

Supplementary Material S4: risk factor domain “mechanical boundary condition”

Table S2: Summary of evidence for risk factor domains and subdomains: “mechanical boundary condition”

| Variables | Studies with <u>significant</u> variables in multivariate model Overall RoB, Study author, variable name | | Studies with <u>non-significant</u> variables in multivariate model Overall RoB, Study author, variable name | |
|--|--|---|--|--|
| Domain 1: mechanical boundary condition | Stage ≥ 1 PI | Stage ≥ 2 PI | Stage ≥ 1 PI | Stage ≥ 2 PI |
| Body size | <u>Low RoB</u> Schultz (1999) – body mass | <u>Low RoB</u> O'Brien et al. (2014) – BMI <18.5 | <u>Low RoB</u> Defloor and Grypdonck (2005) – body mass | <u>Low RoB</u> Brandeis (1994) – BMI Defloor and Grypdonck (2005) – body mass |
| 17 Studies | | | | |
| 8/23 Variables (35%) | <u>Moderate RoB</u> Aloweni (2019) – BMI < 23 Miller (2020) – overweight (BMI > 35) Gao (2018) – BMI < 18.5 | <u>Moderate RoB</u> Allman (1995) – decreased body weight (<58kg) | <u>Moderate RoB</u> Bergstrom and Braden (1992) – ideal body weight (%) Miller (2020) - underweight | <u>Moderate RoB</u> Bergstrom and Braden (1992) – ideal body weight (%) Compton (2008) – body weight (kg), height (cm), BMI Vanderwee (2009) – underweight/overweight vs. Normal Yatabe (2013) – BMI |
| | <u>High RoB</u> Aghazadeh (2020) – weight (kg) Dukes (2018) – BMI | <u>High RoB</u> | <u>High RoB</u> Lannering (2016) – MNA-SF loss of weight, BMI Park and Park (2017) – weight Serpa (2020) – underweight/overweight/obese vs. eutrophic | <u>High RoB</u> |
| Friction/shear | <u>Low RoB</u> Perneger (2002) – Braden friction/shear | <u>Low RoB</u> Cox (2011) – Braden friction/shear | <u>Low RoB</u> Cox (2011) – Braden friction/shear Defloor and Grypdonck (2005) – Braden friction/shear Sardo (2018) – Braden friction/shear | <u>Low RoB</u> Defloor and Grypdonck (2005) – Braden friction/shear |
| 11 Studies | | | | |
| 7/14 Variables (50%) | <u>Moderate RoB</u> Halfens (2000) – Braden friction/shear Miller (2020) – Minimum Braden friction score Tourtual (1997) – Braden friction/shear | <u>Moderate RoB</u> De Laat (2007) – friction and shear present Teschner (2012) – Braden score 1, 2 vs. 3 | <u>Moderate RoB</u> Miller (2020) – mean Braden friction | <u>Moderate RoB</u> Bergquist and Frantz (1999) – Braden friction/shear Vanderwee (2009) – Braden friction/shear |
| | <u>High RoB</u> | <u>High RoB</u> | <u>High RoB</u> | <u>High RoB</u> |
| Interface pressure | <u>Low RoB</u> Schultz (1999) – mattress overlay | <u>Low RoB</u> Manzano (2013) - mattress | <u>Low RoB</u> Defloor and Grypdonck (2005) – sitting posture Kim (2019) – use of restraints | <u>Low RoB</u> Defloor and Grypdonck (2005) – sitting posture Nixon (2006) – overlay: mattress |
| 16 Studies | | | | |
| 10/19 Variables (53%) | | | | |

