PERIOPERATIVE PREDICTORS OF POSTOPERATIVE DELIRIUM AFTER NON-CARDIAC SURGERY

An individual patient data meta-analysis

Benjamin T. Dodsworth[1], Behnam Sadeghirad[2,3,4], Nayeli Schmutz Gelsomino[1,5], Nicolai Goettel[6], Jessica Spence[3], Tayler A Buchan[2] Holly N. Crandon[4] Mohammad R. Baneshi[7], Robert A. Pol[8], Baukje Brattinga[8], Ui Jun Park[9], Masanori Terashima[10], Louise B. D. Banning[8] Barbara L. van Leeuwen[8], Bjørn E. Neerland[11], Alwin Chuan[12,13], Felipe T. Martinez[14], Jeroen L.A. van Vugt[15], Y. Raja Rampersaud[16] Shingo Hatakeyama[17], Enrico Di Stasio[18,19], Koen Milisen[20,21], Bastiaan Van Grootven[22], Lijckle J.W. van der Laan[23], Linda Thomson-Mangnall[24] Sarah J. Goodlin[25], Diana Lungeanu[26], Vibhawari Dhakharia[27], Elizabeth L. Sampson[28,29], Lisa Falco[30], Michael G Zywiel[16], Anna-Lisa V Nguyen[31] Stephana J. Moss[32,33], Karla D. Krewulak[32], Natalia Jaworska[32], Kara Plotnikoff[32], Supun Kotteduwa-Jayawarden[34], Ryan Sandarage[35] Jason W. Busse[1,2,36], Lawrence Mbuagbaw[2,3,37,38,39]

