# Supplemental Material 1- Utilization of Wearable Pedometer Devices in the Perioperative Period- a Qualitative Systematic Review

Zhaosheng Jin, MBBS, Christopher Lee, MD, Kalissa Zhang, MD, , Rosen Jeong, B.S, Tong J Gan, MBA, MHS, FRCA, Deborah C Richman, MB, ChB, FFA(SA)

((fitbit) OR (wearable device) OR (wearable sensor) OR (pedometer) OR (Garmin)) AND

((preop\*) AND (assessment OR (risk stratification)) OR

(prehabilitation) OR (periop\*) OR

((postop\*) AND ((length of stay) OR complications OR readmission)))

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Study ID** | **Device type** | **Patients without pedometer reading** | **Reason for missing pedometer reading** | **Postoperative ICU admission?** |
| Bae 2016 26 | Fitbit® | 2(7%) | Not reported  | Excluded duration of ICU stay |
| Bille 2021 12 | Realalt® 3D TriSport | 12 (13%) | Non-compliance with pedometer use | Not specified |
| Daskivich 2019 20 | Fitbit® Charge | 15 (13%) | Device loss or issue with data capture | Excluded |
| Engel 202128 | Polar® A300 | 19 (9%) | Inconsistent pedometer use, low battery, loss of the pedometer | Not specified |
| Esteban 2017 16 | Omron HJ-720 T-E2 | 0 | n/a | Not specified |
| Hedrick 2020 13Kane 2020 27 | Fitbit® Charge 2 | 7 (7%) | Technical problems or device loss | Not specified |
| Khetrapal 2020 17 | Not specified | Not reported | Not reported | Not specified |
| Kizlcik Özkan 202223 | TNV PM 2000 | 0 | N/a | Excluded if ICU stay > 24 hours |
| Low 2018 25 | Fitbit® Flex or Charge devices | 10 (14%) | Device failure, technical issue with data syncing | Excluded duration of ICU stay |
| Nakajima 2020 14 | Kenz Lifecorder® GS | 15 (14%) | Not reported | Not specified |
| Nevo 202121 | Tractivity TM | 6 (6%) | 4 misplaced pedometers 2 technical issues | Not specified |
| Reed 202119 | FitBit® Flex pinned to the hospital gown | 31 (12%) | Technical issue and non-compliance | Not specified |
| Richards 2020 15 | Garmin vívofit® | 0 | n/a | Included |
| Rossi 202129 | VivoFit® | 12 (23%) | Not reported | Not specified |
| Wolk 2019 18 | Polar® Loop activity tracker | 4(3%) | Technical issue with the tracker | Excluded if ICU stay > 48 hours |
| Wu 2019 24 | Apple® or Samsung® Gear S2 | 6 (14%) | Did not charge device | Excluded prolonged intubation |
| Yi 2021 22 | Fitbit® Charge or Alta HR | 22 (37%) | Not reported | Not specified |

|  |
| --- |
| Bae 2016 |
| Domain | Risk of bias | Justification |
| Confounding | Some concerns | No correlation reported between lower step count and preoperative comorbidity, other variables not analysed. |
| Participant selection | Low | Patients who had abdominal cancer surgeries were recruited |
| Intervention classification | Low | No interventions other than pedometer use  |
| Deviation from intended interventions | Low | No interventions other than pedometer use |
| Missing Outcome data | Low | 6.7 % of patients had missing pedometer data |
| Measurement of outcomes | Some concerns | Unclear if investigators judging the readmission were aware of the pedometer readings |
| Selection of reported results | Some concerns | Protocol not registered |
| Overall | Some concerns |  |

|  |
| --- |
| Bille 2021 |
| Domain | Risk of bias | Justification |
| Confounding | Low | Adjusted for age, gender, BMI, comorbidity, cancer staging and lung function |
| Participant selection | Low | Patients who had lung cancer resection were recruited |
| Intervention classification | Low | No interventions other than pedometer use |
| Deviation from intended interventions | Low | No interventions other than pedometer use |
| Missing Outcome data | Some concerns | Missing pedometer data on 13% of patients |
| Measurement of outcomes | Some concerns | Unclear if investigators judging the complications were aware of the pedometer readings |
| Selection of reported results | Some concerns | Protocol not registered |
| Overall | Some concerns |  |

|  |
| --- |
| Daskivich 2019 |
| Domain | Risk of bias | Justification |
| Confounding | Low | Surgery type, age, sex, race/ethnicity, and Charlson-Deyo comorbidity score |
| Participant selection | Low | Patient undergoing major surgeries including lung lobectomy, gastric bypass, hip replacement, robotic cystectomy, open colectomy, abdominal hysterectomy, sleeve gastrectomy, and laparoscopic colectomy |
| Intervention classification | Low | No interventions other than pedometer use  |
| Deviation from intended interventions | Low | No interventions other than pedometer use |
| Missing Outcome data | Some concerns | 13% of patients had missing pedometer data |
| Measurement of outcomes | Some concerns | Unclear if discharge decision were made with the knowledge of pedometer readings |
| Selection of reported results | Low | NCT02741895 |
| Overall | Some concerns |  |

