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A Modified Screening Tool to Evaluate Risk of Unanticipated Return Visits to the Emergency Department in the Geriatric Population

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A Modified Screening Tool to Evaluate Risk of Unanticipated Return Visits to the

Emergency Department in the Geriatric Population

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Abstract

Purpose: To compare the Modified Screening Tool for Identifying at Risk Seniors (mSTIRS) against the Triage Risk Screening Tool (TRST) and the Identification of Seniors at Risk (ISAR) for predictive value and assess the relationship between presenting complaint with unanticipated return visit (URV) occurrence in geriatric patients.

Design: A prospective, observational study conducted at a large academic medical center. Descriptive statistics and psychometric analyses were used to analyze the association between demographics, clinical data, and to evaluate the modified screening tool.

Methods: 38 geriatric participants in the Emergency Department (ED) were enrolled and 21 completed the study. The screening tools were administered after triage and patients were contacted 72-hours post-discharge from the ED for URV evaluation.

Results: The mSTIRS demonstrated greater sensitivity (87.5%), specificity (57.1%), and predictive value (PPV 50%; NPV 88.9%) than the TRST and ISAR. No association was found between URV and presenting complaint (X^2(6, n=21) = 3.161, $p = 0.788$).

Conclusions: The mSTIRS screening tool better identified geriatric patients at risk for unanticipated 72-hour return visits to the ED compared to the TRST and ISAR. Additional testing with a larger sample is needed to replicate results and determine the validity of this modified screening tool.

Dedication

I would like to dedicate this project to my husband, family, friends, and the US Army Nurse Corps. First, to my husband and children, I would not have been able to complete this journey without your love, support, understanding, and empathy. I could not have succeeded without you by my side and I understand and appreciate the sacrifices made in support of my school schedule. Second, to my parents, I would not be where I am today without your support and encouragement. As a child, I watched as you started your own business, demonstrating the drive and dedication needed to succeed. To my friends, who supported me even before this journey began. Finally, to my mentors and colleagues in the US Army Nurse Corps, I thank you for your constant guidance, support, and for the words of wisdom given during this process and additional thanks for giving me this opportunity to grow in my career.

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Introduction

It is anticipated that the geriatric population (65 and older) will increase from 47.8
million to 98.2 million by 2060.[1] Further, geriatric population growth currently exceeds total
population growth in the US by 10%, a trend that will continue to increase in the coming years.[2]
In the past decade alone, the number of geriatric patients seen in the Emergency Department
(ED) has increased by 34%, has a high utilization of health care services and represents the
second largest patient population seen in the ED.[3-6]

An unanticipated return visit (URV) is defined as an unscheduled return to the ED for the
same complaint within a certain time period with 72-hours being the standard quality indicator
for URVs.[7] Unanticipated return visits to the emergency department (ED) within 72-hours of
ED discharge amongst the geriatric population are associated with increased adverse events,
higher mortality rates, increased ED length of stays, and higher care costs.[8-11] Approximately
32% of geriatric URVs result in inpatient admission and an estimated 27% of URVs result in
adverse events such as unanticipated Intensive Care Unit (ICU) admissions, congestive heart
failure exacerbations, pneumonia, sepsis, and death.[12-15] Factors that influence unanticipated
return visits (URVs) include acute illnesses combined with multiple co-morbidities, a decreased
number of primary care providers, and ED overcrowding.[6,16,17] Use of rapid screening tools may
be beneficial in identifying geriatric patients at high risk for URVs in the ED, allowing for
opportunities to initiate interventions to mitigate the risk of URVs.[2,7,12]

Current research literature supports the use of a screening tool for patients at risk of
URVs as a preliminary tool to identify patients needing a more thorough risk screening.[18-21] The

Agency for Healthcare Research and Quality (AHRQ) found six screening tools to be useful in identifying geriatric patients at risk for URVs.[7] Of the six recommended tools, the Triage Risk Screening Tool (TRST) and the Identification of Seniors at Risk (ISAR) demonstrated desirable qualities including acceptable predictive values, sensitivity and specificity, and time required for administration.[7] One tool, the Rowland Questionnaire, was reported as the most valid tool compared to the TRST and ISAR; however, the Rowland questionnaire consists of 27 questions which could delay the triage process in an ED, therefore making it inappropriate for this setting.[22] Variations in sensitivity, specificity, failure to address care concerns and risk factors identified by AHRQ and the American College of Emergency Physicians' policy statement on geriatric emergency department guidelines inhibit global acceptance of one screening tool over the other.[2,7] Lastly, neither the TRST nor the ISAR consider the impact of medical conditions reported as increasing the risk of URVs in the geriatric population, thus limiting utilization in a population burdened with comorbid conditions as more than half the geriatric population is diagnosed with 3 or more co-morbid conditions[7,23,24]

