

Title: Frailty-informed pain management: A clinical imperative beyond chronological age

Running title: Age, frailty, and chronic pain management

Authors: Mourelle-Sanmartín, Pablo^{1*}; Lorenzo-López, Laura²; Millán-Calenti, José Carlos²; Andrew, Melissa Kathryn³; Theou, Olga^{3,4}

¹Geriatrics Department. University Hospital Lucus Augusti, Lugo, Galicia, Spain.

²Universidade da Coruña, Gerontology & Geriatrics Research Group, Instituto de Investigación Biomédica de A Coruña (INIBIC), Complexo Hospitalario Universitario de A Coruña (CHUAC), SERGAS, A Coruña, Spain.

³Department of Medicine, Dalhousie University, Halifax, Nova Scotia, Canada.

⁴School of Physiotherapy, Dalhousie University, Halifax, Nova Scotia, Canada.

*** Corresponding author:** Pablo Mourelle Sanmartín. Geriatric service, Lucus Augusti University Hospital. Dr. Ulises Romero Street, 1, 27003, Lugo, Galicia, Spain.

pablo.mourelle@udc.es

SUPPLEMENTARY DATA

Appendix A: Participant flow and chronic pain prevalence in the analytical sample (n=455)

Step in recruitment	n (%)	Female (%) [95% CI]	Male (%) [95% CI]	Notes
Patients screened	1646 (100%)	988 (60.0%) [57.6-62.4]	658 (40.0%) [37.6-42.4]	Population approached at baseline
Meeting IASP chronic pain criteria	713 (43.3%)	439 (61.6%) [58.0-65.1]	274 (38.4%) [34.9-42.0]	Includes repeated and institutionalized
Institutionalized participants	37 (8.1%)	24 (64.9%) [48.8-78.7]	13 (35.1%) [21.3-51.2]	Included in the main analysis
Interviewed and included in analysis	455 (63.8% of chronic pain cases)	277 (61.9%) [56.3-65.3]	178 (39.1%) [34.7-43.7]	Final analytical sample

Pearson's X^2 test showed no significant sex difference in chronic pain ($X^2=1.254$, $p=0.263$), with a very small effect size ($\phi=0.028$).

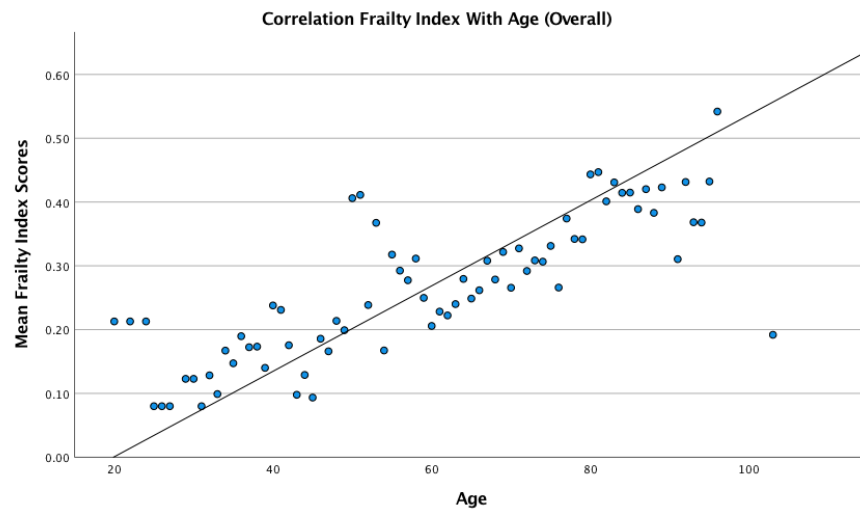
These recruitment data have also been used in a separate manuscript currently under review, addressing a distinct research question.

