristics were summarized **(Table 1)**
- Average weather conditions were summarized **(Table 2)**
- Functional data analysis (FDA) was used to examine differences in VM3 over the work day by agricultural community using LOESS smoothing **(Figure 1);** differences in curves were tested with a point-wise and omnibus critical value using permuted values **(Figure 2)**
- Median minutes spent in MV was summarized over the workday and reported by sex **(Figure 3)**
- Usual work activities were summarized as the percentage of workers engaging in that activity **(Figure 4)**

Results

Table 1: Demographic Characteristics

	Pierson (n = 67)	Immokalee (n = 66)	Fellsmere (n = 26)	Apopka (n = 59)	Homestead (n = 34)
Characteristic					
Age (years), mean SD	37 (7)	38 (8)	37 (9)	39 (9)	41 (11)
Sex, n (%)					
Male	23 (34)	36 (55)	10 (38)	17 (29)	10 (29)
Female	44 (66)	30 (45)	16 (62)	42 (71)	24 (71)
Body mass index (kg/m2), mean (SD)	29 (4)	28 (4)	28 (6)	29 (5)	29 (6)
Nationality					
Mexico	64 (96)	19 (29)	22 (85)	41 (70)	23 (68)
Central America	0 (0)	21 (32)	4 (15)	15 (25)	10 (29)
Caribbean	0 (0)	26 (39)	0 (0)	3 (5)	0 (0)
United States	3 (4)	0 (0)	0 (0)	0 (0)	1 (3)
Education (years), mean (SD)	6 (3)	6 (4)	7 (3)	7 (3)	7 (4)
Years worked in Agriculture, mean (SD)	15 (6)	9 (8)	11 (7)	12 (8)	14 (10)

Table 2. Environmental Conditions from FAWN

Weather Parameter	Pierson (2015) 5/25-7/1	Immokalee (2016) 8/30-10/12	Fellsmere (2017) 5/9-5/24	Apopka* (2015) 7/7-7/22	Homestead (2017) 7/31-8/19
Ambient temperature (ºF)	85	82	83	84	85
Maximum temperature (ºF)	93	88	88	91	90
Average relative humidity (%)	69	82	68	74	76

*2016 Apopka field collection: 6/6 – 6/30

Figure 1. Vector Magnitude Counts by Agricultural Community

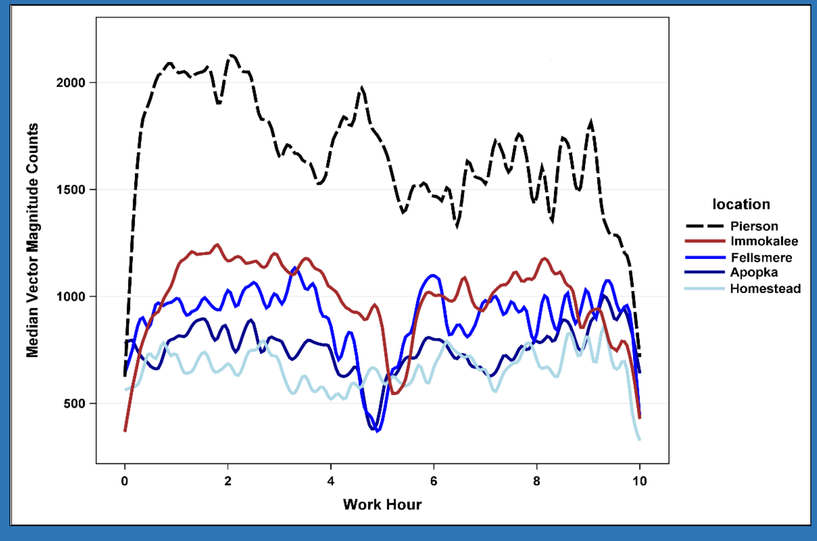
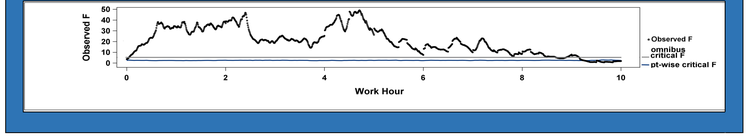


Figure 2. FDA Significance Plots



Results

Figure 3. Time Spent in Moderate to Vigorous Activity

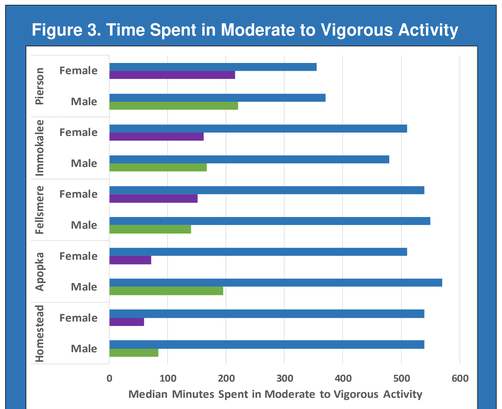


Figure 3 Legend

- median minutes worked per day
- median minutes in MV (female)
- median minutes in MV (male)

Figure 4. Agricultural Activities Performed

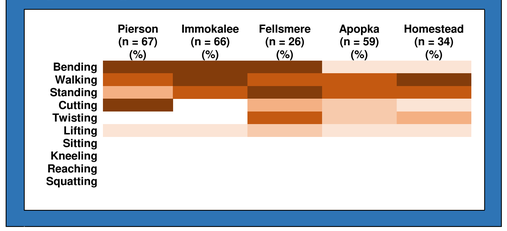


Figure 4 Legend

- 90-100%
- 80-90%
- 70-80%
- 60-70%
- 50-60%
- <50%

Summary and Conclusions

- Fernery work was associated with the highest work intensity, with both males and females spending approximately 60% of their workday in MV
- Fernery workers are generally paid by the piece, which may discourage workers from taking rest breaks
- Males and females work at similar intensities in all field sites, except for nurseries where females spend less time in MV
- Activity contributes to the risk of HRI in agricultural workers; research is underway to examine the relationship between work intensity, dehydration and core body temperature
- More studies are needed to determine how to modify work breaks that incorporate climatic conditions and work intensity

References

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2. Sasaki JE, John D, Freedson PS. Validation and comparison of ActiGraph activity monitors. J Sci Med Sport. 2011;14(5):411-6. doi: 10.1016/j.jsams.2011.04.003. PubMed PMID: 21616714.

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