Due to the limitations of the TRST and ISAR, a hybrid screening tool was developed, incorporating modifications to address identified limitations in literature related to the TRST and ISAR. Development of the Modified Screening Tool for Identification of at-Risk Seniors (mSTIRS) was modeled after the TRST and ISAR and incorporated additional components to address these limitations. The aims of this project were to: 1) compare the predictive properties of the TRST, ISAR and the newly created mSTIRS, a screening tool to identify URVs in the ED in geriatric patients and, 2) determine if there was an association between mSTIRS score and the presenting problem of patients who experienced a URV.

Theoretical Framework

The guiding framework for this study was the Item Response Theory which evaluates relationships between unobserved characteristics and observed responses, or screening questions in the case of this study.[25] In psychometric testing, IRT is used for the design, analysis and scoring of instruments measuring certain variables. The IRT is cyclical in that multiple modifications may be made during the development process based on input, feedback, and reliability testing. The IRT helps creates screening instruments such as the mSTIRS where the items may not necessarily be weighed the same as they are in other instruments that use the Likert scale. As such is the preferred method for developing instruments in the US.[26]

Methods

Design and Setting

This was a prospective observational study conducted from January 29, 2020, through March 24, 2020, at a large academic medical center in southcentral United States. The hospital system consists of two separate emergency departments, which have a combined geriatric URV rate of 59.8 per 386.3 discharged geriatric patients per month. The geriatric URV prevalence for this hospital system is 15.5% of 4,462 discharged geriatric patients.

Sample

A convenience sample of patients were eligible for participation if they were 65 years of age and older, did not have a history of cognitive impairment, and presented to the ED for care. Additionally, patients were excluded who presented to the ED as rule out for stroke, trauma, were pending admission or 24-hour observation, or were non-English speaking. A targeted enrollment of 67 patients was determined as sufficient for the minimum sample size based on prevalence in the absence of power analysis, as outlined by Bujang and Adnan.[27] Local

Institutional Review Board (IRB) approval was obtained. Informed consent with Health

Insurance Portability and Accountability Act consent was obtained at the time of enrollment after

a full explanation of the study protocol was provided.

Data Collection and Measurements

Demographics

The following variables were collected: age, gender, time of visit, presenting complaint,

and final discharge diagnosis. The presenting complaints of the patients were categorized by

system: neurological, head eyes ears nose and throat, respiratory, cardiac, gastrointestinal,

genitourinary, obstetrics, skin, musculoskeletal, and psychiatric.

Mini-Cog

Patients who self-reported having memory problems received an additional evaluation for

cognitive impairment through the administration of the Mini-Cog assessment. The Mini-Cog

test is a valid and reliable tool to assess for cognitive impairment in geriatric patients.[28,29] The

test takes approximately 3 minutes to administer and consists of a three-item recall for memory

and a clock drawing test. Scores ranged from 0 to 5, where a score of two or less was considered

positive for cognitive impairment and excluded from further participation. The Mini-Cog

assessment was initially developed for use in the primary care setting, but use has expanded to

other medical specialties as a means for identifying patients with cognitive impairment.[28,29]

Triage Risk Stratification Tool

The TRST is a functional assessment tool designed to be integrated as part of the triage

process in the ED. The screening tool consists of 5 questions answered by the patient and a sixth

question that relies on the professional judgment of the healthcare professional completing the

questionnaire. Scores for the TRST range from 0 to 6 with a cut off of 2 indicating risk for URV

and need for additional assessment of needs and interventions.[30] The TRST sensitivity ranges

from 47.3%-88.3%, while specificity ranged from 47.2%-61%.[12,20,22,31,32] The TRST has

demonstrated validity and reliability with logistic regression and receiver operating

characteristics (ROC) curve analysis as indicated in the seminal study[33].