|  |
| --- |
| Engel 2021 |
| Domain | Risk of bias | Justification |
| Confounding | Some concerns | Total, rather than daily step count was used, which does not take into account the length of stay |
| Participant selection | Low | Patients who had cesarean delivery with spinal anesthesia were selected |
| Intervention classification | Low | No interventions other than pedometer and standard ambulation |
| Deviation from intended interventions | Low | No interventions other than pedometer and standard ambulation |
| Missing Outcome data | Low | Missing pedometer data on 9% of patients |
| Measurement of outcomes | Low | Any deviations from usual postoperative recovery course were considered complications |
| Selection of reported results | Some concerns | Protocol not registered |
| Overall | Some concerns |  |

|  |
| --- |
| Esteban 2017 |
| Domain | Risk of bias | Justification |
| Confounding | Some concerns | Step count only adjusted for BMI |
| Participant selection | Low | Patients who had lung cancer resection were recruited |
| Intervention classification | Low | No interventions other than pedometer use and routine physical therapy |
| Deviation from intended interventions | Low | No deviations reported |
| Missing Outcome data | Some concerns | Missing data not specified |
| Measurement of outcomes | Some concerns | Unclear if investigators judging the complications were aware of the pedometer readings |
| Selection of reported results | Some concerns | Protocol not registered |
| Overall | High |  |

|  |
| --- |
| Hedrick 2020 |
| Domain | Risk of bias | Justification |
| Confounding | Low | Adjusted for NSQIP score  |
| Participant selection | Low | Patients who had elective colorectal surgeries were recruited |
| Intervention classification | Low | No interventions other than pedometer use  |
| Deviation from intended interventions | Low | No interventions other than pedometer use |
| Missing Outcome data | Low | 7% of pedometer data was lost |
| Measurement of outcomes | Some concerns | Unclear if investigators judging the complications were aware of the pedometer readings |
| Selection of reported results | Some concerns | Protocol not registered |
| Overall | Some concerns |  |

|  |
| --- |
| Khetrapal 2020 |
| Domain | Risk of bias | Justification |
| Confounding | Some concerns | Factors analyzed in the multivariable regression is not clear |
| Participant selection | Low | Patient undergoing radical nephrectomy |
| Intervention classification | Low | No interventions other than pedometer use  |
| Deviation from intended interventions | Some concerns | Deviation from protocol were not specified |
| Missing Outcome data | Some concerns | Missing data were not reported |
| Measurement of outcomes | Some concerns | Unclear if investigators judging the complications were aware of the pedometer readings |
| Selection of reported results | Some concerns | Protocol not registered |
| Overall | High  |  |

|  |
| --- |
| Kizlcik Özkan 2022 |
| Domain | Risk of bias | Justification |
| Confounding | High | No confounders were controlled for |
| Participant selection | Low | Patient undergoing thorascopic lung surgery |
| Intervention classification | Low | No interventions other than pedometer use  |
| Deviation from intended interventions | Low | No interventions other than pedometer use |
| Missing Outcome data | Some concerns | CONSORT diagram not available, not clear if any missing data |
| Measurement of outcomes | Some concerns | Unclear if investigators judging the complications were aware of the pedometer readings |
| Selection of reported results | Some concerns | Protocol not registered |
| Overall | High  |  |

|  |
| --- |
| Low 2018 |
| Domain | Risk of bias | Justification |
| Confounding | Low | Step count adjusted for sex, diagnosis, body mass index, ASA status, comorbidity, or length of stay |
| Participant selection | Low | Patients who had metastatic abdominal cancer resection surgeries were recruited |
| Intervention classification | Low | No interventions other than pedometer use |
| Deviation from intended interventions | Low | No interventions other than pedometer use |
| Missing Outcome data | Some concerns | Missing pedometer data on 14% of patients |
| Measurement of outcomes | Low | Readmission rate was the primary outcome |
| Selection of reported results | Some concerns | Protocol not registered |
| Overall | Some concerns |  |

|  |
| --- |
| Nakajima 2020 |
| Domain | Risk of bias | Justification |
| Confounding | Low | Multivariable regression with age, gender, comorbidity, cancer type/staging, surgical time, blood loss |
| Participant selection | Low | Patients who had elective hepatobiliary cancer surgeries were recruited |
| Intervention classification | Low | No interventions other than pedometer use  |
| Deviation from intended interventions | Low | No interventions other than pedometer use |
| Missing Outcome data | Some concerns | 14 % of patients had missing pedometer data |
| Measurement of outcomes | Some concerns | Unclear if investigators judging the complications were aware of the pedometer readings |
| Selection of reported results | Some concerns | Protocol not registered |
| Overall | Some concerns |  |