Appendix B: 31 variables included in the Frailty Index

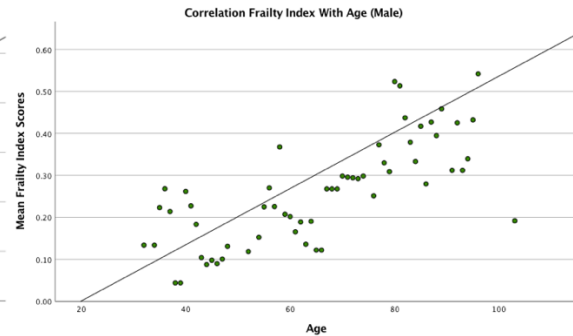
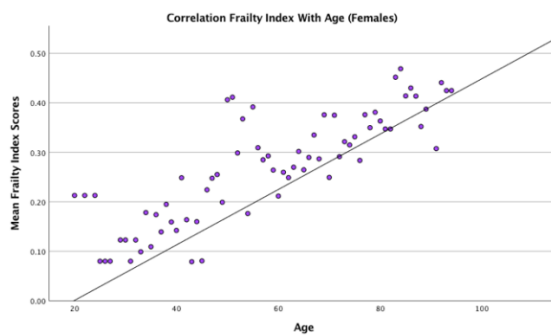
Comorbidities or Chronic Conditions (n=22)	- Arterial hypertension - Anxiety - Depression - Sleep disorders - Other psychiatric disorders - Diabetes mellitus - Sequelae of stroke - Adverse effects of chemotherapy and/or radiotherapy - Surgical interventions - Herpes zoster - Central nervous system infections - Other comorbidities - Rheumatoid arthritis - Osteoarthritis - Fractures - Osteoporosis - Other arthritis - Trauma surgery - Tendinopathy - Spinal canal stenosis - Other musculoskeletal conditions - Total number of drugs
Self-Rated Health (n=1)	- General health (SF-12)
Physical Function and Disability (n=3)	- Moderate effort limitation (SF-12) - Go up several floors by stairs limitation (SF-12) - Stop doing some tasks due to physical health (SF-12)
Mental Health (n=4)	- Do less carefully during the past 4 weeks due to emotional problem (SF-12) - Time feel calm and peaceful during the past 4 weeks (SF-12) - Time a lot of energy during the last 4 weeks (SF-12) - Time feeling discouraged and sad during the last 4 weeks (SF-12)
Social Health (n=1)	- Social limitation during the past 4 weeks due to physical health or emotional problems (SF-12)

Appendix C: Frailty Index characteristics

Frailty Index Categories		Weighted frequency	
		Absolute	Relative (%) (95% CI)
0-0.1	Non-Frail	51	11.2% (8.6%-14.4%)
0.11-0.2	Very Mildly Frail	92	20.2% (16.7%-24.1%)
0.21-0.3	Mildly Frail	140	30.8% (26.7%-35.1%)
0.31-0.4	Moderately Frail	74	16.3% (13.1%-19.9%)
0.41+	Severely Frail	88	19.3% (14.5%-25.2%)



Variables	Correlation coefficient	Significance	Sample size (N)
Age-FIScore	<i>Pearson (r)</i> =0.625	$p < 0.001$	455



