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Short Communication

Multimorbidity and Longitudinal Healthcare Utilisation in Adults Aged 50+ Attending a Falls Clinic

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Abstract

Adults attending outpatient falls clinics are at increased risk of subsequent emergency department (ED) attendance and hospital admission. This single-centre retrospective longitudinal cohort study examined healthcare utilisation in 109 adults aged ≥50 years attending the Falls and Syncope Unit (FASU) at St James's Hospital, Dublin (mean age 69.9 years, SD 10.9; 55.0% female). Multimorbidity was assessed using the Cumulative Illness Rating Scale for Geriatrics (CIRS-G), physical frailty using the SHARE Frailty Instrument (SHARE-FI), and low muscle quantity using sex-specific EWGSOP2 appendicular skeletal muscle mass (ASMM) cut-points (<20 kg in men; <15 kg in women), with ASMM estimated by bioelectrical impedance analysis. Electronic patient records provided 1-year and 3-year ED attendance and 3-year hospital admission outcomes. Complete-case multivariable logistic regression was performed in 102 participants. Higher CIRS-G score was associated with 1-year ED attendance (OR 1.25, 95% CI 1.06-1.47; p=0.007), 3-year ED attendance (OR 1.16, 95% CI 1.03-1.32; p=0.019), and 3-year hospital admission (OR 1.14, 95% CI 1.002-1.30; p=0.046). Age, sex, physical frailty and low ASMM were not statistically significantly associated with these outcomes. Given the small sample, limited event counts and single-hospital outcome capture, these associations are hypothesis-generating and require confirmation in larger multicentre cohorts before clinical risk-stratification use.

Keywords: Multimorbidity, Physical Frailty, Low Muscle Mass, Falls, Emergency Department

Adults attending outpatient falls services often have complex clinical profiles and substantial subsequent healthcare use. Falls are an important source of healthcare utilisation among older adults in Ireland[1]. Specialist falls-clinic populations are also more clinically selected than community-dwelling samples because referral commonly follows falls, syncope, dizziness, gait or balance problems and related vulnerability; findings from such cohorts therefore may not generalise directly to the wider community. Multimorbidity, frailty and low muscle mass have each been associated with adverse healthcare outcomes, but their relative longitudinal associations in specialist falls-clinic populations remain uncertain.

The FRAILMatics clinical research programme has characterised adults attending the Falls and Syncope Unit (FASU) at St James's Hospital, Dublin, using measures of physical frailty, body composition and orthostatic physiology[2-5]. Previous analyses have focused mainly on baseline or physiological associations. We therefore examined associations of age, multimorbidity, physical frailty and low ASMM with 1-year and 3-year ED attendance and 3-year hospital admission.

The analytic cohort comprised 109 participants

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assessed at FASU between November 2021 and August 2022. FASU is a specialist multidisciplinary referral service for people with falls, syncope, dizziness and related disorders. St James's Hospital is Ireland's largest acute academic teaching hospital, based in Dublin's south inner city, and provides acute, emergency and specialist services at local, regional and national levels. Participants were aged 50 years or older, provided written informed consent, and were independently mobile with or without a mobility aid at assessment. Contraindications to bioelectrical impedance analysis (BIA), including an implanted battery-operated electronic device such as a pacemaker, were exclusion criteria. Longitudinal outcomes were obtained from the St James's Hospital electronic patient record (EPR) for 3 years following baseline assessment. Participants whose records could not be linked because of missing or invalid medical record numbers were excluded from follow-up. Reliable residential catchment information was not available in the research dataset, so the proportion of FASU participants residing within the St James's Hospital catchment area could not be quantified.

Age and sex were recorded at baseline; for the revised analyses, sex was modelled as female = 1 and male = 0. Multimorbidity was measured using the Cumulative Illness Rating Scale for Geriatrics (CIRS-G)[6]. Physical frailty was assessed using the SHARE Frailty Instrument for primary care (SHARE-FI)[7], dichotomised as robust (0) versus pre-frail or frail (1). This contrast was selected a priori to compare participants with any physical-frailty vulnerability against robust participants while maintaining a parsimonious model in a small cohort; we acknowledge that collapsing pre-frail and frail categories loses information and may reduce power. Body composition was measured using the TANITA DC-430MA Body Composition Analyser (Tanita Europe, Amsterdam, The Netherlands). Appendicular skeletal muscle mass (ASMM) was estimated from BIA using the previously described Sergi approach[3,8]. Low ASMM was defined using the EWGSOP2 absolute muscle-quantity cut-points of <20 kg in men and <15 kg in women[9]. A binary low-ASMM variable was used to apply these prespecified clinically interpretable thresholds consistently across sexes; as with frailty dichotomisation, this categorisation may reduce statistical information. Throughout this report, the exposure is therefore described as low ASMM or low muscle quantity rather than sarcopenia, because the complete EWGSOP2 sarcopenia diagnosis additionally requires assessment of muscle strength[9].