|  |
| --- |
| Nevo 2021 |
| Domain | Risk of bias | Justification |
| Confounding | Low | Multivariable regression with age, BMI, comorbidity, preop labs |
| Participant selection | Low | Patients who had abdominal surgeries were recruited |
| Intervention classification | Low | No interventions other than pedometer use  |
| Deviation from intended interventions | Low | No interventions other than pedometer use |
| Missing Outcome data | Low | 6 % of patients had missing pedometer data |
| Measurement of outcomes | Some concerns | Unclear if investigators judging the complications were aware of the pedometer readings |
| Selection of reported results | Some concerns | Protocol not registered |
| Overall | Some concerns |  |

|  |
| --- |
| Reed 2021 |
| Domain | Risk of bias | Justification |
| Confounding | Some concerns | Comorbidities not included in the multivariable regression |
| Participant selection | Low | Patients who had bariatric surgery surgeries were recruited |
| Intervention classification | Low | Postoperative day 0 and day 1 step counts were measured |
| Deviation from intended interventions | Low | No interventions other than pedometer use |
| Missing Outcome data | Some concerns | 12% of patients did not have pedometer data |
| Measurement of outcomes | Some concerns | Unclear if investigators judging the complications were aware of the pedometer readings |
| Selection of reported results | Some concerns | Protocol not registered |
| Overall | High |  |

|  |
| --- |
| Richards 2020 |
| Domain | Risk of bias | Justification |
| Confounding | Low | Adjusted for age, gender, tumor stage and operative access |
| Participant selection | Low | Patients who had major colorectal surgery surgeries were recruited |
| Intervention classification | Low | Preoperative step count monitored for 14 days |
| Deviation from intended interventions | Low | No interventions other than pedometer use |
| Missing Outcome data | Low | No missing data reported |
| Measurement of outcomes | Some concerns | Unclear if investigators judging the complications were aware of the pedometer readings |
| Selection of reported results | Low | Registration ACTRN12618000045213 |
| Overall | Low/ Some concerns |  |

|  |
| --- |
| Rossi 2021 |
| Domain | Risk of bias | Justification |
| Confounding | Some concerns | Not clear how the predictive models are generated and what covariates are included in the analysis |
| Participant selection | Some concerns | Patient data from two previous studies were analyzed |
| Intervention classification | Some concerns | It's not clear how the pedometer data is processed through machine learning |
| Deviation from intended interventions | Low | No interventions other than pedometer use |
| Missing Outcome data | Low | Study data from previous studies were included |
| Measurement of outcomes | Some concerns | Unclear if investigators judging the complications were aware of the pedometer readings |
| Selection of reported results | some concerns | Protocol not registered |
| Overall | High |  |

|  |
| --- |
| Wolk 2021 |
| Domain | Risk of bias | Justification |
| Confounding | Some concerns | No correlation reported between lower step count and preoperative comorbidity, other variables not analysed. High dropout rate among patients who required prolonged critical care stay |
| Participant selection | Low | Patients who had elective colorectal surgeries were recruited |
| Intervention classification | Low | Cohort divided according to the median step count amongst the cohort |
| Deviation from intended interventions | Low | No interventions other than pedometer use |
| Missing Outcome data | Low | 4% of patient excluded due to missing pedometer data |
| Measurement of outcomes | Some concerns | Unclear if investigators judging the complications were aware of the pedometer readings |
| Selection of reported results | Some concerns | Protocol not registered |
| Overall | Some concerns |  |

|  |
| --- |
| Wu 2020 |
| Domain | Risk of bias | Justification |
| Confounding | Some concerns | Only accounted for surgery type and cancer type in the multivariable analysis |
| Participant selection | Low | Patient undergoing gastric cancer surgery |
| Intervention classification | Low | No interventions other than pedometer use  |
| Deviation from intended interventions | Low | No interventions other than pedometer use |
| Missing Outcome data | Some concerns | Up to 14% of patients had missing pedometer data |
| Measurement of outcomes | Some concerns | Unclear if discharge decision were made with the knowledge of pedometer readings |
| Selection of reported results | Some concerns | Protocol not registered |
| Overall | High |  |

|  |
| --- |
| Yi 2021 |
| Domain | Risk of bias | Justification |
| Confounding | Low | Multivariable regression with age, gender, comorbidity, ASA classification, preoperative labs, surgical procedure.  |
| Participant selection | Low | Patients who had elective colorectal surgeries were recruited |
| Intervention classification | Low | No interventions other than pedometer use  |
| Deviation from intended interventions | Low | No interventions other than pedometer use |
| Missing Outcome data | High | 27 % of patients had missing pedometer data |
| Measurement of outcomes | Some concerns | Unclear if investigators judging the complications were aware of the pedometer readings |
| Selection of reported results | Some concerns | Protocol not registered |
| Overall | High |  |