



# Nurses' energy expenditure and physical activity level measurement: Systematic literature review

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## Introduction

The understanding of the energy and expenditure and physical activity (PA) levels of nurses are essential because physical performance at work has implications both for nurses' health and patient care.

## Objective

This study aims at understanding nurses' PA levels, energy expenditure, and determining the PA patterns across a shift. Further objectives include examining how nurses accumulate PA across a shift

## Methods

This is a systematic review that were guided by using keywords in online data bases. The key search strings were 'healthcare worker', 'nurse', 'physical activity level', 'energy expenditure', 'occupational health', 'job demands/recovery'. Utilized data bases to accomplish the objectives include PubMed, Scopus, Web of Science, Science Direct, and IEEE Xplore. The search were limited to articles published after 2010.

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## Results

Author, Sample Design	Sample	Instrument	Shift Data	PA
Chappel et al. (2020) Experimental	50 F, 5 M Emergency Nurse	ActiGraph activPAL Work/Sleep diary	Rotating	55% standing, 29% sitting, 16% stepping Afternoon-morning rotation showed lower PA
Yu et al. (2020) Cross-Sectional	102 total Nurse	Axivity AX3	Day/Night 12-hr	Standing/Dynamic Standing: 70% of physical workload Physical workload higher for day shift than night shift
Holtermann et al. (2018) Cross-Sectional	401 shift 78 non-shift	Actigraph GT3X	Shift/Non-shift	<b>Shift:</b> Standing (37.7%), Walking (11.8%), Sedentary (50.0%) <b>Non-shift:</b> Standing (29.0%), Walking (9.9%), Sedentary (63.5%) *decrease in differences with an increase in night shifts
Babiolkakis et al. (2015) Experimental	27 F Nurse	ActiGraph IPAQ	..	<b>Uninjured:</b> 60.2 mins standing <b>Injured:</b> 19.3 mins standing
Chen et al. (2014) Observational	8 F Registered Nurse	Achtiheart Observation	Day shifts 12-hr shift	53.7% indirect patient care 24.1% direct patient care 20.7% breaks, 12.6% resting 5% manual patient handling 15.9% bedside care tasks 38% care coordination 41% walking/standing

Author, Sample Design	Sample	Instrument	Shift Data	Energy Expenditure
Allan et al. (2019) Experimental	90 F, 6 M Ward Nurse	Actiheart	12-hr shift	Avg energy expenditure: 1521 kcals 72% expend enough to maintain healthy body weight
Almajwal (2015) Cross-Sectional	362 F Nurse	Questionarre	Day/Rotating	Day shift Rotating shift 40-49 h-w 50-59 h-w > 60 h-hw
Babiolkakis et al. (2015) Experimental	27 F Nurse	ActiGraph IPAQ	..	<b>Uninjured</b> 960 METs/min/week MPA 3000 METs/min/week walking 500 METs/min/week VPA <b>Injured</b> 240 METs/min/week 1500 METs/min/week walking
Chen et al. (2014) Observational	8 F Nurse	Achtiheart Observation	Day shifts 12-hr shift	Mean 55.3%HRmax
Chen et al. (2011) Descriptive	145 F Registered Nurse	Achtiheart Work logbooks	Day shift 12-hrs	Avg energy expenditure: 1,454 kcal (1.91 METs) Total energy expenditure: 22.9 METs Avg heart rate = 53.9%HRmax

## Conclusion

Most nurses expend sufficient energy on a working day to maintain a healthy weight, under the assumption that caloric consumption does not exceed recommended levels. This is achieved mainly through light-intensity PA, intermixed with some moderate-intensity. For most shift patterns, nurses can maintain or increase their PA levels for consecutive shifts. Prolonged periods of standing can cause fatigue in nurses, and recovery is encouraged by alternating between sitting and standing. However, data about nurses' average occupational PA levels was conflicting, likely attributed to the measurement instrument used.

## Discussion

The differences in occupational activity levels may be explained by the different nursing roles, the range of tasks nurses perform, and variation of the manual handling regulatory frameworks. Day shifts appear to be more physically demanding than night shifts; nurses spend more time throughout the day in higher activity levels with less recovery time between tasks performed. The finding that nurses typically engage in light-intensity work suggests that nursing may not be physical demanding. However, light-intensity PA across a 12-hour shift is equal to moderate-intensity PA for 8-hours when total energy expenditure is considered.

