


Examining the relationship between triage acuity and frailty to inform the care of older emergency department patients: Findings from a large Canadian multisite cohort study

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CLINICIAN CAPSULE

What is known about the topic?

The 2016 Canadian Triage and Acuity Scale updates introduced frailty as a level 3 first-order modifier to up-code frail patients with non-urgent presentations.

What did this study ask?

Is there a relationship between triage acuity and frailty, and are these measures associated with the same patient outcomes?

What did this study find?

Triage acuity and frailty are independent measures and are associated with different outcomes.

Why does this study matter to clinicians?

Comprehensive frailty assessment post-triage may further identify at-risk seniors that can benefit from additional geriatric assessment, intervention, and resources.

Methods: We conducted a secondary analysis of the Canadian cohort from a multinational prospective study. Data were collected on ED patients 75 years of age and older from eight ED sites across Canada between November 2009 and April 2012. Triage acuity was assigned using the CTAS, whereas frailty was measured using an ED frailty index. Spearman rank and binary logistic regression were used to examine associations.

Results: A total of 2,153 ED patients were analyzed. No association was found between the CTAS and ED frailty index scores assigned to patients ($r = .001$; $p = 0.99$). The ED frailty index was associated with hospital admission (odds ratio [OR] = 1.5; 95% confidence interval [CI] = 1.4–1.6), hospital length of stay (OR = 1.4; 95% CI = 1.2–1.6), future hospitalization (OR = 1.1; 95% CI = 1.05–1.2), and ED recidivism (OR = 1.1; 95% CI = 1.04–1.2). The CTAS was associated with hospital admission (e.g., CTAS 2 v. 5; OR = 6; 95% CI = 3.3–11.4).

Conclusion: Our findings demonstrate that frailty and triage acuity are independent but complementary measures. EDs may benefit from comprehensive frailty screening post-triage, as frailty and its associated geriatric syndromes drive outcomes separate from traditional measures of acuity.

ABSTRACT

Background: The 2016 Canadian Triage and Acuity Scale (CTAS) updates introduced frailty screening within triage to more accurately code frail patients who may deteriorate waiting for care. The relationship between triage acuity and frailty is not well understood, but may help inform which supplemental geriatric assessments are beneficial to support care in the emergency department (ED). Our objectives were to investigate the relationship between triage acuity and frailty, and to compare their associations with a series of patient outcomes.

RÉSUMÉ

Contexte: L'Échelle canadienne de triage et de gravité (ECTG) a été mise à jour en 2016 et un nouvel élément de reconnaissance de la fragilité a été intégré au triage afin que les patients fragiles dont l'état est susceptible de se détériorer durant l'attente des soins reçoivent un score plus exact de gravité. On ne connaît pas très bien la relation entre

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l'évaluation du degré de gravité durant le triage et la fragilité, mais elle permettrait de préciser les évaluations supplémentaires en gériatrie utiles à la prestation de soins au service des urgences (SU). L'étude visait donc à examiner la relation entre l'évaluation du degré de gravité durant le triage et la fragilité, et à comparer les associations établies avec différents résultats cliniques.

Méthode: Il s'agit d'une analyse secondaire de la cohorte canadienne ayant participé à une étude prospective internationale. Des données ont été recueillies sur des patients âgés de 75 ans et plus, examinés dans l'un des 8 SU participants au Canada, entre novembre 2009 et avril 2012. Les scores de gravité ont été accordés selon l'ECTG durant le triage, et la fragilité a été mesurée selon un indice de fragilité appliqué au SU. Les associations ont été évaluées à l'aide de la corrélation de rangs de Spearman et d'une analyse de régression logistique binaire.

Résultats: Ont été analysés, au total, les dossiers de 2153 patients examinés au SU. Aucune association n'a été établie

entre les cotes de gravité selon l'ECTG et les scores de l'indice de fragilité utilisé au SU ($r = 0,001$; $p = 0,99$). Toutefois, l'indice de fragilité accordé au SU était associé aux hospitalisations (risque relatif approché [RRA] = 1,5; IC à 95% = 1,4–1,6), à la durée du séjour à l'hôpital (RRA = 1,4; IC à 95% = 1,2–1,6), aux hospitalisations ultérieures (RRA = 1,1; IC à 95% = 1,05–1,2) et aux nouvelles consultations au SU (RRA = 1,1; IC à 95% = 1,04–1,2). Quant à l'ECTG, elle était associée aux hospitalisations (p. ex. score de 2 contre 5 sur l'ECTG : RRA = 6; IC à 95% = 3,3–11,4).