EUROPEAN DELIRIUM ASSOCIATION

PIPRA

www.pipra.ch

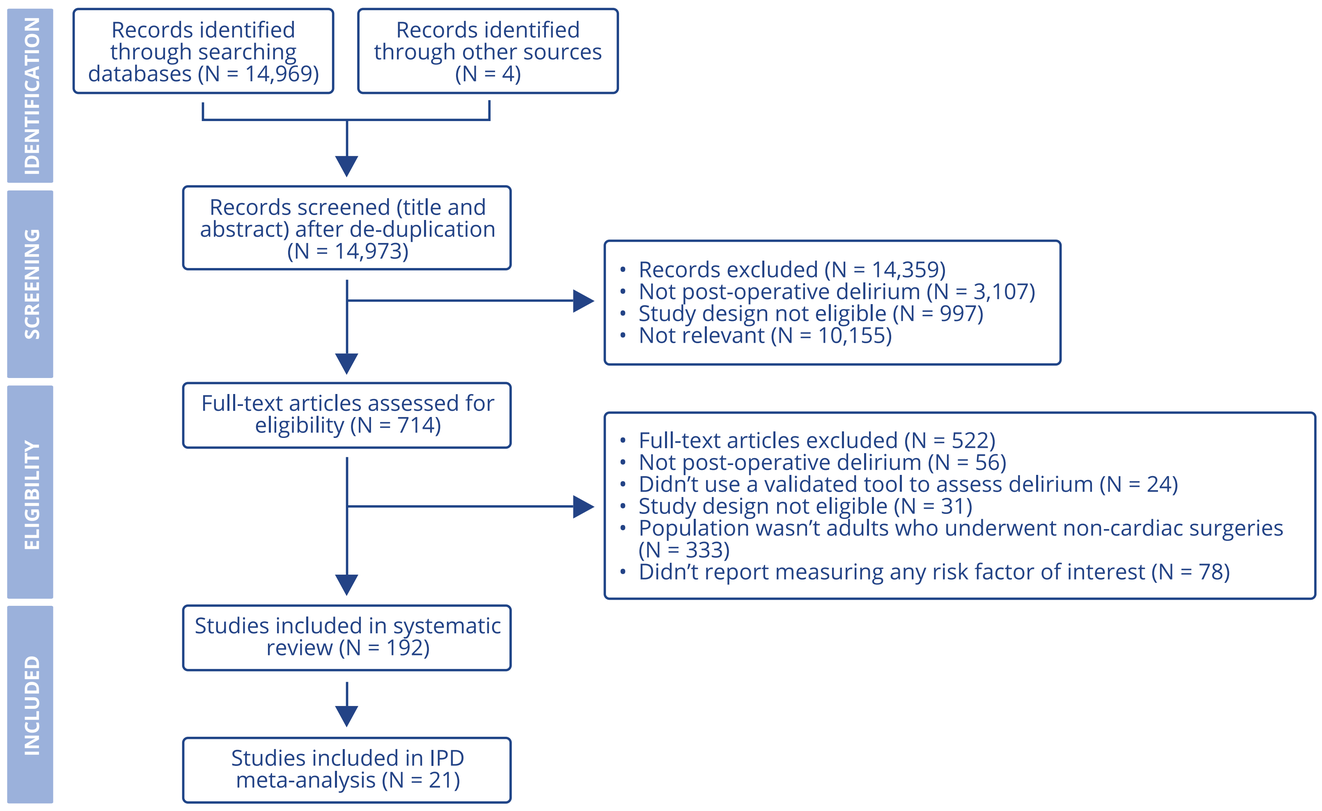
Connect with Ben
ben@pipra.ch

INTRODUCTION & METHODS

We performed a systematic review and individual participant data meta-analysis to identify risk factors for postoperative delirium. Results in press. Protocol was published prior on PROSPERO (CRD42022337566) and detailed procotol: Buchan TA, Sadeghirad B, Schmutz N, Goettel N, Foroutan F, Couban R, Mbuagbaw L, Dodsworth BT. Preoperative prognostic factors associated with postoperative delirium in older people undergoing surgery: protocol for a systematic review and individual patient data meta-analysis. Syst Rev. 2020 Nov 14;9(1):261. doi: 10.1186/s13643-020-01518-z. PMID: 33189147; PMCID: PMC7666505.

The data from this analysis contributed to the development of an automated delirium risk prediction tool. The implementation of the tool can be seen in the poster **"Implementation and Evaluation of a Partially Automated Non-Pharmacological Delirium Prevention Bundle in a Private Tertiary Care Hospital: A Hospital-Wide Quality Improvement Project"**

RESULTS



Flow diagram for study selection

Study (reference)	Country	Study design	POD diagnostic tool	Type of surgery	POD (%)	Sample size
Vasilian et al[40]	Romania	Prospective cohort	CAM	Femoral fracture caused by accidental fall	66.3	98
Andreozzi et al[41]	Italy	Case-control	CAM	TKA patients	8.3	206
McAlpine et al[42]	Canada	Prospective cohort	CAM & MMSE	Gynecologic malignancy	17.5	103
Honda et al[43]	Japan	Case-control	DSM criteria, or diagnosis by attending physician or nurse	Gastric Cancer Patients	4.8	1057
Dworkin et al[44]	USA	Prospective cohort	CAM	Any elective surgery	13.2	115
Sato et al[45]	Japan	Prospective cohort	DSM-V	Urological surgery	4.7	215
Martinez et al[46]	Chile	Randomized trial	CAM	Any elective surgery	9.4	287
Kim et al[47]	South Korea	Prospective cohort	Nu-DESC & CAM	Major general surgery	20.0	1114
Mosk et al[48]	Netherlands	Retrospective cohort	DOSS & DSM-IV	Elective colorectal surgery	13.2	251
Mangnall et al[49]	Australia	Prospective cohort	CAM	Major elective colorectal surgery	34.8	118
Van Grootven et al[50]	Belgium	Prospective cohort	CAM	Hip fracture undergoing surgery	43.3	164
Hight et al[51]	New Zealand	Prospective cohort	CAM-ICU	Any elective surgery	14.4	229
Sampson et al[52]	United Kingdom	Randomized trial	DSI	Elective total hip replacement	21.2	33
Dezube et al[53]	USA	Retrospective cohort	DSM criteria	Elective esophagectomy	16.9	378
Chuan et al[54]	Australia	before-after [longitudinal]	3D-CAM	Isolated primary hip fracture	27.4	300
Watne et al[55]	Norway	Randomized trial	CAM	Hip fracture undergoing surgery	19.2	324
Visser et al[56]	Netherlands	Prospective cohort	DOSS	Vascular surgery	5.5	1294
Denhaerynck et al*	Switzerland	Prospective cohort	DOSS	Any elective surgery	14.2	900
Brattinga et al[57]	Netherlands	Prospective cohort	DOSS	Any elective surgery	9.6	1019
Dhakharia et al[58]	India	Retrospective cohort	DSM criteria, or diagnosis by attending physician or nurse	oncological abdominal surgery	40.7	81
Zywiel et al[59]	Canada	Retrospective cohort	CAM	Hip fracture undergoing surgery	47.9	242

Table of participating studies. * Unpublished study. CAM: confusion assessment method; DOSS: delirium observational screening scale; DSI: delirium symptom interview; DSM: diagnostic and statistical manual of mental disorders; MMSE: mini mental state examination; Nu-DESC: nursing delirium screening scale; POD: post-operative delirium; TKA: Total knee arthroplasty.