Outcomes were binary variables indicating ED attendance within 1 year of assessment, ED attendance within 3 years, and hospital admission within 3 years (0: no; 1: yes). EPR follow-up was completed in April 2026, allowing a minimum of three years of potential follow-up for all included participants. Only encounters recorded in the St James's Hospital EPR were captured. ED attendances or admissions to other hospitals could therefore have been missed, potentially misclassifying some participants with external healthcare use as having no event in the study EPR.

Data were analysed using IBM SPSS Statistics for Windows, version 29.0 (IBM Corp., Armonk, NY, USA). Continuous variables were summarised using mean, range and standard deviation (SD), and their distributions were reviewed using histograms, normal-probability plots, boxplots and Shapiro-Wilk tests; categorical variables were summarised using counts and percentages. Age showed no statistically significant departure from normality (Shapiro-Wilk p=0.071), whereas CIRS-G (p=0.020) and ASMM (p=0.009) did; normality of predictors is not an assumption of logistic regression. Complete-case multivariable logistic regression was performed separately for each outcome, with age, female sex, CIRS-G score, dichotomised physical frailty and low ASMM entered simultaneously. Five participants had missing ASMM data and two had missing longitudinal outcome data; the remaining predictors were complete, yielding n=102 for each model. Odds ratios (ORs), 95% confidence intervals (CIs) and p-values were reported, with $p<0.05$ considered statistically significant. Omnibus likelihood-ratio chi-square tests compared each fitted model with the intercept-only model, and calibration was examined with Hosmer-Lemeshow goodness-of-fit tests. Linearity of the logit for age and CIRS-G was examined using Box-Tidwell-type predictor-by-log-predictor interaction terms; none was statistically significant in any model. Casewise studentised-residual diagnostics were also reviewed. No material multicollinearity was identified on tolerance/VIF diagnostics (tolerance 0.756–0.938; VIF 1.066–1.323).

Among the 109 participants, 60 (55.0%) were female, mean age was 69.9 years (SD 10.9), and mean CIRS-G score was 7.0 (SD 4.0). ASMM data were available for 104 participants, of whom 12 (11.5%) met the prespecified low-ASMM cut-points. Fifty-one of 109 participants (46.8%) were pre-frail or frail by dichotomised SHARE-FI. Longitudinal outcome data were available for 107 participants: 20/107 (18.7%) attended the ED within 1 year, while 51/107 (47.7%) attended the ED within 3 years and 51/107 (47.7%) had a hospital admission within 3 years (Table 1). Verification showed that the identical 3-year marginal totals represented different, overlapping outcomes: 40 participants experienced both, 11 had ED attendance without admission, 11 had admission without recorded ED attendance, and 45 had neither. Five participants were missing ASMM and two were missing longitudinal outcomes, leaving 102 complete cases for each regression. Within those complete cases there were 19 1-year ED events, 49 3-year ED events and 47 3-year hospital admissions.

Higher CIRS-G score was associated with greater adjusted odds of 1-year ED attendance (OR 1.25, 95% CI 1.06–1.47; p=0.007), 3-year ED attendance (OR

Characteristic	Value
Age, years	69.9 (range 50-93; SD 10.9)
Female	60/109 (55.0%)
Male	49/109 (45.0%)
CIRS-G score	7.0 (range 0-20; SD 4.0)
Low ASMM (<15 kg women; <20 kg men)	12/104 (11.5%)
Low ASMM status missing	5/109 (4.6%)
Robust by dichotomised SHARE-FI	58/109 (53.2%)
Pre-frail or frail by dichotomised SHARE-FI	51/109 (46.8%)
1-year ED attendance	20/107 (18.7%)
1-year ED attendance missing	2/109 (1.8%)
3-year ED attendance	51/107 (47.7%)
3-year ED attendance missing	2/109 (1.8%)
3-year hospital admission	51/107 (47.7%)
3-year hospital-admission outcome missing	2/109 (1.8%)

***Abbreviations**: CIRS-G, Cumulative Illness Rating Scale for Geriatrics; ASMM, appendicular skeletal muscle mass; SHARE-FI, SHARE Frailty Instrument; ED, emergency department; SD, standard deviation. Percentages for low ASMM and longitudinal outcomes use available-case denominators.*

Table 1. Participant characteristics and longitudinal outcomes.