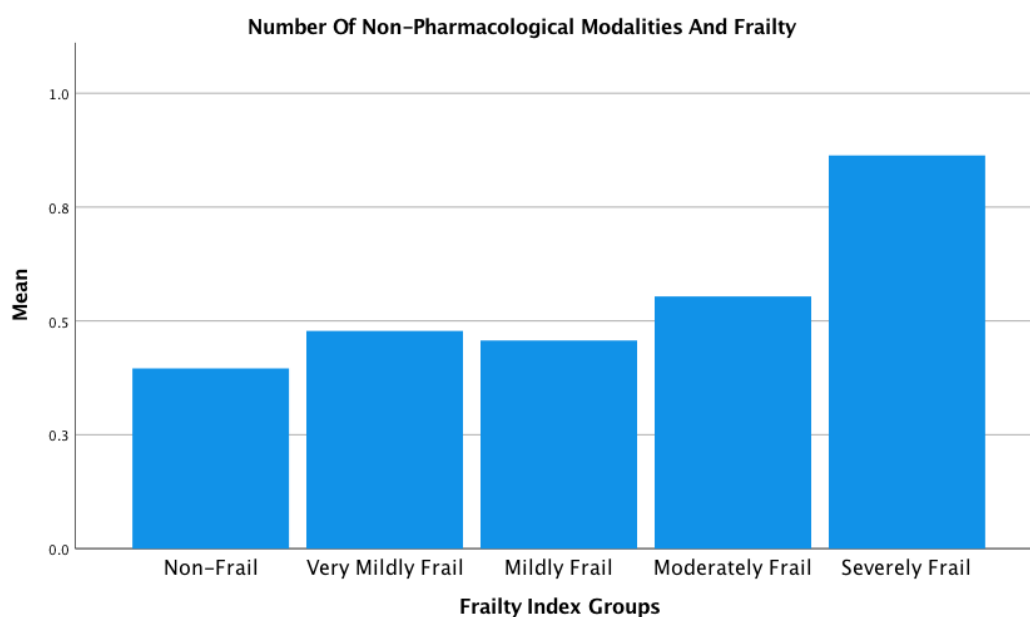
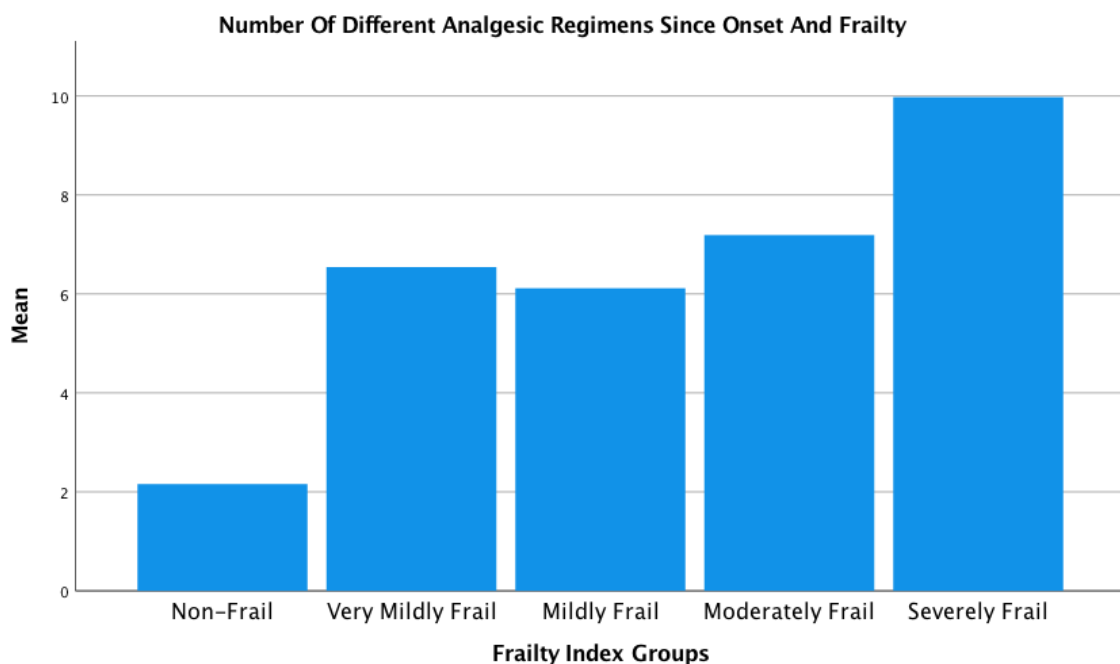
Variables	Age-FIScore in women	Age-FIScore in men
Correlation	<i>Pearson (r)</i> =0.632	<i>Pearson (r)</i> =0.648
Significance	$p < 0.001$	$p < 0.001$
Sample size (N)	269	176
455		

