REFORGE:

Resilience Effects on Frailty and Outcomes in Rehabilitation Geriatrics

MESH HEADINGS:
Frailty, Geriatric, Rehabilitation, Resilience

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Resilience, Frailty and Outcomes in Geriatric Rehabilitation

ABSTRACT (148 words)

Objective: To assess relationships between resilience, frailty and outcomes in geriatric rehabilitation inpatients.

Method: Eighty-nine inpatients had Brief Resilience Scale (BRS) and frailty index (FI-CGA) completed. Pearson or Spearman correlation was used to determine correlation between BRS, FI-CGA and covariates. Multivariate logistic regression was used to determine associations between resilience, frailty and covariates with functional independence measure (FIM) gain, length of stay (LOS)>21 days, mortality and discharge care requirements.

Results: There was a negative correlation between BRS and premorbid FI-CGA (r=-31, p=0.03) and admission FI-CGA (r=-0.26, p=0.01) and between BRS and Minimental State Examination score (rho=-0.26, p=0.02). BRS was not associated with observed outcomes. Premorbid FI-CGA was associated with inpatient mortality and greater increase in FI-CGA during acute stay was associated with greater LOS. All patients who died were frail (FI-CGA>0.25).

Conclusion: Resilience and frailty were inversely related. Frailty was an independent predictor of rehabilitation LOS and mortality.

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INTRODUCTION

The frailty syndrome characterizes the loss of physiological reserve that is associated with increased susceptibility to illness and higher mortality [1]. Interventions to mitigate frailty have shown modest benefit to date [2]. Psychological resilience – the ability to adapt positively when faced with adversity [3,4] – is dynamic, potentially-modifiable [5], and can be approximated using validated scales [6,7]. A "health asset," resilience may be protective against physical changes in setting of frailty and acute health conditions [8]. However, there is little published literature examining relationships between psychological resilience measures, frailty, and functional recovery in older people [8].

AIMS

This study aimed to (1) assess factors associated with resilience and frailty in geriatric rehabilitation inpatients, (2) examine the relationships between resilience and frailty, and (2) associations between resilience, frailty and outcomes of GEM admission.

METHODS

Setting and participants. A prospective, single-centre cohort study was conducted over 9 months in a GEM (Geriatric Evaluation and Management) ward. Participants were over 65 years of age, spoke English, MiniMental State Examination (MMSE) score>18 [9]. Ethics approval was obtained from the Austin Health, Research Ethics Committee; informed consent was obtained for all participants.

Data collection and outcome measures. Resilience was assessed using the Brief Resilience Scale (BRS) within one week of GEM admission. The BRS comprises self-rated statements on a 5-point Likert scale. Scores range from 6-30, higher scores reflecting greater resilience. The BRS has consistently shown excellent psychometric properties, takes 10-15 minutes to administer, is validated in older adults, freely available and requires no user training [10].

Frailty was measured using the Frailty Index from a Comprehensive Geriatric Assessment (FI-CGA) based on health deficits coded as ordinal or binary variables [11-13]. FI-CGA was completed for the day of interview (admission FI-CGA) and retrospective premorbid FI-CGA was based on participants' health records (premorbid FI-CGA). "Frail" was defined as FI-CGA>0.25

[14]. Additional baseline data included age, gender, admission diagnosis, comorbidities, acute LOS, MMSE scores and current use of psychotropic medications.

Outcome data included Functional Independence Measure (FIM) gain (high/low: dichotomised at median), length of stay (LOS)>21 days, inpatient mortality and increased care needs on discharge. Routinely-completed on admission and discharge from subacute rehabilitation, FIM is used to track changes in performance over time [15]. It comprises 18 items, grouped into two subscales (motor and cognition), scored from 18-126 (higher=greater independence) [16].

Statistical analysis. Statistical analysis was completed using SPSS v24. Data were compared between groups using Mann-Whitney U test (nonparametric), Student's or paired t-test (unpaired/paired parametric data). Pearson (parametric) or Spearman (nonparametric) correlation were used to assess correlation between frailty, resilience and functional measures (FI-CGA, BRS and baseline FIM scores) and BRS and age, comorbidities, psychotropic medications and MMSE score.

Multivariate binary logistic regression was used to determine associations between BRS, frailty indices and covariates (e.g. age) with dichotomised functional outcomes (i.e. FIM gain (high/low), extended LOS, increased care on discharge, and mortality). All models included age, BRS, and frailty measure. As premorbid and admission FI measures were highly correlated, only the term of greatest significance were retained in the model to avoid multicollinearity.

Other variables were included in multivariate models using forward conditional selection if $p<0.05$ including interaction terms (BRS*frailty measures) to determine whether resilience influenced any observed associations between frailty and outcomes or vice versa.

RESULTS

Baseline characteristics and outcomes are presented in Table 1. BRS did not differ significantly according to gender ($p=0.47$) or NESB status ($p=0.06$). There was a significant correlation between BRS and MMSE Score (Spearman rho=-0.26, $p=0.02$) but no correlation with age ($r=0.17$, $p=0.11$) or number of comorbidities ($r=-0.08$ $p=0.47$).