Conclusion: D'après les résultats de l'étude, la fragilité et l'évaluation du degré de gravité durant le triage sont des mesures indépendantes mais complémentaires. Aussi une recherche approfondie de la fragilité après le triage pourrait-elle se révéler utile dans les SU, puisque la fragilité et les syndromes gériatriques connexes produisent des résultats cliniques indépendants de ceux associés aux mesures habituelles du degré de gravité.

Keywords: Emergency department, frailty, older adults, triage

INTRODUCTION

The demographic shift has resulted in an increase of older adults seeking health care, with emergency departments (ED) acting as a conduit and a common access point for older people in search of medical attention.^{1,2} As a result, EDs are counted upon to modify traditional models of care to meet the unique physical and psychosocial needs of older adults, who frequently present for care.^{3,4} The complexity of older ED patients warrants the need to identify those at risk for poor patient outcomes. Frailty screening has been proposed as a strategy to achieve this goal.^{4,5} Frailty is a multifactorial syndrome characterized by a heightened vulnerability to adverse health events and a diminished physiologic reserve, inhibiting homeostatic recovery from stressors.^{6,7} When assessed in the ED, frailty has proven to be a consistent predictor of hospitalization, hospital length of stay, functional decline, and death.^{8–12}

The 2016 Canadian Triage and Acuity Scale (CTAS) guidelines were updated based on expert consensus. Recommendations to enhance geriatric triage education and to incorporate a rapid frailty assessment within triage were endorsed to supplement decision making upon ED arrival. As standard practice in Canada, all patients presenting to the ED are assigned a CTAS score to prioritize and sort patients based on acuity of illness. The CTAS is a single-item Likert scale that ranges from

one to five, with a score of one regarded as the most urgent and five the least urgent. The frailty modifier within CTAS is a level 3 first-order modifier designed to help identify frail patients with apparent non-urgent presentations who would otherwise have been assigned a CTAS level of 4 or 5. This is based on concerns that these patients may suffer more or deteriorate if subjected to prolonged waits for care.¹³ Prior work has demonstrated the predictive and clinical utility of screening for frailty in the ED.⁵ However, little is known about how frailty and triage acuity relate to one another. Identifying the relationship between frailty and triage acuity will help clarify the information value of frailty in triage, and whether frailty screening can further support clinical decision-making outside of triage.

We investigated the relationship between triage acuity and frailty scores in patients 75 years of age and older who presented to the ED before the implementation of the 2016 CTAS updates. We also compared their associations with patient outcomes, such as: hospitalization, hospital length of stay, and hospital recidivism. Bearing in mind that the CTAS is purposed to assess and prioritize medical acuity, whereas frailty screening is intended to highlight geriatric complexity and vulnerability, we hypothesized that there would be no relationship between these two measures. We also hypothesized and that these measures would be independently associated with different patient outcomes.

METHODS

Study design

We conducted a secondary analysis of the Canadian data from a multi-site, multinational prospective cohort study, the interRAI Multinational ED study.^{14,15}

Study setting and population

Data were collected from eight ED sites across five provinces in Canada (e.g., Ontario, Nova Scotia, Manitoba, Saskatchewan, and British Columbia) between November 2009 and April 2012.¹⁶ Patients 75 years of age and older were recruited during ED registration. Patients were excluded if: they were in severe medical distress, they were expected to die within 24 hours of arrival as determined by the nurse assessor, or they did not speak English and/or did not have a valid interpreter. Data were collected by research nurses or allied health professionals during day time hours (8 AM to 7 PM) based on staff availability and extant literature reporting high day time usage by older adults.¹⁷ Ethics approval was obtained from the respective academic institutions and research ethics boards of all participating hospitals.¹⁶