Identification of Seniors at Risk

The ISAR screening tool is a 6-item questionnaire without input from the healthcare

professional and is scored on a range of 0 to 6. A score of 2 indicates a risk of URV.[34]

Sensitivity and specificity for the ISAR ranged from 69%-91.9% and 37.3%-39%,

respectively.[12,20,22,31,35,36] The ISAR also used regression studies and ROC curve analysis in the

seminal study to establish validity and reliability[37].

Modified Screening Tool to Identify at Risk Seniors

The mSTIRS screening tool was developed as a modified instrument derived from

analysis of the TRST and ISAR and addressed the addition of co-morbid conditions, number of

medications taken, and inconsistencies in sensitivity and specificity in the TRST and ISAR. The

first draft of the questionnaire consisted of 9 questions. After testing for internal consistency, the

final questionnaire (Figure 1) consisted of 6 items. Over the counter medications, number of

prescription medications, and visual impairment were removed because to improve internal

consistency. The modified 6-item tool is scored on scale of 0 to 6 with a score of three or more

indicating a risk of URV.

Procedure

A list of patients who completed the triage process and met inclusion criteria was

provided to the primary investigator (PI) by the charge nurse. The PI then verified screening

eligibility of potential participants before approaching the patient's care team to determine

availability to administer the questionnaire. Once the ED staff validated appropriateness of the

patient, the PI obtained the ED staff consent to complete the professional judgement question

related to the TRST. Next the PI provided the patient with a brief description of the study and

invited them to participate. Once the patient indicated interest in the study, informed and HIPPA

consent was obtained at the time of enrollment after full explanation of the study protocol was

provided. A copy of the signed consent was provided to the patient and the original, signed form

was kept as per protocol. The PI then administered the questionnaire to the patient. Seventy-two

hours after completing the questionnaire, the PI reviewed the patient medical record in the EMR

and verified the discharge status of the patient. If the EMR indicated that a URV had occurred

within 72 hours, it annotated in the research database. All other patients who were discharged

home were contacted via phone and/or email per the patient's preference to determine if a URV

occurred at an outside hospital. Responses were documented in the research database. Attempts

to contact the patient were discontinued after five phone calls and/or four email attempts. All

data were stored in the Research Electronic Data Capture (REDcap), a HIPPA compliant,

secured, online database repository with limited access.[38,39]

Statistical Analysis

Descriptive statistics including central tendencies, dispersion, and variance were used to

describe the sample. Parametric and nonparametric statistical tests were conducted to identify

predictive ability, specificity and sensitivity of the screening tools to include Cronbach's alpha

coefficient, receiver operating characteristics (ROC) curve analysis, Mann-Whitney U test, and

Spearman's Rank Correlation. Chi-square analysis was used to evaluate the association between

presenting complaint and URV occurrence for the mSTIRS screening tool. All data were

analyzed using IBM SPSS version 25.[40] A *p*-value less than or equal to 0.05 constituted

significance for all analyses.

Results

During the study period, 1,700 patients were registered between the two emergency

departments at the study site. Of these, 556 patients were screened as part of the convenience

sample. In total, 491 patients were excluded. Of the 65 eligible patients approached to

participate, 27 declined to participate and 38 consented to participate and completed the study

questionnaire. Of the 38 patients consented, 17 were dropped from the study for failure of

follow-up contact. Of the remaining 21 consented patients, 7 experienced a URV. Figure 2

details the study population flowchart. The patients in our sample had a mean age of 73 ± 5

years, were primarily female (66.7%) and Caucasian (81%) (Table 1). There was no difference

in age between the URV group and non-URV group (p = 0.287).

Comparison of Screening Instruments Predictive Qualities

The mean mSTIRS score for the sample was 2.9±1.8. In the URV group, the average

mSTIRS score was higher (3.6±1.4) compared to the non-URV group (2.5±1.9) and no

differences were found in the scores between the URV and non-URV groups (p = 0.197).

Specificity and sensitivity were 57% and 86% respectively and positive predictive value was

calculated at 50% while negative predictive value was 89%. Cronbach's alpha coefficient testing

resulted in a value of 0.735. Lastly, receiver operating characteristic (ROC) curve analysis of

the means scores for URV positive patients resulted in an area under the curve (AUC) of 0.714

for those patients scoring a three or higher on the mSTIRS scale identifying the cut point of three

for this tool.