Outcome	Predictor	OR	95% CI	p-value
1-year ED attendance Omnibus chi-square^{5}=8.9; p=0.112	Age	0.97	0.92-1.03	0.305
	Female sex	1.22	0.40-3.73	0.724
	CIRS-G	1.25	1.06-1.47	0.007[a]
	Dichotomised SHARE-FI	0.86	0.27-2.75	0.803
	Low ASMM	0.83	0.15-4.68	0.829
3-year ED attendance Omnibus chi-square^{5}=9.8; p=0.082	Age	1.00	0.96-1.04	0.919
	Female sex	1.04	0.43-2.51	0.927
	CIRS-G	1.16	1.03-1.32	0.019[a]
	Dichotomised SHARE-FI	1.29	0.52-3.21	0.587
	Low ASMM	1.51	0.40-5.70	0.544
3-year hospital admission Omnibus chi-square^{5}=19.0; p=0.002[a]	Age	1.02	0.98-1.07	0.282
	Female sex	0.41	0.16-1.06	0.067
	CIRS-G	1.14	1.002-1.30	0.046[a]
	Dichotomised SHARE-FI	2.37	0.89-6.29	0.083
	Low ASMM	0.60	0.16-2.29	0.451

***Abbreviations**: OR, odds ratio; CI, confidence interval; ED, emergency department; CIRS-G, Cumulative Illness Rating Scale for Geriatrics; SHARE-FI, SHARE Frailty Instrument; ASMM, appendicular skeletal muscle mass. ORs for age and CIRS-G represent one-unit increases in the recorded variables. [a] Statistically significant (p < 0.05).*

Table 2. Multivariable logistic regression analyses of healthcare utilisation outcomes. All models used complete cases (n=102) and simultaneously included age, female sex, CIRS-G score, dichotomised SHARE-FI status and low ASMM. The OR for sex represents female versus male. Hosmer-Lemeshow goodness-of-fit p-values were 0.664, 0.474 and 0.794 for the 1-year ED, 3-year ED and 3-year hospital-admission models, respectively.

1.16, 95% CI 1.03-1.32; p=0.019), and 3-year hospital admission (OR 1.14, 95% CI 1.002-1.30; p=0.046). Age, female sex, dichotomised physical frailty and low ASMM were not statistically significantly associated with any outcome (Table 2). The overall 3-year hospital-admission model was statistically significant (chi-square^5=19.0, p=0.002), whereas the overall 1-year and 3-year ED models did not reach conventional statistical significance (chi-square^5=8.9, p=0.112 and chi-square^5=9.8, p=0.082, respectively). An individual coefficient can be statistically significant when the omnibus model test is not because the tests address different hypotheses; in this small dataset, this discordance further supports cautious, exploratory interpretation. Hosmer-Lemeshow tests did not indicate lack of fit for the 1-year ED, 3-year ED, or 3-year admission models (p=0.664, p=0.474, and p=0.794, respectively). The Box-Tidwell-type interaction terms were non-significant for age (p=0.137, 0.518, and 0.535 across the three models) and CIRS-G (p=0.892, 0.846, and 0.364), providing no evidence of departure from logit-linearity. Casewise diagnostics identified six observations with studentised residuals >2 in the 1-year ED model, none in the 3-year ED model, and one in the 3-year admission model; these findings reinforce the need for cautious interpretation, particularly for the low-event 1-year model.

The association between multimorbidity and subsequent healthcare use is consistent with larger external evidence. A 2025 Canadian population-based study of 57,138 adults aged ≥50 years examined frequent ED use and found multimorbidity to be independently associated with frequent attendance[10]. A 2022 systematic review of 10 studies examined household and area determinants of ED attendance and hospitalisation among people with multimorbidity and found that deprivation-related factors were often associated with greater use, although evidence was heterogeneous[11]. A 2015 review of 36 validated risk-stratification studies, 29 of which examined hospital admission or readmission, also showed that multimorbidity frequently contributed to risk models[12]. In the present cohort, each one-point higher CIRS-G score corresponded to approximately 25% higher adjusted odds of 1-year ED attendance, 16% higher odds of 3-year ED attendance and 14% higher odds of 3-year hospital admission. These effect sizes may be clinically relevant, but the confidence intervals, small sample and exploratory modelling preclude use as validated risk estimates.

Physical frailty was not independently associated with ED attendance or hospital admission in this cohort, but this does not establish absence of an effect. Multimorbidity and frailty overlap conceptually because both capture aspects of accumulated health vulnerability; entering CIRS-G and SHARE-FI simultaneously estimates their independent associations and shared variance may attenuate individual coefficients. The dichotomisation of SHARE-FI may also have reduced information. In 2008, Hastings et al. studied 1,851 community-dwelling adults aged ≥65 years discharged from EDs and found a deficit-accumulation frailty index predicted serious adverse outcomes but not repeat outpatient ED visits within 30 days[13]. A 2024 prospective multicentre study of 1,835 adults aged >65 years attending three Swedish EDs found that frailty measured by the Clinical Frailty Scale was associated with more revisits, admissions and mortality[14]. A 2018 meta-analysis including 32,998 older people across eight studies found progressively greater hospitalisation risk from robust to pre-frail to frail groups[15]. Against this literature, the broad CIs in our sample of 109 participants - including only 19 1-year ED events among 102 complete cases - are compatible with clinically important effects that the present study was underpowered to detect. SHARE-FI primarily reflects the physical frailty phenotype; deficit-accumulation or Clinical Frailty Scale approaches may capture different dimensions and could yield different associations.