Measurement and variables

Upon study enrolment, all patients received a formal geriatric assessment by a nurse or allied health professional using the interRAI ED Contact Assessment. All assessors were trained on the ED Contact Assessment and its supplementary software.¹⁶ The ED Contact Assessment is a brief assessment and a standardized clinical decision support tool to inform diagnostic, treatment, and discharge decision-making in the ED, and to improve communication and continuity post-discharge.¹⁸ The items of the ED Contact Assessment have established test content validity in acute care,¹⁹ inter-rater reliability,^{20,21} and predictive validity across a series of outcomes in the ED setting.^{8,14} After the initial assessment, a standardized follow-up was conducted at 90 days post ED or hospital discharge to determine hospital length of stay and post-discharge outcomes. Those admitted for in-patient services received follow-up by means of manual chart reviews or a secondary analysis of electronic medical records. Those discharged from the ED were contacted by means of telephone. Hospital medical and/or mortality

records were reviewed if the telephone follow-up was unsuccessful.

The ED frailty index was created by Brousseau et al.⁸ using the items of the ED Contact Assessment to gauge the number of health deficits present at the time of ED assessment. A cumulative health deficit model was used to create the frailty index with guidance from methods proposed by Searle et al.²² In the general population, older adults deemed to be frail using a cumulative health deficit model have a median index score of 0.4.²³ The ED frailty index is presented as a fraction, with the numerator being the number of health deficits present and the denominator being the total number of deficits possible in the ED Contact assessment. The ED frailty index has demonstrated predictive validity in both Canadian and international cohorts.⁸ In our study, frailty was operationalized using the ED frailty index scores assigned to patients during their ED visit, and triage acuity was based on the CTAS score assigned to patients upon presentation to the ED. Data were collected before the introduction of the frailty modifier and enhanced triage nurse geriatric education. As a result, the CTAS scores examined in this study reflect practice before the 2016 CTAS revisions, preventing contamination between the CTAS and frailty scores assigned.

The primary outcome measure for this study was hospital admission resulting from the index ED visit. Hospital length of stay, future hospitalization, and repeat ED visitation were also of interest. Hospital length of stay was dichotomized to parallel the figures reported by provincial governing bodies. An extended in-patient length of stay was defined as patients who experienced a hospital length of stay greater than the 90th percentile. Future hospitalization was defined as any hospital stay that occurred within 90 days of discharge from the index hospital presentation. Repeat ED visitation was defined as any ED visit that occurred within 30 days of discharge from the index hospital presentation. Patients who died in hospital were excluded from outcomes concerning hospital recidivism.

Data analysis

Descriptive statistics were reported using general measures of frequency and central tendency. Spearman rank was conducted to examine the relationship between CTAS and ED frailty index scores. Frailty and triage acuity were dichotomized with the top 33% of frailty scores deemed to be the most frail, and those with a

CTAS of three or less deemed to be higher acuity. A series of chi-square tests were conducted to compare the proportion of post-disposition outcomes across patients with varying frailty and CTAS scores. Multiple logistic regression was performed to determine the adjusted observed relationships between the ED frailty index, CTAS, age, and gender, in relation to the outcome measures. For multivariable models, frailty was analyzed as a continuous variable to retain information, and also as quintiles to match the split of the CTAS and to provide a paralleled comparison. Cases with missing data were deleted within each analysis. Analyses were performed using SAS 9.4 (SAS institute Inc, Car, NC, USA), and sample size calculations were performed using G*Power 3.1.9.4. The required sample size was 1,046 patients based on a conservative correlation coefficient of 0.1, assuming 90% power and a two tailed-alpha of .05.²⁴

RESULTS

The cohort contained 2,153 older adults who presented to the ED for care. Overall, 1,119 (51.9%) of ED visits resulted in hospitalization, with 139 patients (6.4%) dying in hospital. The mean age of all patients was 82.2 (SD \pm 7.3), 60.7% were female, 37.3% lived alone, 41.3% had used the ED in the previous 90 days, and 80.1% of the sample received an urgent triage score (CTAS 1–3). ED frailty index scores were calculated for 89% (n = 1,916) of all observations, with a mean index score of 0.3 (range = 0–0.8).²³ Missing data were minimal with a range of 0–3.8% (mean of 0.71%) across all variables examined. Additional patient demographics can be found in Table 1. We found no evidence of an association between the CTAS and ED frailty index scores assigned to patients within the ED ($r = .001$; $p = 0.99$).