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| | | | Strazzieri-Pulido (2018) – mattress type | |
| | <u>Moderate RoB</u> Donnelly (2011) – heel support surface Forni (2018) – foam dressing Gao (2018) – application of external force during operation, prone position during operation Shaw (2014) – nonsupine vs. supine position Suriadi (2008) – S.S. scale interface pressure (≥ 35 mmHg, bony prominence, at sacrum) | <u>Moderate RoB</u> De Laat (2007) – preventive transfer to specific mattress vs. no transfer | <u>Moderate RoB</u> | <u>Moderate RoB</u> Anrys (2018) – static air mattress vs. alternating pressure air mattress Schoonhoven (2002) – mattress on OR table (air and warming mattress), posture on OR table |
| | <u>High RoB</u> Dukes (2018) – more than 2 transports | <u>High RoB</u> | <u>High RoB</u> Dukes (2018) – vacuum spine board, en route time (h) | <u>High RoB</u> Park and Park (2017) – restraint |
| <u>Subdomain immobility</u> | | | | |
| <u>Mobility</u> | | | | |
| 28 Studies | <u>Low RoB</u> Cox (2011) – Braden mobility Cox (2020) – cardiovascular surgery Perneger (2002) – Braden mobility Sardo (2018) – Braden mobility | <u>Low RoB</u> Brandeis (1994) – ambulation difficulty O'Brien et al. (2014) – noncardiac surgery Rademakers (2007) – postoperative hip dislocation, time to surgery > 12h | <u>Low RoB</u> Defloor and Grypdonck (2005) – spontaneous movements Galivanche (2020) – pre-/postoperative use of mobility aid | <u>Low RoB</u> Cox (2011) – Braden mobility Defloor and Grypdonck (2005) – spontaneous movements Rademakers (2007) – delayed commencement of mobilization (> 2days) |
| 26 /51 Variables (51%) | <u>Moderate RoB</u> Boyle and Green (2001) – coma/unresponsiveness/paralyzed and sedated Gao (2018) – operation time Shaw (2014) – use of general anesthesia (PI directly after surgery), orthopedics surgery, cardiac surgery (PI 30 min after surgery) Yoshimura (2016) – > 6hrs surgery + core temperature > 38.1°C | <u>Moderate RoB</u> Bergquist and Frantz (1999) – Braden mobility, recent fracture Schoonhoven (2002) – length of surgery Teschler (2012) – surgery, Braden score 2 vs. 3, 4 Vanderwee (2009) – contractures | <u>Moderate RoB</u> Gao (2018) – preoperative waiting time (min) Halfens (2000) – Braden mobility Miller (2020) – time in OR Shaw (2014) – use of general anesthesia (PI 30 min after surgery), neurosurgery, cardiac surgery Tourtual (1997) – Braden mobility, limb weakness Yoshimura (2016) – > 6hrs surgery + core temperature < 38.1°C | <u>Moderate RoB</u> Bergquist and Frantz (1999) – ADL: toilet, transfer, bath De Laat (2007) – major surgery Schoonhoven (2002) – posture on OR table Teschler (2012) – Braden score 1 vs. 3, 4 Vanderwee (2009) – Braden mobility |
| | <u>High RoB</u> Bourdel Marchasson (2000) – lower limb fracture Ek (1987) – Norton mobility Ek (1991) – Norton mobility | <u>High RoB</u> | <u>High RoB</u> Magny (2017) – delay to surgery Park and Park (2017) – surgery Popow (2019) – Norton mobility Salzberg (1999) – Mobility | <u>High RoB</u> |