Low ASMM was also not independently associated with the measured outcomes. This exposure represents low muscle quantity rather than the complete sarcopenia construct, so comparisons with studies of clinically diagnosed sarcopenia should be cautious. In a 2017 longitudinal study of 172 hospitalised adults aged ≥70 years, Pérez-Zepeda et al. assessed EWGSOP sarcopenia using strength, gait speed and BIA-derived muscle mass; sarcopenia predicted 12-month mortality but not subsequent ED admission[16]. In 2019, Yang et al. compared EWGSOP and EWGSOP2 definitions in 384 community-dwelling older adults in relation to subsequent falls and hospitalisation, illustrating how associations vary with diagnostic definition[17]. A 2018 meta-analysis of five prospective studies comprising 2,832 older participants found sarcopenia associated with greater hospitalisation risk[18]. The absence of an association for low ASMM in the present analysis may therefore reflect the restricted muscle-quantity exposure, the specialist cohort, dichotomisation and limited statistical power rather than evidence that muscle health is unrelated to healthcare utilisation.

Age was not independently associated with the outcomes. Population-level evidence shows that ED use changes substantially with age, but the relationship between age and admission is influenced by clinical severity and healthcare context[19]. Among frail older adults, access to community care, barriers to healthcare seeking and transitions between settings can also influence repeated ED attendance[20]. The specialist nature of the present cohort may have reduced variation in underlying vulnerability, but the modest overall sample size (n=109; n=102 in complete-case models) also limited power to detect an independent age effect.

These findings suggest that multimorbidity warrants further study as a pragmatic marker of subsequent

healthcare use among falls-clinic attendees, but the present analysis is hypothesis-generating rather than a clinical prediction model. This is relevant in Ireland, where recent TILDA data indicate that approximately one in eight community-dwelling adults aged 70 years or older required medical attention for a fall over 12 months and about one in sixteen attended an ED because of a fall[1].

Strengths include a well-characterised specialist cohort, consistent baseline assessment and 3-year EPR follow-up. Important limitations are the small single-centre sample (n=109) and limited event counts. In particular, the 1-year ED model contained 19 events among 102 complete cases for five simultaneously entered predictors (approximately 3.8 events per predictor parameter), increasing the risk of overfitting, unstable coefficients and wide confidence intervals; even the 3-year models contained only 49 ED events and 47 admissions. Dichotomising SHARE-FI and ASMM may have further reduced statistical information. Potentially relevant variables such as cognition, medication burden, previous falls and prior healthcare use were not included. Frailty and muscle status are dynamic but were measured only at baseline[21,22]. Complete-case analysis may introduce bias if missingness was not random. Because follow-up relied exclusively on the St James's Hospital EPR and residential catchment status was unavailable, ED attendances or admissions at other hospitals could not be quantified and may have been missed. If such underascertainment was unrelated to the predictors it would tend to dilute associations, but differential use of other hospitals could bias estimates in either direction. Casewise residual diagnostics also identified several observations with studentised residuals >2 in the 1-year model and one in the 3-year admission model, further underscoring potential instability in this small dataset. The observational design supports interpretation in terms of association rather than causality.

Larger multicentre studies should examine multimorbidity alongside medication use, cognition, previous falls and social factors, use repeated measures of frailty and muscle health, and capture healthcare use across institutions. In this small specialist cohort, greater multimorbidity was associated with higher adjusted odds of all three measured healthcare-use outcomes, whereas age, sex, physical frailty and low ASMM were not independently associated. These findings should be regarded as hypothesis-generating and require replication and external validation before CIRS-G or any related measure is used for clinical risk stratification in falls services.

Ethics Approval

Ethics approval was granted by the Tallaght University Hospital/St James's Hospital Joint Research Ethics Committee (Project ID: 0221; approval date: 4 May 2021) and by the St James's Hospital Research & Innovation Office (Reference: 6567; approval date: 26 July 2021). The study was conducted in accordance with the Declaration of Helsinki.

Consent to Participate

Written informed consent was obtained from all participants before inclusion in the FRAILMatics study.

Authors' Contributions

AOB, JB, JXO, KF and YSL contributed equally to the investigation, literature review, data analysis, interpretation of the findings, and drafting and revision of the manuscript. RRO conceived and supervised the student research project, provided academic and methodological supervision, contributed to interpretation of the findings, and critically revised the manuscript for important intellectual content. All authors reviewed and approved the final manuscript and agree to be accountable for the work. RRO accepts responsibility for the integrity of the data analysis.

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