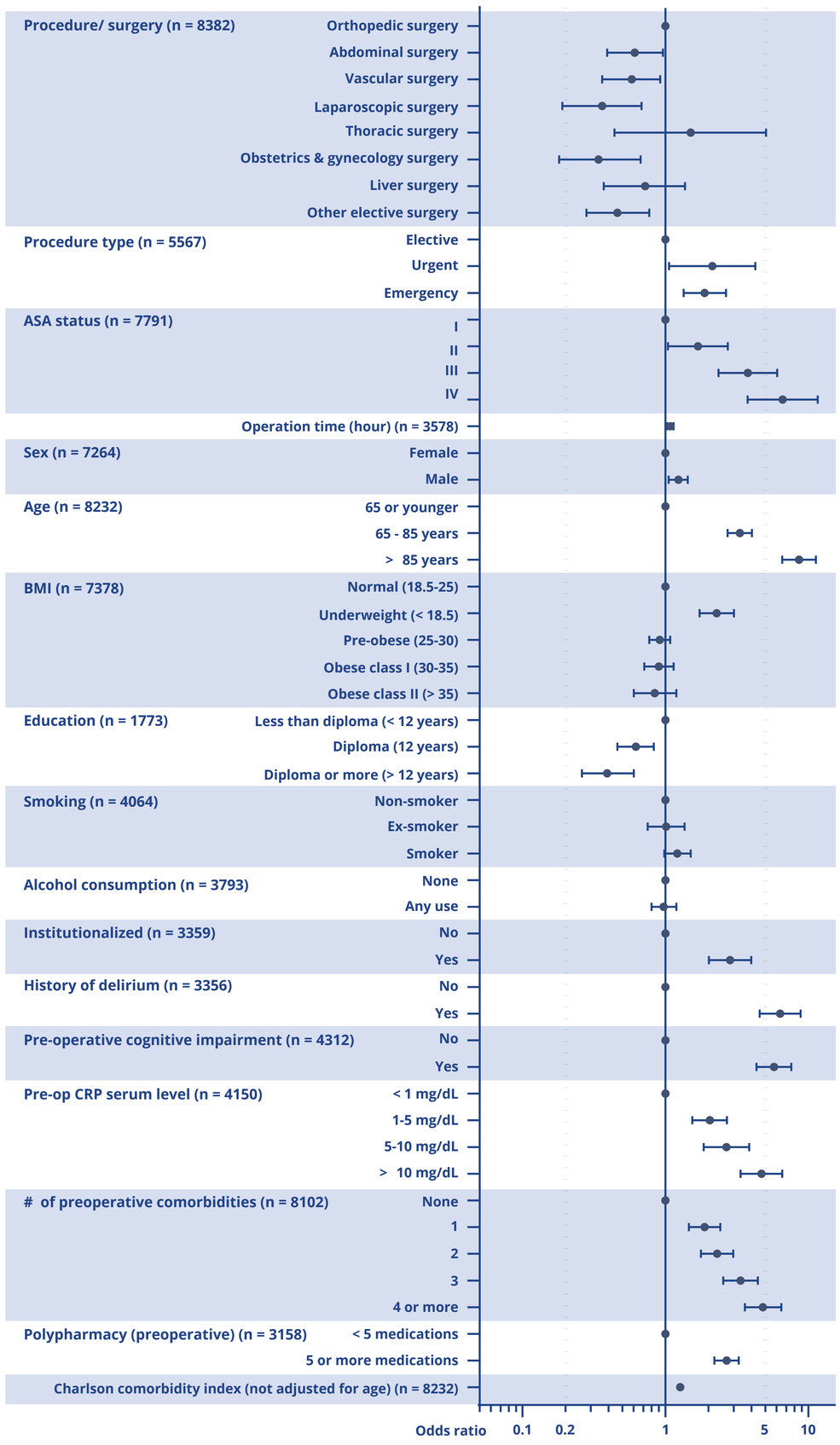


Table: The estimated associations for prognostic factors of post-operative delirium from univariate mixed-effects logistic regression with MICE imputation. MICE: multiple-variable imputation using chained equations; ASA: American Society of Anaesthesiologists; CRP: C-Reactive Protein

ACKNOWLEDGEMENTS

We would like to thank Dr Darren Hight, Dr Jessica McAlpine and Dr Kris Denhaerynck for providing their original study data. We also thank Katie O'Hearn and Dr James (Dayre) McNally for their support through InsightScope platform. Many thanks to Dr Kelly Reeve for insightful comments.

