

Professor Alasdair MJ MacLullich

Employment

Professor of Geriatric Medicine, University of Edinburgh	2009-date
MRC Clinician Scientist Fellow, University of Edinburgh	2005-2009
Hon Consultant in Geriatric Medicine, Royal Infirmary of Edinburgh	2005-date
Clinical Lecturer in Geriatric Medicine, University of Edinburgh	2000-2005

Education

BSc(Hons), Psychology, First Class	University of Edinburgh	1990
MB ChB	University of Edinburgh	1993
MRCP(UK)	Royal College of Physicians of Edinburgh	1996
PhD	University of Edinburgh	2003

Elected fellowships

Royal College of Physicians of Edinburgh, 2015

Selected awards and esteem indicators

President, European Delirium Association, 2012-15

Visiting Professor, Harvard Medical School, 2015

William Farr Medal from the Worshipful Society of Apothecaries, London. For UK-based medical practitioners 'who have made a particularly significant contribution in any clinically related or research discipline to the management of elderly people.' 2017

Maeve Leonard Award, European Delirium Association, 2018

Deliriumologist of the Year, Australasian Delirium Society, 2018

Cambridge Biomedical Research Centre Distinguished Visitor, 2018

Selected positions of responsibility

Head of Section, Geriatric Medicine, University of Edinburgh (2009-)

Member, British Geriatrics Society Research and Development Committee, 2013-

Specialist Member, Quality Standards Advisory Committee (QSAC) for Delirium, National Institute for Health and Care Excellence (NICE), 2013-2014

Member, Chief Scientist Office (Scotland) Translational Clinical Studies Research Committee, 2014-2020

Chair (Joint), Guideline Development Group, 'Assessment and management of delirium', Scottish Intercollegiate Guidelines Network, 2017-2019

Issue expert, AARP Global Council on Brain Health working group on delirium, Boston, USA, 2019 (one of 4 invited non-US experts)

Chair, Scottish Hip Fracture Audit, Scottish Government, 2020-

Executive Committee, Fragility Fracture Network (Global), 2023-

Selected national and international invited talks

Keynote Speaker, Age Anaesthesia Association, Edinburgh, UK, 2014

Grand Round, Vanderbilt University, Nashville, USA, 2014

Keynote International Speaker, Australian and New Zealand Society for Geriatric Medicine Annual Scientific Meeting, Perth, Australia, 2015

Keynote Speaker, European Delirium Association, Villamoura, Portugal, 2016

Grand Round, Stanford Medicine, Stanford, USA, 2018
Plenary speaker, Fragility Fracture Network Global Congress, Dublin, 2018
American Delirium Society International Webinar Speaker, 2020
Grand Round (virtual), Sinai Hospital, Toronto, Canada, 2022
Plenary speaker (virtual), Brazilian Congress of Geriatrics and Gerontology, Brazil, 2023
Plenary speaker (virtual), Japan Academy of Gerontological Nursing national conference, 2023
Invited speaker, Network for Investigation of Delirium: Unifying Scientists (NIDUS) international working group on delirium treatment, Providence, USA, 2023
Grand Round, Cleveland Clinics, Cleveland, USA, 2023
Keynote Speaker, Annual Congress of the German Geriatric Society, Frankfurt, Germany, 2023
Plenary Speaker, Fragility Fracture Network Global Congress, Oslo, Norway, 2023
Plenary Speaker, Australasian Delirium Association, Sydney, Australia, 2023
Keynote Speaker, Annual Meeting of the Norwegian Geriatrics Society, Oslo, Norway, 2024
(forthcoming)

Clinical Work

I work 0.4 FTE for NHS Lothian as an Honorary Consultant in Geriatric Medicine. My current main clinical work is to provide medical liaison to acute hip fracture patients and also patients in the Major Trauma Unit in the Royal Infirmary of Edinburgh. I also do acute geriatric medicine on-call.