Table 2 displays a combined assessment of triage acuity and frailty across post-disposition outcomes. Older adults considered to be both frail and of high acuity were most likely to be admitted for in-patient care (67.3%; $p < 0.001$). Those deemed to be frail but who lacked medical acuity were most likely to experience an extended hospital length of stay (20.8%; $p < 0.001$), or a hospitalization within 90 days of discharge from the index hospital presentation (28.5%; $p = 0.04$). For a comprehensive display of frailty and triage acuity across all prognostic factors, refer to appendix A.

After adjusting for triage acuity, age, and gender, multivariable logistic regression determined that a 0.1 unit

increase in the ED frailty index score is associated with hospital admission (odds ratio [OR] = 1.5; 95% confidence interval [CI] = 1.4–1.6), an extended hospital length of stay (OR = 1.4; 95% CI = 1.2–1.6), future hospitalization (OR = 1.2; 95% CI = 1.1–1.3), and repeat ED use (OR = 1.1; 95% CI = 1.04–1.2). The CTAS was only associated with hospital admission, with patients assigned a score of one (OR = 4.9; 95% CI = 1.02–27.9), two (OR = 6; 95% CI = 3.3–11.4), or three (OR = 3.6; 95% CI = 2.1–6.7) at greater risk for admission when compared with a non-urgent CTAS score of five. Table 3 displays a multivariable model with frailty divided into quintiles to match the split of the CTAS.

DISCUSSION

Interpretation of findings

To our knowledge, this is the first study to examine the relationship between triage acuity and frailty, and to compare their associations across several outcomes. We found that frailty and triage acuity are independent measures; however, both have clinical utility and are important for driving separate outcomes. Our findings demonstrated that frailty is associated with hospital admission, an extended hospital length of stay, repeat ED visitation, and future hospitalization, for older adults seeking emergency care. The CTAS was only associated with hospital admission. Finally, we identified a distinct cohort of frail older adults who presented for non-urgent medical attention. This group experienced the greatest number of hospitalized days per patient, and the highest rates of hospitalization post-discharge.

Comparison to previous studies

Our findings are consistent with existing literature examining the predictive utility of frailty screening in the ED.^{8–10} Despite the heterogeneity of instrumentation used to measure frailty across different emergency settings, studies examining similar outcomes consistently produced paralleled results. Little is known about the predictive utility of the CTAS for older adults in Canada. Bearing in mind that the CTAS was not purposed to predict patient outcomes, prior studies have demonstrated that the CTAS score assigned is associated with hospital admission, length of stay, and resource usage among the general Canadian population.^{25–28} Studies outside of

Table 1. Patient characteristics	
Variable	N (%) N = 2,153
Age*	82.2 (± 7.3)
Gender (female)	1290 (60.7)
Lives alone	794 (37.3)
Caregiver distress†	408 (19)
Cognitive impairment ‡	
PrePremorbid §	341 (15.9)
Admission	453 (21.2)
Potential delirium ¶	561 (26.1)
Activity of daily living impairment	
Bathing	
PrePremorbid §	735 (34.6)
Admission	1210 (57.3)
Acute decline from premorbid**	479 (22.7)
Personal hygiene	
Premorbid §	310 (14.5)
Admission	552 (25.8)
Acute decline from premorbid**	247 (11.6)
Dressing lower body	
Premorbid§	475 (22.1)
Admission	906 (42.3)
Acute decline from premorbid**	437 (20.5)
Locomotion	
Premorbid §	308 (14.4)
Admission	876 (41.2)
Acute decline from premorbid**	566 (26.8)
Any premorbid impairment ††	800 (37.2)
Any impairment at admission ††	1348 (62.6)
Independent activities of daily living status	
Difficulty with medications ††	614 (28.6)
Difficulty with stairs §§	1263 (59)
Impaired comprehension	75 (3.5)
Conditions and symptoms	
Poor self-reported health ¶¶	
Premorbid §	173 (8)
Admission	429 (19.9)
Depressive symptoms ***	432 (20.1)
Expresses anhedonia †††	798 (37.1)
Hallucinations or delusions	129 (6)
Any falls (past 90 days)	679 (32)
Traumatic injury	149 (7.2)
Daily or severe pain §§§	401 (18.6)
Dyspnea ¶¶¶	
Premorbid §	439 (20.4)
Admission	606 (28.2)
Decrease food/fluids ****	640 (29.9)
Weight loss ††††	191 (8.9)
ED visitation prior 90 days	889 (41.3)
ED frailty index score*	0.3 (0.2)
Canadian Triage and Acuity Scale (CTAS)	
CTAS 1 (most urgent)	13 (0.6)
	(Continued)