CONCLUSIONS

1 in 5

patients developed delirium (18%)

Prognostic factors identified:

- **Older age**
- **Low BMI**
- **ASA status IV**
- **Elevated pre-op CRP levels**
- **Pre-op cognitive impairment**
- **History of delirium**
- **Completing a college degree or higher**

[1] PIPRA AG, Tessinerpl. 7, 8002 Zürich, Switzerland [2] Department of Health Research Methods, Evidence, and Impact, McMaster University, Hamilton, Canada [3] Department of Anesthesia, McMaster University, Hamilton, Canada [4] Michael G. DeGroote Institute for Pain Research and Care, McMaster University, Hamilton, Canada [5] Department of Anesthesiology, University of Basel, Switzerland [6] Department of Anesthesiology, Perioperative and Pain Medicine, Brigham and Women's Hospital, Harvard Medical School, Boston, MA, USA [7] The University of Queensland, Australian Women and Girls' Health Research (AWaGHR) Centre, School of Public Health, Herston Road, Herston, Queensland, Australia [8] Department of Surgery, University of Groningen, University Medical Center Groningen, Groningen, The Netherlands [9] Transplant & Vascular Surgery, School of Medicine, Keimyung University, Dongsan Hospital, #1035, Dalgubeol-daero, Dalseo-gu, Daegu, South Korea [10] Division of Gastric Surgery, Shizuoka Cancer Center, 1007 Shimonagakubo, Nagaizumi-Cho, Shizuoka, Japan [11] Oslo Delirium Research Group, Department of Geriatric Medicine, Oslo University Hospital, Oslo, Norway [12] South West Sydney Clinical School, University of NSW Australia, NSW, Australia [13] Department of Anaesthesia, Liverpool Hospital, NSW, Australia [14] Escuela de Medicina, Universidad de Andrés Bello, Viña del Mar, Chile [15] Department of Surgery, Erasmus MC University Medical Center, Rotterdam, the Netherlands [16] Division of Orthopaedic Surgery, Department of Surgery, Toronto Western Hospital, University of Toronto, Ontario, Canada [17] Department of Advanced Blood Purification Therapy, Hirosaki Graduate School of Medicine, Hirosaki, Japan [18] Dipartimento di Scienze biotecnologiche di base, cliniche intensivologiche e perioperatorie, Università Cattolica del Sacro Cuore, Largo F. Vito 1, 00168, Rome, Italy [19] Dipartimento di scienze laboratoristiche ed infettivologiche, UOC Chimica, Biochimica e Biologia Molecolare Clinica, Fondazione Policlinico Universitario A. Gemelli IRCCS, Roma, Italy [20] Department of Public Health and Primary Care, Academic Centre for Nursing and Midwifery, KU Leuven, Leuven, Belgium [21] Department of Geriatric Medicine, University Hospitals Leuven, Leuven, Belgium [22] Nursing Science (INS), Department Public Health (DPH), Faculty of Medicine, University of Basel, Basel, Switzerland [23] Department of Surgery, Amphia Hospital, Breda, the Netherlands [24] Sydney Adventist Hospital, Wahroonga, New South Wales, Australia [25] Geriatrics Section, Veterans Affairs Portland Health Services Center and Oregon Health & Science University, Portland, Oregon, USA [26] Department of Functional Sciences, Centre for Modelling Biological Systems and Data Analysis, Victor Babes University of Medicine and Pharmacy, Timisoara, Romania [27] Department of Gynaecological Oncology, Health Care Global Enterprises Ltd (HCG), Bangalore, India [28] Division of Psychiatry, University College London, London, UK [29] Department of Psychological Medicine, East London NHS Foundation Trust, Royal London Hospital, London, UK [30] Zühlke Engineering AG, Zürcherstrasse 39J, 8952 Schlieren, Switzerland [31] Schulich School of Medicine and Dentistry, Western University, London, ON, Canada [32] Department of Critical Care, Cumming School of Medicine, University of Calgary, Calgary, AB, Canada [33] Department of Critical Care Medicine, University of Pittsburgh, Pittsburgh, United States [34] Department of Family Medicine, University of Ottawa, Ottawa, ON, Canada [35] Department of Surgery, Division of Neurosurgery, University of Ottawa, Ottawa, ON, Canada [36] Michael G. DeGroote National Pain Centre, McMaster University, Hamilton, Canada [37] Centre for Development of Best Practices in Health (CDBPH), Yaoundé Central Hospital, Yaoundé, Cameroon [38] Division of Epidemiology and Biostatistics, Department of Global Health, Stellenbosch University, Cape Town, South Africa [39] Department of Pediatrics, McMaster University, Hamilton, Canada [40] Vasilian CC, Tamasan SC, Lungeanu D, Poenaru DV. Clock-Drawing Test as a Bedside Assessment of Post-operative Delirium Risk in Elderly Patients with Accidental Hip Fracture. World J Surg. 2018;42(5):1340-1345 [41] Andreozzi V, Conteduca F, Iorio R, et al. Comorbidities rather than age affect medium-term outcome in octogenarian patients after total knee arthroplasty. Knee Surg Sports Traumatol Arthrosc. 