Fifty-nine (66%) of patients were classified as "frail" according to premorbid FI-CGA (FI>0.25). FI-CGA did not differ according to gender ($p=0.06$ [premorbid], $p=0.10$ [admission]) or NESB

status (p=0.90 [premorbid], p=0.52 [admission]). FI-CGA at GEM was significantly lower than premorbid FI (paired t-test, p<0.001). There was a negative correlation between change in FI and MMSE (rho=-0.30, p=0.007).

Resilience, Frailty and Baseline FIM. There was a small negative correlation between BRS and premorbid FI-CGA (r=-31, p=0.03) and admission FI-CGA (r=-0.26, p=0.01) that remained significant when controlling for age, gender, MMSE, psychotropic medications and comorbidities (data not shown). There was no correlation between BRS and change in FI-CGA (r=0.05, p=0.64) or baseline FIM (r=0.92, p=0.39). FIM on admission correlated significantly with FI-CGA at admission (r=-0.40, p<0.001) but not premorbid (r=-0.15, p=0.15). Admission FIM also correlated with change in FI-CGA such that those with greater increase in frailty between premorbid and GEM admission were more likely to have poorer FIM scores (r=-0.45, p<0.001).

Patient Outcomes. Outcomes are reported in table 1. Four patients were transferred to acute or palliative care wards (of whom 3/4 died as inpatients); 4 patients died on the ward. Of the remainder, thirty-eight patients required higher care on discharge (including 11 discharged to nursing home care). FI-CGA were higher in patients that died; premorbid: (mean [standard deviation, SD]= 0.39 [0.07] vs 0.31 [0.10], p=0.02; admission: 0.52 [0.06] versus 0.44 [0.11], p=0.009; BRS did not differ (p=0.90). All patients that died were "frail" (i.e.premorbid and admission FI-CGA>0.25).

FIM Gain. FIM gain was associated with baseline FIM motor score such that those with lower FIM motor were more likely to have higher FIM gains. There was no association seen with frailty (premorbid FI-CGA: trend-level only, p=0.06), age or BRS (Table 2).

Extended LOS. LOS>21 days was associated with change in FI-CGA (between premorbid and GEM admission) such that increase in frailty during acute admission was associated with longer LOS); no association was seen with age or BRS.

Inpatient mortality was associated with increased FI-CGA at premorbid but not GEM admission, adjusted for age and BRS score (each non-significant).

Requirement for increased care on discharge was associated with living alone prior to admission,

baseline FIM and FIM gain (each $p \leq 0.001$), such that lower FIM and smaller FIM gain during admission increased the likelihood of increased care requirement on discharge; there was no significant association with age, FI-CGA and BRS.

DISCUSSION:

In this study our findings were (1) a robust, significant negative correlation between resilience scores and frailty indices (i.e. lower frailty correlated with higher resilience and vice versa), (2) no relationship between resilience and rehabilitation outcomes, and (3) significant associations between frailty, LOS and mortality but not FIM gain or discharge destination.

To our knowledge, only one paper has previously described frailty and resilience measures in geriatric rehabilitation. In orthopedic surgery patients (n=81, mean age=74), Rebagliati and colleagues reported that resilience appeared to influence the relationship between frailty and disability, in that frail individuals with higher resilience had higher discharge FIM scores than frail individuals with low resilience. In their cohort, resilience, but not frailty, was associated with function at discharge [8]. In our study, frailty but not resilience, was associated with functional outcomes in our study, and no significant interaction between resilience and frailty on outcomes was demonstrated. Sample demographics and methodological differences limit direct comparison, but could account for some of this disparity. A possible reason that this study did not demonstrate a relationship between resilience and functional outcomes is due to small cohort size and selection factors. The study population reported relatively-high BRS scores, did not include non-English speakers, was older (median age=83) and was predominantly (66%) frail [14], but excluded those too frail or unwell for transfer to GEM. Previous studies have actually suggested a correlation between advancing age and increasing resilience [17]. Inclusion of greater diversity of age and backgrounds may enable a better appreciation of this.

The inverse correlation identified between resilience and frailty, and resilience and cognition are interesting and consistent with previous literature suggesting that psychological resilience may play a role in physical health [17]. However the direction of associations cannot be assumed, i.e. it is not clear whether physical frailty is impacting psychological wellbeing or vice versa, or associations reflect important shared risk factors (e.g. depression, cerebrovascular disease).

Characterisation of these relationships may further our understanding of how to foster resilience as a potential intervention to mitigate detrimental impacts of frailty [18].