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Analysis of the TRST instrument demonstrated a mean score of 2.4±1.3 for all patients. In the URV group, the mean score was 3.0±1.4 which was higher than the non-URV group (2.1±1.0). There were no differences found in scores between the URV and non-URV groups (p = 0.110). Sensitivity and specificity for the TRST were 86% and 35.7% respectively and the Cronbach's alpha test for internal reliability resulted in 0.632. Positive and negative predictive values (PPV/NPV) were 40% and 83.3% in this study.

The mean ISAR score for the sample was 2.0±1.0. In the URV group, the average score was higher (3.0±1.0) compared to the non-URV group (2.0±1.0), there was no significant difference found between the two groups (p = 0.056). Sensitivity and specificity values were 85.7% and 28.6% respectively; PPV and NPV were calculated to be 37.5% and 80%. Cronbach's internal consistency testing resulted in a value of 0.668. A Spearman's Rank correlation was used to analyze the relationship between the three screening tool's scores to determine the strength of association between each tool. Table 3.

Association Between mSTIRS and Presenting Complaint

Of the seven participants to experiences an URV to the ED, we found no association between their presenting complaint and URV occurrence (X_2(6, N=21) = 3.161, p = 0.788). Cardiac complaints were the most frequent presenting problem of the patients who had a URV (3/7, 43%).

Discussion

Assessment of the psychometric properties of screening instruments is important for assessing the accuracy of their predictive ability. This study assessed several measures to evaluate the psychometric properties of the TRST, ISAR, and mSTIRS to determine which more accurately identified geriatric patients at risk for URV in the ED. ROC curve analysis mapped

the various sensitivity and specificity scores of all potential cut points based off of mSTIRS mean score.[41] This analysis indicated a cut point of 3 provided the greatest AUC and provided the highest sensitivity and specificity of the potential cut points which led to a score of three or more, indicating a high risk for URV.

In this study, the mSTIRS was psychometrically favored over the TRST and ISAR based on greater specificity, Cronbach's alpha greater than 0.7, and higher predictive value. Sensitivity was equal among all three tools (Table 2). The was a positive correlation among the scales, indicating similarity among the tools despite differences in test items (Table 3).

Sensitivity for both the TRST and ISAR in this study was similar to that of previous studies[12,18-21]; however, specificity was lower than found in previous studies, potentially a result of a small sample size.[22,31,32,35,36] Cronbach's alpha coefficient was used to validate internal reliability for the mSTIRS while seminal studies for the ISAR and TRST indicated validation was completed with logistic regression and ROC analysis.[37,33] Since no Cronbach's alpha coefficients were documented as part of previous studies for the TRST or ISAR, we completed analyses as part of this study in order to directly compare the internal reliability of these tools. The Cronbach's alpha coefficient measures the internal consistency of the screening tools with a score of 0.7 or higher indicating an acceptable level of internal consistency and reliability. It must be noted that Cronbach's alpha can be artificially lowered in screening tools with fewer than 10 items and as such, the internal reliability for these screening tools may be higher than is indicated in this study.[40] The mSTIRS screening tool was the only tool with a Cronbach alpha greater than 0.7 thus indicating acceptable internal consistency. Overall predictive values for the ISAR were congruent with previous studies while the PPV for the TRST exceeded past studies

by nearly 20%. However, the NPV for the TRST fell far below previous standards with a score of 40% as compared to 90% [42].

Cardiomyopathy, heart disease, depression, congestive heart failure, and renal disease are commonly identified as the most common co-comorbid conditions associated with URV.[7,23,24] In contrast to reports by AHRQ and ACEP identifying association between co-morbidities and URV occurrence,[2,7] this study did not identify an association as Chi-square test for association resulted in a p-value > 0.05. This was likely due to the small sample size of this study.

There were several limitations were recognized for this study. The first was that the sample size was small and did not meet the intended target of 67. Recruitment and enrollment were complicated by a decrease in the number of patients reporting to the ED for care as a result of the COVID-19 pandemic encountered in March 2020. Additionally, other studies calculated geriatric URV rates as ranging from 1% to 15%,[3] which contrasts with our finding of 33%, potentially due to the small study size and loss of patients to follow-up failure. The second limitation was related to the ability to track return visits that occurred at a facility outside of the study site. Lastly, the study was limited as it was conducted at one site, limiting the generalizability of the results.