2020;28(10):3142-3148 [42] McAlpine JN, Hodgson EJ, Abramowitz S, et al. The incidence and risk factors associated with postoperative delirium in geriatric patients undergoing surgery for suspected gynecologic malignancies. Gynecol Oncol. 2008;109(2):296-302 [43] Honda S, Furukawa K, Nishiwaki N, et al. Risk Factors for Postoperative Delirium After Gastrectomy in Gastric Cancer Patients. World J Surg. 2018;42(11):3669-3675 [44] Dworkin A, Lee DS, An AR, Goodlin SJ. A Simple Tool to Predict Development of Delirium After Elective Surgery. J Am Geriatr Soc. 2016;64(11):e149-e153 [45] Sato T, Hatakeyama S, Okamoto T, et al. Slow Gait Speed and Rapid Renal Function Decline Are Risk Factors for Postoperative Delirium after Urological Surgery. PLoS One. 2016;11(5):e0153961 [46] Martinez FT, Tobar C, Beddings CI, Vallejo G, Fuentes P. Preventing delirium in an acute hospital using a non-pharmacological intervention. Age Ageing. 2012;41(5):629-634 [47] Kim MY, Park UJ, Kim HT, Cho WH. DELirium Prediction Based on Hospital Information (Delphi) in General Surgery Patients. Medicine (Baltimore). 2016;95(12):e3072 [48] Mosk CA, van Vugt JLA, de Jonge H, et al. Low skeletal muscle mass as a risk factor for postoperative delirium in elderly patients undergoing colorectal cancer surgery. Clin Interv Aging. 2018;13:2097-2106 [49] Mangnall LT, Gallagher R, Stein-Parbury J. Postoperative delirium after colorectal surgery in older patients. Am J Crit Care. 2011;20(1):45-55 [50] Van Grootven B, Detroyer E, Devriendt E, et al. Is preoperative state anxiety a risk factor for postoperative delirium among elderly hip fracture patients? Geriatr Gerontol Int. 2016;16(8):948-955 [51] Hight DF, Sleigh J, Winders JD, et al. Inattentive Delirium vs. Disorganized Thinking: A New Axis to Subcategorize PACU Delirium. Front Syst Neurosci. 2018;12:22 [52] Sampson EL, Raven PR, Ndhlovu PN, et al. A randomized, double-blind, placebo-controlled trial of donepezil hydrochloride (Aricept) for reducing the incidence of postoperative delirium after elective total hip replacement. Int J Geriatr Psychiatry. 2007;22(4):343-349 [53] Dezube AR, Bravo-Iñiguez CE, Yelamanchili N, et al. Risk factors for delirium after esophagectomy. J Surg Oncol. 2020;121(4):645-653 [54] Chuan A, Zhao L, Tillekeratne N, et al. The effect of a multidisciplinary care bundle on the incidence of delirium after hip fracture surgery: a quality improvement study. Anaesthesia. 2020;75(1):63-71 [55] Watne LO, Torbergsen AC, Conroy S, et al. The effect of a pre- and postoperative orthogeriatric service on cognitive function in patients with hip fracture: randomized controlled trial (Oslo Orthogeriatric Trial). BMC Med. 2014;12:63 [56] Visser L, Prent A, van der Laan MJ, et al. Predicting postoperative delirium after vascular surgical procedures. J Vasc Surg. 2015;62(1):183-189 [57] Brattinga B, Plas M, Spikman JM, et al. The association between the inflammatory response following surgery and post-operative delirium in older oncological patients: a prospective cohort study. Age Ageing. 2022;51(2) [58] Dhakharia V, Sinha S, Bhaumik J. Postoperative Delirium in Indian Patients Following Major Abdominal Surgery for Cancer: Risk Factors and Associations. Indian J Surg Oncol. 2017;8(4):567-572 [59] Zywiel MG, Hurley RT, Perruccio AV, Hancock-Howard RL, Coyte PC, Rampersaud YR. Health economic implications of perioperative delirium in older patients after surgery for a fragility hip fracture. J Bone Joint Surg Am. 2015;97(10):829-836