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| | Lannering (2016) – MNA-SF mobility Salzberg (1999) – extent of paralysis Zarei (2019) – muscular paralysis | | | |
| Activity | <u>Low RoB</u> Han (2018) – admission with wheelchair Kim (2019) – ADL: total and partial positioning, partial ambulating, total and partial toilet use Sardo (2018) – Braden activity | <u>Low RoB</u> Defloor and Grypdonck (2005) – Braden activity Ooi (1999) – transfer | <u>Low RoB</u> Defloor and Grypdonck (2005) – Braden activity Han (2018) – admission with stretcher car Kim (2019) – ADL: total ambulating, partial and total eating Perneger (2002) – Braden activity | <u>Low RoB</u> Brandeis (1994) – ADL: bathing, transfer Nixon (2006) – Braden activity bedfast vs walks frequently |
| 29 Studies | | | | |
| 20/46 Variables (43%) | <u>Moderate RoB</u> González-Méndez (2018) – days of immobilisation Tsaousi (2015) – limited autonomy in everyday activities | <u>Moderate RoB</u> Allman (1995) – immobility Baumgarten (2004) – no. of ADL dependencies (0- 6) Bergquist and Frantz (1999) – limitation in activity to wheelchair, ADL dress (need assistance) Okuwa (2006) – length of bedfast period Tescher (2012) – Braden activity score 2 vs. 3, 4 | <u>Moderate RoB</u> Gao (2018) – score daily activity ability Halfens (2000) – Braden activity Miller (2020) – mean, minimum Braden activity Tourtual (1997) – Braden activity | <u>Moderate RoB</u> Baumgarten (2004) – bedfast Bergquist and Frantz (1999) – Braden activity, ADL dress dependent De Laat (2007) – inactivity, immobility Tescher (2012) – Braden score 1 vs. 3, 4 Vanderwee (2009) – Braden activity |
| | <u>High RoB</u> Bourdel Marchasson (2000) – Kuntzmann score (1 point increase) Ek (1991) – Norton activity Popow (2019) – limited condition | <u>High RoB</u> | <u>High RoB</u> Dukes (2018)- duration of immobility (h) Ek (1987) – Norton activity Park and Park (2017) – activity disorder Magny (2017) – ADL6, IADL4 Salzberg (1999) – level of activity | <u>High RoB</u> |
| Sensory perception | <u>Low RoB</u> Defloor and Grypdonck (2005) – Braden subscale | <u>Low RoB</u> Defloor and Grypdonck (2005) – Braden subscale | <u>Low RoB</u> Cox (2011) – Braden subscale Perneger (2002) – Braden subscale Sardo (2018) – Braden subscale | <u>Low RoB</u> Cox (2011) – Braden subscale |
| 9 Studies | | | | |
| 4/13 Variables (31%) | <u>Moderate RoB</u> Halfens (2000) – Braden subscale | <u>Moderate RoB</u> Tescher (2012) – Braden score 2/3 vs. 4 | <u>Moderate RoB</u> Miller (2020) – mean, minimum score Tourtual (1997) – Braden subscale | <u>Moderate RoB</u> Tescher (2012) – Braden score 1 vs. 4 Vanderwee (2009) – Braden subscale |
| | <u>High RoB</u> | <u>High RoB</u> | <u>High RoB</u> | <u>High RoB</u> |
| Mental status | <u>Low RoB</u> Artico (2020) – ESASr score sleepy | <u>Low RoB</u> Reed (2003) - confused | <u>Low RoB</u> Defloor and Grypdonck (2005) – Norton mental state | <u>Low RoB</u> Brandeis (1994) - disorientation Defloor and Grypdonck (2005) – Norton mental state |
| 18 Studies | | | | |
| 9/29 Variables (31%) | | | | |

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|-----------------------|--|---|--|--|
| | Galivanche (2020) – postoperative delirium Han (2018) – drowsy, stupor, semi-coma/coma Schultz (1999) – exhibits fear | | Galivanche (2020) – preoperative delirium, dementia Han (2018) – confused Perneger (2002) – Norton mental status Sala (2020) – Glasgow Coma Scale ≤ 8 | |
| | <u>Moderate RoB</u> | <u>Moderate RoB</u> | <u>Moderate RoB</u> | <u>Moderate RoB</u> Anrys (2018) – neurological disorders Baumgarten (2004) – dementia Compton (2008) – min./max Glasgow Coma Scale De Laat (2007) – limited response or unresponsive |
| | <u>High RoB</u> Park and Park (2017) – decreased consciousness Popow (2019) – neurological diagnosis | <u>High RoB</u> | <u>High RoB</u> Ek (1987) – Norton mental state Magny (2017) – dementia, hemiplegia/paraplegi a Lannering (2016) – MNA-SF psychological stress, neuropsych impairment Park and Park (2017) – cognitive impairment Popow (2019) – Norton mental state | <u>High RoB</u> |
| Turning/repositioning | <u>Low RoB</u> | <u>Low RoB</u> | <u>Low RoB</u> | <u>Low RoB</u> |
| 1 Study | <u>Moderate RoB</u> | <u>Moderate RoB</u> | <u>Moderate RoB</u> | <u>Moderate RoB</u> |
| 1/2 Variables (50%) | | Manzano (2014) – implementation rate of turning schedule | | Manzano (2014) – 2h turning |
| | <u>High RoB</u> | <u>High RoB</u> | <u>High RoB</u> | <u>High RoB</u> |

PI, pressure injury; RoB, risk of bias