Frailty measures were associated with LOS and mortality: premorbid frailty predicted mortality, whereas increase in FI-CGA during acute stay predicted extended LOS. Previous studies have also shown that frailty is associated with increased in-hospital mortality and LOS [12]. The association greater increase in FI-CGA with greater LOS is intriguing and warrants further review. Resilience, frailty and functional outcomes remain challenging concepts to define [10]. This makes analysis and interpretation difficult; lack of association may reflect deficits in measurement scales rather than lack of a true relationship. The scores on the BRS and FIM demonstrate ceiling effect, resulting in limited result variation. As three different investigators administered the scales, inter-rater reliability may have affected findings, although efforts were made to establish concordance and train all assessors prior to data collection. The medical heterogeneity of this population may contribute to challenges improving functional outcomes regardless of the intervention. Selection bias is another consideration, for instance, those who were cognitively impaired (unable to consent) or lacked conversational English were excluded, limiting applicability of results to general Australian older adults, where 22% of the population over the age of 65 are from a non-main English speaking country [20].

CONCLUSION:

In this small study of geriatric rehabilitation inpatients, there was an inverse correlation between resilience and frailty observed. Although resilience was not associated with functional outcomes in this study, independent associations were seen between frailty or increase in frailty, mortality and extended LOS. Further study is required to better appreciate whether intervention to address psychological resilience could influence frailty or outcomes for geriatric rehabilitation inpatients.

IMPACT STATEMENT:

It is envisaged that resilience may act as an adjunct to the assessment of frailty in the ageing population. Understanding how psychological resilience influences physical health and outcomes has broad applications. These may include better selection of participants for certain programs as well as resilience training to improve functional outcomes.

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TABLES

Table 1: Participant Baseline Characteristics and Outcomes

Baseline Characteristics	
Age in years, median (IQR)	83 (78-88)
Gender (%) Female Male F:M	 57 (64) 32 (36) 16:9
Marital Status (%) Married Single	 32 (36) 57 (64)
Non-native English speaker (%)	12 (13.5)
Number of comorbidities, median (IQR)	7 (5.5-9)
Prescribed psychotropic medications (%)	27 (30)
Premorbid residence, n (%) Private residence no carer Private residence with carer Residential Aged Care Facility	 52 (58) 35 (39) 2 (2)
BRS	3.83 (3.17-4.17)

FI-CGA	
Premorbid	0.32 (0.24-0.40)
Admission to GEM	0.46 (0.37-0.52)
Change in FI-CGA (premorbid to GEM)	0.13 (0.09-0.17)
Premorbid frailty (premorbid FI-CGA>0.25), n (%)	59 (66)
Outcome Measures	
FIM gain: median (interquartile range)	24 (15-38)
Length of Stay, days, median (interquartile range)	
Total (acute + GEM):	46 (29-57)
GEM only	26 (18-42)
Extended LOS (>21 days), n (%)	58 (65)
Discharge destination, n (%)	
Private residence no carer	23 (26)
Private residence with carer	45 (51)
Residential Aged Care Facility	13 (15)
Died/transferred to acute/palliative care	8 (9)
Higher care on discharge (including mortality)	38 (43)

Table 2: Multivariate Logistic Regression Analysis: GEM Outcomes

A. Increased Care on Discharge	**Odds Ratio**	**95% Confidence Interval**	**p-value**
Age	0.97	0.90-1.05	0.97
Resilience Score	0.98	0.87-1.10	0.77
Admission FI	0.97	0.92-1.03	0.39
Home alone (vs with carer/RACF)	0.08	0.02-0.31	<0.001
FIM total (admission)	0.93	0.90-0.97	<0.001
FIM gain	0.94	0.91-0.98	0.001
B. Mortality	**Odds Ratio**	**95% Confidence Interval**	**p-value**
Age	1.04	0.93-1.16	0.53
Resilience Score	1.07	0.88-1.31	0.51
FI_Premorbid	1.1	1.01-1.22	0.04

C. Long Rehab LOS	**Odds Ratio**	**95% Confidence Interval**	**p-value**
Age	1.06	0.99-1.13	0.10
Resilience Score	0.92	0.82-1.02	0.13
Change in FI-CGA	1.15	1.05-1.27	0.004
D. FIM Gain (high/low)	**Odds Ratio**	**95% Confidence Interval**	**p-value**
Age	0.95	0.88-1.01	0.10
Resilience Score	1.02	0.92-1.14	0.72
Premorbid FI	0.95	0.91-1.00	0.06
FIM motor baseline	0.95	0.91-0.98	0.002

Table legend: Regression terms. A. Increased care on discharge. Non-significant variables excluded from model: gender, NESB, premorbid FI, change in FI, acute LOS, interaction terms (premorbid FI*Resilience Score, Admission FI*Resilience Score, Change in FI*Resilience Score). B. Mortality. Non-significant variables excluded from model: gender, premorbid residence status, NESB, GEM admission FI, change in FI, acute LOS, interaction terms (premorbid FI*Resilience Score, Admission FI*Resilience Score, Change in FI*Resilience Score). C. Extended LOS. Non-significant variables excluded from model: gender, NESB, premorbid FI, Admission FI, acute LOS, interaction terms (premorbid FI*Resilience Score, Admission

FI*Resilience Score, Change in FI*Resilience Score). D. Fim Gain. Non-significant variables excluded from model: gender, NESB, admission FI, change in FI, acute LOS, total FIM baseline, interaction terms (premorbid FI*Resilience Score, Admission FI*Resilience Score, Change in FI*Resilience Score).