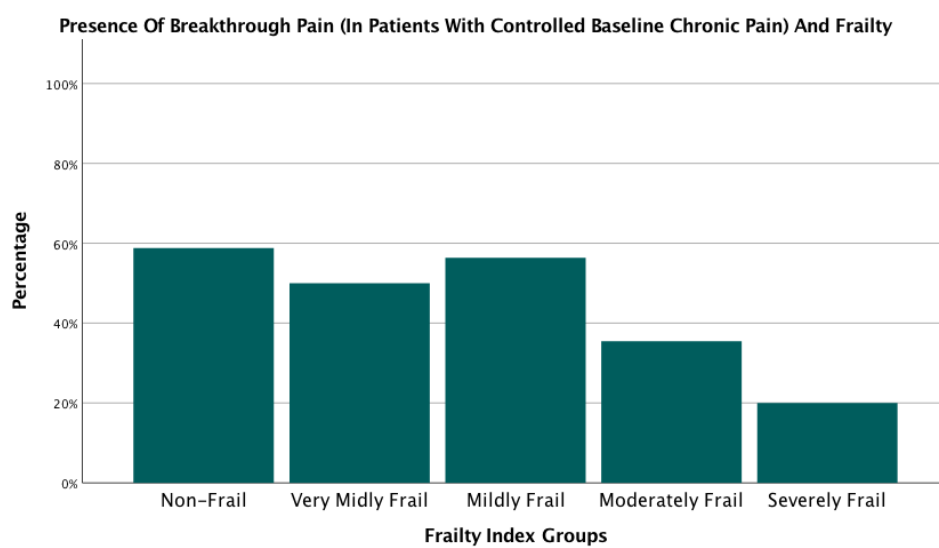
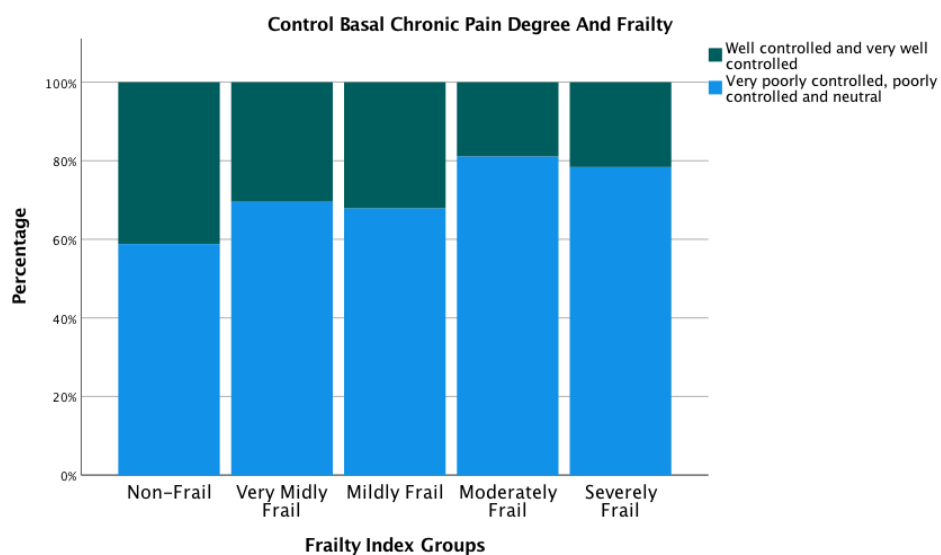
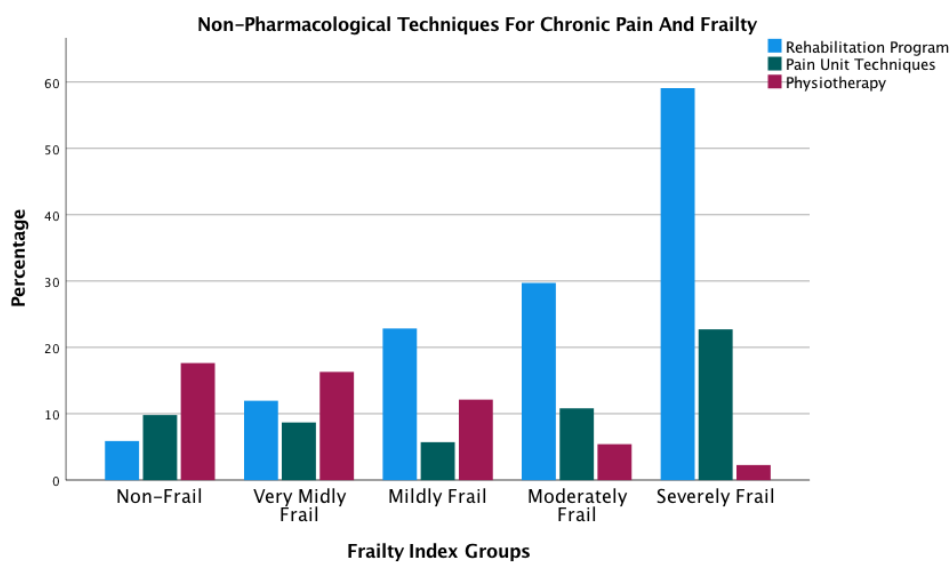
Variables	ANOVA	Significance	Sample size (N)
sex-FIScore	Means: - Mean females: 0.285 - Mean males: 0.277	$p = 0.520$	455

Appendix D: Main pain management variables according to frailty level

Interpretative note: This appendix presents graphical representations of key pain management characteristics stratified by frailty level (non-frail, mildly frail, moderately-frail, severely frail). The figures aim to visually support the main findings of the study by illustrating trends across increasing frailty, using bar graphs and linear regression plots derived from standardized SPSS outputs. Variables were selected based on clinical relevance, statistical significance in regression models, and potential implications for clinical decision-making.