Impact and Policy Contributions

Founder (with two others), European Delirium Association, 2006. This was the world's first international organisation devoted to delirium research and practice. It has had successful annual meetings since 2006. The success of this organisation stimulated two other international associations, the American Delirium Society in 2011, and the Australasian Delirium Association in 2012.

Co-founder of Scottish Delirium Association in 2011, and together with Healthcare Improvement Scotland worked on producing new educational and clinical resources that were implemented across Scotland from 2012.

Main author of the 4 'A's Test (4AT), a bedside assessment tool for the detection of delirium. This was first made available on a website I set up (www.the4AT.com) in 2011. The first formal validation study was published in 2014. Since then the 4AT has become the best-validated delirium tool in the literature, with 26 studies involving >5000 patients. It has approximately double the validation data of the next two best-validated tools. It is recommended by multiple guidelines and pathways. The 4AT is the main delirium tool recommended by NICE since Jan 2023. The website www.the4AT.com, which I continue to run independently, has attracted >700,000 visits since 2011. The 4AT is now the standard delirium assessment tool across the UK; for example it is now mandated in all over 75 emergency patients attending hospitals in England (~5M/yr). With many other healthcare systems adopting the 4AT it has become a standard tool across the world, likely in the top 3 most-used in practice.

Main author of the Observational Scale for level of Arousal (OSLA). This brief tool is also recommended by NICE and multiple other guidelines and pathways as a clinical and research tool.

Chair of the Scottish Hip Fracture Audit since 2020. In my role I have facilitated the expansion of our research output through expanding access to our data for research purposes via Public Health Scotland. I led the development of a new pain protocol now being implemented in multiple centres across Scotland. I have also modified several standards and audit recording processes.

Founder (with three others), new journals Delirium, and Delirium Communications, in 2020. Current role is Deputy Editor. These journals are the first to focus on delirium. The journals have now accepted and published papers which are available on Pubmed and other databases. Co-founder, World Delirium Awareness Day, and ongoing involvement of this campaign which has run annually since 2016, with ~30M impressions on Twitter. In 2023 I set up a new website (www.deliriumday.com) to increase the impact of this event.

Current and relevant grants

- 2022 Dunhill Medical Trust, £500K. Acute illness, delirium and long-term cognitive decline in later life: causes and consequences. Funding for 5 PhD studentships. Chief Investigator.
