

Frail by four different measures and new adverse events from lower blood pressure control in hypertensive older adults: a 2-year prospective study in The Irish Longitudinal Study on Ageing (TILDA)

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Background: The 2018 European Society of Cardiology/European Society of Hypertension (ESC/ESH) guidelines for management of hypertension in adults aged ≥ 65 years recommend a blood pressure (BP) treatment target of 130–139/70–79 mmHg if tolerated [1]. Randomised controlled trials have advocated for lower BP, but this may lead to adverse outcomes in the frail. Yet, different operationalisations of frailty exist in the literature [2,3].

Purpose: We compared four frailty classifications in their ability to predict 2-year incident adverse outcomes (falls/fractures, syncope, transient ischaemic attack/stroke, heart attack, heart failure, hospitalisation, and mortality) associated with below-target BP control ($<130/70$ mmHg) in The Irish Longitudinal Study on Ageing (TILDA).

Methods: Data from participants aged ≥ 65 years treated for hypertension in Wave 1 (W1) was analysed. Frailty was identified by Frailty Phenotype (FP) [4], the Clinical Frailty Scale-classification tree (CFS) [5], a 32-item self-reported Frailty Index (FI) [6], and the 5-item FRAIL (Fatigue, Resistance, Ambulation, Illnesses & Loss of Weight) scale [7]. We formulated 16 participant groups at W1 based on frailty-BP combinations. Outcomes at wave 2 (W2) two years later were analysed with binary logistic regression models adjusted for age, sex, education, polypharmacy, classic orthostatic hypotension, Montreal Cognitive Assessment (MOCA) score and number of chronic diseases.

Results: Of 1920 W1 participants aged ≥ 65 years and treated for hypertension, 1229 had full BP/FP data, 1282 for BP/CFS, 1274 for BP/FI, and 1276 for BP/FRAIL. The non-frail groups in all 4 frailty classifications with BP treated below or above target did not have an increased risk of any of the adverse health outcomes at W2. For the frail treated below target, hospitalisation by W2 was significantly more likely in those who were frail by FP and FRAIL. The frail by FRAIL and BP treated below target were the only with increased risk of mortality by W2. The frail by FI and FRAIL with BP treated below target had increased risk of new heart failure and falls/fractures by W2.

Conclusions: Frailty was independently associated with adverse outcomes in hypertensive older adults treated below the ESC/ESH target. However, different frailty classifications had different prognostic implications. For those below BP target, frailty by FRAIL was associated with the highest number of risks (falls/fractures, heart failure, hospitalisation and mortality), followed by the frail by FI (falls/fractures, heart failure). Based on our results and frailty measures considered, we recommend that FRAIL and FI are regarded as the methods of choice to identify frailty when applying the ESC/ESH guideline. Models of frailty that do not explicitly measure comorbidities (such as FP and CFS) may be less useful to capture risk of adverse events from lower blood pressure control.

Outcomes at Wave 2	Logistic Regression	Frailty Phenotype BP Threshold 130/70mmHg				Clinical Frailty Scale BP Threshold 130/70mmHg			
		Frail Treated Low	Frail Treated High	Non-Frail Treated Low	Non-Frail Treated High	Frail Treated Low	Frail Treated High	Non-Frail Treated Low	Non-Frail Treated High
1. Hospitalisation	Basic								
	Full								
2. Syncope	Basic								
	Full								
3. Heart Attack	Basic								
	Full								
4. Heart Failure	Basic								
	Full								
5. Mortality	Basic								
	Full								
6. Any falls /any fracture	Basic								
	Full								
7. TIA or Stroke	Basic								
	Full								

Legend:

No statistical significance
 Statistically significant increased risk ($P < 0.05$)
 Statistically significant reduced risk ($P < 0.05$)

Figure 1. FP & CFS Logistic Regression Analysis

Outcomes at Wave 2	Logistic Regression	1. Frailty Index BP Threshold 130/70mmHg				2. FRAIL Scale BP Threshold 130/70mmHg			
		Frail Treated Low	Frail Treated High	Non-Frail Treated Low	Non-Frail Treated High	Frail Treated Low	Frail Treated High	Non-Frail Treated Low	Non-Frail Treated High
1. Hospitalisation	Basic								
	Full								
2. Syncope	Basic								
	Full								
3. Heart Attack	Basic								
	Full								
4. Heart Failure	Basic								
	Full								
5. Mortality	Basic								
	Full								
6. Any falls /any fracture	Basic								
	Full								
7. TIA or Stroke	Basic								
	Full								

Legend:

No statistical significance
 Statistically significant increased risk ($P < 0.05$)
 Statistically significant reduced risk ($P < 0.05$)

Figure 2. FI & FRAIL Logistic Regression Analysis