Table 1. Continued.	
Variable	N (%) N = 2,153
CTAS 2	437 (20.9)
CTAS 3	1224 (58.6)
CTAS 4	332 (15.9)
CTAS 5	84 (4)
ED = emergency department. *Data are reported as a mean and standard deviation. † Primary informal helper(s) expresses feelings of distress, anger, or depression. ‡ Modified independent or any impairment in making decisions regarding tasks of daily living. §Premorbid: the 3-day period before the onset of the current acute illness or episode. Admission: the past 24 hours or time since acute illness or episode that prompted the ED visit. ¶ Acute change in mental status from person's usual functioning (e.g., restlessness, lethargy, difficult to arouse, altered environmental perception). ** Acute decline from premorbid: at admission, new impairment relative to premorbid. †† Any supervision or any physical assistance in bathing, personal hygiene, dressing lower body, and locomotion. ††† Difficulty remembering to take medicines, opening bottles, taking correct drug dosages, giving injections, or applying ointments. §§Supervision or any assistance during full flight of stairs (12 to 14 stairs). Sometimes, rarely, or never understands direct communication. ¶¶ When asked, "In general, how would you rate your health?" person responds "Poor." *** When asked, patient reports feeling sad, depressed, or hopeless in past 3 days. ††† When asked, patient reports little interest or pleasure in things they normally enjoy. §§§ Pain that is severe or excruciating in past 3 days. ¶¶¶ Dyspnea at rest or present when performing normal day-to-day activities. **** Noticeable decrease in the amount of food usually eaten or fluids usually consumed. †††† Weight loss of 5% or more in last 30 days, or 10% or more in past 180 days.	

Canada have demonstrated that triage acuity is predictive of the same outcomes for older ED patients.^{29,30}

Clinical implications

Acuity is the primary function of the ED, and assigning a triage score to patients upon ED presentation is the standard of care. However, frailty and other geriatric syndromes are commonly overlooked by ED clinicians and processes.^{31,32} We support the decision of CTAS to up-code frail patients presenting for non-urgent complaints, given their increased risk for under-triage and decompensation while waiting for treatment.^{33,34} However, the lack of collinearity between triage acuity and frailty suggests that there is further information to be gained from measuring frailty, above and beyond the CTAS score assigned. The high rates of hospital admissions, recidivism, and health service use by frail older ED patients presenting with low medical acuity underscores the value of frailty screening. Evaluating frailty as a measure encapsulated within triage acuity is likely to omit the geriatric complexity that drives health service use. Assessing frailty through a distinct lens may further highlight the unique needs and geriatric syndromes of

Table 2. Comparison of Frailty and Triage Acuity (CTAS) across patient outcomes

Outcome	Most frail* Higher acuity^ N = 504	Least frail Higher acuity N = 991	Most frail Lower acuity N = 130	Least frail Lower acuity N = 237	p
Admitted to hospital	67.3%	49.2%	55.4%	20.3%	< .001
Hospital length of stay greater than the 90th percentile	15.9%	5.6%	20.8%	10.4%	< .001
Repeat ED visitation†	33.3%	28.3%	28.5%	24.1%	0.39
Future hospitalization§	21.2%	18.4%	28.5%	18.1%	0.04

ED = emergency department.
 * Most Frail = Top 33% of ED Frailty Index scores, Least Frail = Bottom 66% of ED Frailty Index scores.
 ^ Higher Acuity = Canadian Triage Acuity Scale 1–3, Lower Acuity = Canadian Triage Acuity Scale 4–5
 † Returned to an ED within 30 days of the index ED presentation.
 § Admitted to a hospital within 90 days of the index ED presentation.

frail older adults, information that is not apparent upon the review of a triage score.