Observed trends highlight the clinical impact of frailty on prescribing patterns (e.g., paracetamol, opioids, adjuvants), pharmacological adherence, self-medication, and use of healthcare services. In several outcomes, frailty and age showed inverse patterns, with frailer patients receiving more active management despite being younger on average. These results underscore the importance of integrating frailty into chronic pain assessment and treatment decisions, beyond chronological age alone.





Appendix E: Extended multivariable associations between chronic pain management variables and sex, age, and frailty

Table A. Associations between categorical pain management variables and sex, age, and frailty (Odds Ratios [95% CI])

Group of pain variables	Variables	% outcome	Sex	Age	Frailty
Initial pain relief strategy	Type (non-pharmacological)	434 (5.8%)	2.090 (0.770-5.676)	0.974 (0.943-1.006)	0.953 (0.908-1.000)
Prescribed pharmacological treatment	Metamizole	455 (6.7%)	0.677 (0.311-1.474)	0.971 (0.946-0.997)	1.048 (1.012-1.085)
	COXIBs	455 (2.7%)	0.357 (0.108-1.184)	0.961 (0.922-1.002)	1.015 (0.960-1.074)
	Weak opioids	455 (7.6%)	2.219 (0.954-5.165)	0.999 (0.974-1.025)	1.040 (1.006-1.074)
	Potent opioids	455 (11.9%)	0.496 (0.264-0.933)	0.975 (0.954-0.997)	1.089 (1.057-1.122)
	Anxiolytics	455 (6.7%)	0.684 (0.309-1.514)	0.941 (0.914-0.969)	1.032 (0.995-1.070)
	Antidepressants	455 (5.6%)	3.521 (1.163-10.662)	0.997 (0.968-1.026)	1.025 (0.987-1.064)
	Corticoids	455 (3.8%)	2.538 (0.825-7.808)	1.057 (1.021-1.095)	0.929 (0.879-0.981)
	Pharmacological schedule pain drugs (both)	455 (17.8%)	1.390 (0.778-2.482)	0.962 (0.943-0.982)	1.073 (1.043-1.104)
	Pharmacological schedule pain drugs (none)	166 (37.3%)	0.719 (0.403-1.285)	1.039 (1.019-1.061)	0.932 (0.906-0.959)
Self-medication	Previous prescription	257 (49.7%)	3.051 (1.458-6.387)	1.034 (1.010-1.060)	0.946 (0.916-0.978)
Chronic pain control	Basal control pain degree	455 (28.5%)	0.904 (0.584-1.399)	1.022 (1.006-1.037)	0.960 (0.940-0.981)
	Satisfaction pain control	455 (35.5%)	0.784 (0.521-1.178)	1.014 (1.000-1.029)	0.981 (0.962-1.000)
	Presence breakthrough pain	169 (17.8%)	1.835 (0.877-3.840)	0.978 (0.950-1.008)	0.971 (0.934-1.009)

Bolded values indicate statistical significance.

Table B. Associations between continuous pain-related outcomes and sex, age, and frailty (unstandardized B [95% CI] and semipartial correlations [variance explained])

Group of pain variables	Variables	Sex	Age	Frailty
Healthcare utilization due to pain	Number visits hospital care since onset	0.014 (-0.044-0.072)	0.002 (0.0001-0.004)	0.004 (0.002-0.007)
		0.022 (0.048%)	0.108 (1.17%)	0.149 (2.22%)
	Number visits private care since onset	1.892 (-0.813-2.971)	-0.155 (-0.192-0.119)	0.198 (0.148-0.248)
		0.025 (0.16%)	-0.246 (2.85%)	0.277 (6.26%)

Bolded values indicate statistical significance.