- 2022 Wellcome Trust. Multimorbidity, delirium, and outcomes in hospitalised patients: a big data project using routine clinical and national audit data. Multimorbidity Clinical PhD programme for Rose Penfold. 2022-2024. £150K. (Primary supervisor).
- 2021 NIHR. Development and testing of an intervention to improve Recovery after an Episode of Delirium (RecoverED study). 2021-2025. £2.5M. Co-investigator.
- 2020 NIHR. The impact of REstrictive versUs Liberal Transfusion strategy on cardiac Injury in patients undergoing surgery for Hip Fracture (RESULT-HF). 2021-2015. £2.2M. Co-investigator.
- 2020 Medical Research Council. Delirium as an acute brain injury in hospital inpatients: can clinical features and biomarkers predict outcomes? Precision Medicine PhD for Temi Ibitoye. 2020-2024. £87K. (Primary supervisor).
- 2019 Dunhill Medical Trust, £178K. Assessing recovery from delirium in older hospitalised people: optimisation and validation of the 4AT. Principal Investigator.
- 2018 Chief Scientist Office, Scotland, £40K. Diagnostic accuracy study of a MALDI-MS biomarker of acute kidney injury after femoral fracture surgery. Co-Investigator.
- 2017 NIHR, £1.7M. HTA Project: Alpha 2 agonists for sedation to produce better outcomes from critical illness (A2B Trial): A randomised, parallel-group, allocation concealed, controlled, open, phase 3 pragmatic clinical and cost-effectiveness trial with internal pilot. Co-Investigator.
- 2017 NIA, \$50K. Advancing understanding of delirium severity: the contribution of domains of the delirium syndrome to outcomes. Co-Investigator.
- 2016 Alzheimer's Research UK, £260K: The impact of acute systemic inflammation upon cerebrospinal fluid and blood biomarkers of brain inflammation and injury in dementia: a study in acute hip fracture and memory clinic patients. Co-Investigator.
- 2016 Dunhill Medical Trust, £186K: Associations Between Brain Computed Tomography (CT) Abnormalities and Delirium: A Study in 3000 Older Emergency Medical Patients. Co-Investigator.
- 2015 Wellcome Trust, £0.9M: The population impact of delirium on long-term cognitive impairment (Intermediate Clinical Research Fellowship for Daniel Davis), Co-Investigator
- 2014 MRC, £1.04M: Development of a software application for detection and monitoring of attentional deficits in delirium. Principal Investigator.
- 2013 Lifelong Health and Wellbeing, £3.4M: Centre for Cognitive Ageing and Cognitive Epidemiology (renewal grant). Co-Investigator.
- 2013 NIHR, £0.82M: Development and validation of the 4AT: a new rapid screening tool for delirium. Principal Investigator.
- 2013 NIHR, £1.96M: Peri-operative Enhanced Recovery hip Fracture Care of patients with Dementia (PERFECTED). Co-Investigator.
- 2012 Age UK, £220K: Delirium as a marker of undiagnosed dementia in the general hospital setting: Evaluation and validation of pragmatic methods for screening and follow-up (Research Fellowship for Thomas Jackson), Co-Investigator