Time constraints in triage along with the complex and multifaceted nature of frailty screening suggest that triage is a suboptimal environment to support an inclusive frailty assessment. A second and more comprehensive frailty screening during clinical treatment may be useful for case-finding to further identify seniors who could benefit from additional geriatric assessment, and targeted senior friendly pathways. The interRAI ED screener and the Identification of Seniors at Risk (ISAR) tool recommended by the geriatric ED guidelines are key examples of case-finding instruments currently embedded as the standard of

care in many EDs.^{18,35} A common trait of these screening systems is that they produce an exclusive frailty score to supplement decision-making during clinical treatment. To obtain a similar effect with the CTAS modifier, and to prevent a loss of information during the transition of care from triage to treatment, ED clinicians should be made aware of patients who screen positive for frailty in triage. This information can be used to help guide emergency treatment and post-discharge follow-up. Cognizant of the limited resources and staffing available within the ED, comprehensive screening post-triage may be best suited to older ED patients who present with high geriatric complexity but low medical acuity.

Table 3. Adjusted odds ratio for frailty and triage acuity across ED disposition outcomes

Variable	Odds ratio (95% confidence interval)			
	Hospital admission [n = 933/ N = 1,830]	Hospital length of stay (> 90th percentile) [n = 93 / N = 933]	Future hospitalization [n = 363/ N = 1,718]	Repeat ED visit [n = 518/ N = 1,718]
ED frailty index				
1 (Most frail)	6.9 (4.9–9.6)	11.3 (3.4–70.4)	2.7 (1.8–4.1)	1.8 (1.4–2.5)
2	3.8 (2.8–5.3)	4.6 (2.8–24.1)	2.7 (1.8–4.0)	2.0 (1.4–2.7)
3	3.2 (2.3–4.4)	4.5 (1.5–13.3)	2.4 (1.6–3.6)	1.7 (1.2–2.4)
4	2.1 (1.5–2.8)	2.8 (0.5–6.2)	1.6 (1.1–2.5)	1.4 (0.99–2.0)
5 (Reference)	–	–	–	–
CTAS				
1 (Most urgent)	5.8 (1.2–32.8)	1.3 (0.1–10.7)	0.5 (0.02–2.9)	1.6 (0.4–6.9)
2	5.9 (3.2–11.2)	0.3 (0.1–1.1)	1.5 (0.8–3.0)	1.0 (0.6–1.8)
3	3.4 (1.9–6.4)	0.3 (0.1–1.2)	0.9 (0.5–1.9)	0.9 (0.6–1.6)
4	1.6 (0.9–3.1)	0.4 (0.1–1.6)	1.3 (0.7–2.6)	0.7 (0.41–1.3)
5 (Reference)	–	–	–	–
Hosmer-Lemeshow goodness of fit	p = 0.3	p = 0.3	p = 0.9	p = 0.3

ED = emergency department; CTAS = Canadian Triage Acuity Scale.
 Sample sizes vary due to missing data.

Strengths and limitations

Our study is one of the few that used data with a comprehensive set of functional and geriatric syndromes not typically available in ED medical records. The secondary nature of the study limited our analyses to only those available in the archived data. Diagnostic information would have provided supplementary information to assist in understanding the clinical reasoning behind the ED disposition outcomes. Similarly, data were only collected during daytime hours; patient and visit characteristics may differ during night-time visitation. Finally, due to a low mortality event rate during the study period, we were unable to analyze mortality as an outcome.

Our findings are hypothesis generating, and future research is needed to determine the optimal timing of comprehensive frailty screening in the ED, and how to adapt traditional emergency management pathways to incorporate this practice post-triage. Given the recommendation for the CTAS frailty modifier, future studies should aim to examine the impact of the frailty modifier on time-to-treatment and other important patient outcomes. Finally, our study identified a unique subgroup of older adults with high frailty and low medical acuity driving health service use. Future research is needed to further characterize this distinct cohort.

CONCLUSION

We demonstrated that triage acuity and frailty are two distinct but clinically important constructs found to be associated with different outcomes for older ED patients. Frailty was associated with hospitalization, extended hospital length of stay, and hospital recidivism, demonstrating that this measure can be used to guide clinical decision-making post-triage. Frail older adults presenting to the ED with low medical acuity were identified as a subgroup of patients driving health service use.

Supplementary material: The supplementary material for this article can be found at <https://doi.org/10.1017/cem.2019.432>.

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