- 2011 Dunhill Medical Trust, £200K: Delirium and long-term cognitive impairment after stroke: the role of dysregulation of the hypothalamic-pituitary-adrenal axis. (Research Fellowship for Amanda Barugh)
- 2011 Lifelong Health and Wellbeing, £1.4M: Lifelong health and wellbeing of the 6-Day Sample of the Scottish Mental Survey 1947. Co-Investigator.

Books and book chapters

- 2015 Murdoch I, Turpin S, Johnston B, MacLulich AM, Losma E. Geriatric Emergencies. Wiley.
- 2017 MacLulich AM, Marcantonio ER, & Meagher DJ. Chapter: Delirium. In: Oxford Textbook of Geriatric Medicine. Eds: Michel J-P, Beattie BL, Martin FC, and Walston JD. Oxford University Press.
- 2019 Ellis G, MacLulich AM, Harwood. Chapter: Older People in Hospital. In: Oxford Textbook of Medicine. Eds: Warrell DA, Cox TM, Firth JD. Oxford University Press.

Recent publications

- Penfold RS, Squires C, Angus A, Shenkin SD, Ibitoye T, Tiegies Z, Neufeld KJ, Avelino-Silva TJ, Davis D, Anand A, Duckworth AD, Guthrie B, **MacLulich AMJ**. Delirium detection tools show varying completion rates and positive score rates when used at scale in routine practice in general hospital settings: A systematic review. *Journal of the American Geriatrics Society*, *in press*
- Harris E, Clement N, **MacLulich A**, Farrow L. The impact of an ageing population on future increases in hip fracture burden. *Bone Joint J*. 2024 Jan 1;106-B(1):62-68. doi: 10.1302/0301-620X.106B1.BJJ-2023-0740.R1. PMID: 38160690.
- Walsh TS, Aitken LM, McKenzie CA, Boyd J, Macdonald A, Giddings A, Hope D, Norrie J, Weir C, Parker RA, Lone NI, Emerson L, Kydonaki K, Creagh-Brown B, Morris S, McAuley DF, Dark P, Wise MP, Gordon AC, Perkins G, Reade M, Blackwood B, **MacLulich A**, Glen R, Page VJ. Alpha 2 agonists for sedation to produce better outcomes from critical illness (A2B Trial): protocol for a multicentre phase 3 pragmatic clinical and cost-effectiveness randomised trial in the UK. *BMJ Open*. 2023 Dec 10;13(12):e078645. doi: 10.1136/bmjopen-2023-078645. PMID: 38072483.
- Farrow L, Clement ND, Mitchell L, Sattar M, **MacLulich AMJ**. Does the time to surgery influence outcomes for patients with a hip fracture who undergo total hip arthroplasty? *Bone Joint J*. 2023 Nov 1;105-B(11):1201-1205. doi: 10.1302/0301-620X.105B11.BJJ-2023-0597.R1. PMID: 37907072.
- Hall AJ, Clement ND, **MacLulich AMJ**, White TO, Duckworth AD. Vaccination against COVID-19 reduced the mortality risk of COVID-positive hip fracture patients to baseline levels: the nationwide data-linked IMPACT Protect study. *Osteoporos Int*. 2023 Oct 28. doi: 10.1007/s00198-023-06954-w. Epub ahead of print. PMID: 37897507.
- Johansen A, Sahota O, Dockery F, Black AJ, **MacLulich AMJ**, Javaid MK, Ahern E, Gregson CL. Call to action: a five nations consensus on the use of intravenous zoledronate after hip fracture. *Age Ageing*. 2023 Sep 1;52(9):afad172. doi: 10.1093/ageing/afad172. PMID: 37776543; PMCID: PMC10542103.
- Clement ND, Penfold RS, Duffy A, Murthy K, **MacLulich AMJ**, Duckworth AD. Completion of the Emergency Department "Big 6" in Patients with an Acute Hip Fracture Is Associated with a Lower Mortality Risk and Shorter Length of Hospital Stay. *J Clin Med*. 2023 Aug 26;12(17):5559. doi: 10.3390/jcm12175559. PMID: 37685625; PMCID: PMC10488202.
- Makaram NS, Hall AJ, Clement ND, **MacLulich AMJ**, Simpson AHRW. Lessons learned from hip fracture registries - From the Scottish perspective to global practice. *Injury*. 2023 Jul 12:110935. doi: 10.1016/j.injury.2023.110935. Epub ahead of print. PMID: 37451905.

- Bowman EML, Brummel NE, Caplan GA, Cunningham C, Evered LA, Fiest KM, Girard TD, Jackson TA, LaHue SC, Lindroth HL, **MacLulich AMJ**, McAuley DF, Oh ES, Oldham MA, Page VJ, Pandharipande PP, Potter KM, Sinha P, Slooter AJC, Sweeney AM, Tiegies Z, Van Dellen E, Wilcox ME, Zetterberg H, Cunningham EL. Advancing specificity in delirium: The delirium subtyping initiative. *Alzheimers Dement*. 2023 Jul 31. doi: 10.1002/alz.13419. Epub ahead of print. PMID: 37522255.
- Penfold RS, Hall AJ, Anand A, Clement ND, Duckworth AD, MacLulich AMJ. Delirium in hip fracture patients admitted from home during the COVID-19 pandemic is associated with higher mortality, longer total length of stay, need for post-acute inpatient rehabilitation, and readmission to acute services. *Bone Jt Open*. 2023 Jun 16;4(6):447-456. Noble E, McCartney H, **MacLulich AM**, Shenkin SD, Muniz-Terrera G, Evans JJ, Davis D, Sandeman D, Tiegies Z. Assessing Recovery from Delirium: An International Survey of Healthcare Professionals Involved in Delirium Care. *Delirium Commun*. 2022 Dec 19;1:56675.
- Hall AJ, Clement ND, Kay RS, Penfold RS, **MacLulich AMJ**, White TO, Duckworth AD. COVID-19 is associated with increased care needs and a decreased likelihood of returning home following a hip fracture: The IMPACT frailty study. *Musculoskeletal Care*. 2023 Mar 11.
- Tsui A, Yeo N, Searle SD, Bowden H, Hoffmann K, Hornby J, Goslett A, Weston-Clarke M, Lanham D, Hogan P, Seeley A, Rawle M, Chaturvedi N, Sampson EL, Rockwood K, Cunningham C, Ely EW, Richardson SJ, Brayne C, Muniz Terrera G, Tiegies Z, **MacLulich AMJ**, Davis D. Extremes of baseline cognitive function determine the severity of delirium: a population study. *Brain*. 2023 Feb 28:awad062.
- Ditzel FL, Slooter AJC, van den Boogaard M, Boonstra M, van Nesselrooij TA, Kromkamp M, Pop-Purceanu M, Rood PJT, Osse RJ, Chan CK, **MacLulich AMJ**, Tiegies Z, Neufeld KJ, Hut SCA. The Delirium Interview as a new reference standard in studies on delirium assessment tools. *J Am Geriatr Soc*. 2023 Feb 21.
- MacLulich AMJ**, Hosie A, Tiegies Z, Davis DHJ. Three key areas in progressing delirium practice and knowledge: recognition and relief of distress, new directions in delirium epidemiology and developing better research assessments. *Age Ageing*. 2022 Nov 2;51(11):afac271.
- Vardy ER, Santhirasekaran S, Cheng M, Anand A, **MacLulich AM**. NEWS2 shows low sensitivity and high specificity for delirium detection: a single site observational study of 13,908 patients. *Clin Med (Lond)*. 2022 Nov;22(6):544-548.
- Farrow L, Brasnic L, Martin C, Ward K, Adam K, Hall AJ, Clement ND, **MacLulich AMJ**. A nationwide study of blood transfusion in hip fracture patients : linked analysis from the Scottish Hip Fracture Audit and the Scottish National Blood Transfusion Service. *Bone Joint J*. 2022 Nov;104-B(11):1266-1272.
- Hall AJ, Clement ND; IMPACT Revisited Group; **MacLulich AMJ**, White TO, Duckworth AD. COVID-19 during the index hospital admission confers a 'double-hit' effect on hip fracture patients and is associated with a two-fold increase in 1-year mortality risk. *Musculoskeletal Care*. 2022 Sep;20(3):705-717.
- Hall AJ, Clement ND, **MacLulich AMJ**, Simpson AHRW, Johansen A, White TO, Duckworth AD. The delivery of an emergency audit response to a communicable disease outbreak can inform future orthopaedic investigations and clinical practice : lessons from IMPACT Hip Fracture Global Audits. *Bone Joint Res*. 2022 Jun;11(6):346-348.
- Hall AJ, Clement ND, **MacLulich AMJ**, Simpson AHRW, White TO, Duckworth AD. The IMPACT of COVID-19 on trauma & orthopaedic surgery provides lessons for future communicable disease outbreaks : minimum reporting standards, risk scores, fragility trauma services, and global collaboration. *Bone Joint Res*. 2022 Jun;11(6):342-345.

- Hall AJ, Clement ND; IMPACT-Global Group; Ojeda-Thies C, **MacLulich AM**, Toro G, Johansen A, White TO, Duckworth AD. IMPACT-Global Hip Fracture Audit: Nosocomial infection, risk prediction and prognostication, minimum reporting standards and global collaborative audit: Lessons from an international multicentre study of 7,090 patients conducted in 14 nations during the COVID-19 pandemic. *Surgeon*. 2022 Dec;20(6):e429-e446.
- Tsui A, Searle SD, Bowden H, Hoffmann K, Hornby J, Goslett A, Weston-Clarke M, Howes LH, Street R, Perera R, Tae K, Kustermann C, Chitalu P, Razavi B, Magni F, Das D, Kim S, Chaturvedi N, Sampson EL, Rockwood K, Cunningham C, Ely EW, Richardson SJ, Brayne C, Terrera GM, Tiegies Z, **MacLulich A**, Davis D. The effect of baseline cognition and delirium on long-term cognitive impairment and mortality: a prospective population-based study. *Lancet Healthy Longev*. 2022 Apr;3(4):e232-e241.
- Anand A, Cheng M, Ibitoye T, **MacLulich AMJ**, Vardy ERLC. Positive scores on the 4AT delirium assessment tool at hospital admission are linked to mortality, length of stay and home time: two-centre study of 82,770 emergency admissions. *Age Ageing*. 2022 Mar 1;51(3):afac051.
- Cross JL, Hammond SP, Shepstone L, Poland F, Henderson C, Backhouse T, Penhale B, Donell S, Knapp M, Lewins D, **MacLulich A**, Patel M, Sahota O, Smith TO, Waring J, Howard R, Ballard C, Fox C. PERFECTED enhanced recovery pathway (PERFECT-ER) versus standard acute hospital care for people after hip fracture surgery who have cognitive impairment: a feasibility cluster randomised controlled trial. *BMJ Open*. 2022 Feb 28;12(2):e055267.
- Chang Y, Ragheb SM, Oravec N, Kent D, Nugent K, Cornick A, Hiebert B, Rudolph JL, **MacLulich AMJ**, Arora RC. Diagnostic accuracy of the "4 A's Test" delirium screening tool for the postoperative cardiac surgery ward. *J Thorac Cardiovasc Surg*. 2021 Jun 1:S0022-5223(21)00876-X.
- Peterson A, Marengoni A, Shenkin S, **MacLulich A**. Delirium in COVID-19: common, distressing and linked with poor outcomes. . . can we do better? *Age Ageing*. 2021 Sep 11;50(5):1436-1438.
- Hasemann W, Duncan N, Clarke C, Nouzova E, Süßenbach LM, Keerie C, Assi V, Weir CJ, Evans J, Walsh T, Wilson E, Quasim T, Middleton D, Weir AJ, Barnett JH, Stott DJ, **MacLulich AMJ**, Tiegies Z. Comparing performance on the Months of the Year Backwards test in hospitalised patients with delirium, dementia, and no cognitive impairment: an exploratory study. *Eur Geriatr Med*. 2021 Dec;12(6):1257-1265.
- Hall AJ, Clement ND, **MacLulich AMJ**, Ojeda-Thies C, Hoefler C, Brent L, White TO, Duckworth AD. IMPACT of COVID-19 on hip fracture services: A global survey by the International Multicentre Project Auditing COVID-19 in Trauma & Orthopaedics. *Surgeon*. 2022 Aug;20(4):237-240.
- Tiegies Z, Lowrey J, **MacLulich AMJ**. What delirium detection tools are used in routine clinical practice in the United Kingdom? Survey results from 91% of acute healthcare organisations. *Eur Geriatr Med*. 2021 Dec;12(6):1293-1298.
- Tiegies Z, **MacLulich AMJ**, Anand A, Brookes C, Cassarino M, O'connor M, Ryan D, Saller T, Arora RC, Chang Y, Agarwal K, Taffet G, Quinn T, Shenkin SD, Galvin R. Diagnostic accuracy of the 4AT for delirium detection in older adults: systematic review and meta-analysis. *Age Ageing*. 2021 May 5;50(3):733-743.
- Morandi A, Grossi E, Lucchi E, Zambon A, Faraci B, Severgnini J, **MacLulich A**, Smith H, Pandharipande P, Rizzini A, Galeazzi M, Massariello F, Corradi S, Raccichini A, Scrimieri A, Morichi V, Gentile S, Lucchini F, Pecorella L, Mossello E, Cherubini A, Bellelli G. The 4-DSD: A New Tool to Assess Delirium Superimposed on Moderate to Severe Dementia. *J Am Med Dir Assoc*. 2021 Jul;22(7):1535-1542.e3
- Tew YY, Chan JH, Keeling P, Shenkin SD, **MacLulich A**, Mills NL, Denvir MA, Anand A. Predicting readmission and death after hospital discharge: a comparison of conventional frailty

measurement with an electronic health record-based score. *Age Ageing*. 2021 Sep 11;50(5):1641-1648.

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