Conclusion

Geriatric patients are one of the highest user populations for the emergency department. Due to their age, co-morbid conditions, and frailty, they are more susceptible to experience adverse events and unnecessary ICU admission as a result of a URV. Measures must be in place to identify geriatric patients at risk for URV to develop and implement measures to mitigate this risk. While the TRST and ISAR are the most studied and most frequently used screening tools in the emergency department, they lack consistent sensitivity and specificity scores, fail to address

individual risk factors, and lack internal consistency testing. The mSTIRS screening tool was

developed to address these deficiencies and to provide a more accurate screening tool for

geriatrics at risk of URV.   Additional studies with larger sample sizes and multiple study sites is

recommended to examine validity of the mSTIRS screening tool.

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Participant Characteristics	Total Participants (N = 21)	URV Participants (N = 7)	Non-URV Participants (N = 14)	P-value
Age*	73.0 (± 5.01)	71.86 (± 7.08)	73.57 (± 3.78)	0.287
Gender**				0.513
Male	7 (33.3%)	3 (42.9%)	5 (35.7%)	
Female	14 (66.7%)	4 (57.1%)	9 (64.3%)	
Ethnicity**				0.432
Caucasian	17 (81%)	5 (71.4%)	12 (85.7)	
African American	4 (19%)	2 (28.6%)	2 (14.3%)	
Presenting Complaint**				0.788
Respiratory	4 (19%)	1 (14.3%)	3 (21.4%)	
Cardiac	7 (23.8%)	3 (42.9%)	4 (28.6%	
GI	2 (9.5%)	1 (14.3%)	1 (7.1%)	
MSK	4 (19%)	2 (28.6%)	2 (14.3%)	
Neuro	1 (4.8%)	0	1 (7.1%)	
HEENT	1 (4.8%)	0	1 (7.1%)	
GU	2 (9.5%)	0	2 (14.3%)	
Mean Score*				
TRST	2.43±1.3	3.0±1.4	2.1±1.2	0.110
ISAR	2.4±1.0	3.0±1.0	2.0±1.0	0.056
mSTIRS	2.9±1.8	3.57±1.40	2.5±1.90	0.197

Table 1: Sample characteristics of the study population, association of URV occurrence and presenting complaint, and comparison of mean scores between the TRST, ISAR, and mSTIRS

*: Mann-Whitney U test was used to compare age and means scores in the URV and non-=URV groups

**: Chi-square test was used to evaluate associations for gender, ethnicity, and presenting complaint

Abbreviations: GI, gastroenterology; GI, genitourinary; MSK, musculoskeletal; GU, genitourinary; HEENT, head eyes ears nose throat

	TRST	ISAR	mSTIRS
True Negative	5	4	8
False Negative	1	1	1
*Negative Predictive Value**	(5/6) = 83.3%	(4/5) = 80%	(8/9) = 88.9%
True Positive	6	6	6
False Positive	9	10	6
Positive Predictive Value†	(6/15) = 40%	(6/16) = 37.5%	(6/12) = 50%
Sensitivity	35.7%	28.6%	57.1%
Specificity	85.7%	85.7%%	85.7%
Cronbach's alpha	0.632	0.668	0.735

Table 2. Predictive validity measures of the TRST, ISAR, and mSTIRS instruments on 21 geriatric emergency department patients (n = 21; with URV n = 7; without URV n = 14)

*: Negative Predictive Value calculated by observed to not have case (True Negative) divided by total number of negative predictions (True Negative + False Negative [number predicted to not have case but did]) times 100.

†: Positive Predictive Value calculated by observed to have case (True Positive) divided by total number of positive predictions (True Positive + False Positive [number predicted to have case but did not]) times 100.

Table 3: Spearman's Rank Correlation Among mSTIRS, TRST, and ISAR

Variables			mSTIRS	TRST	ISAR
Spearman's rho	mSTIRS	Correlation Coefficient	1.000	.604[**]	.730[**]
		Sig. (2-tailed)		0.004	0.000
	TRST	Correlation Coefficient		1.000	.702[**]
		Sig. (2-tailed)			0.000
	ISAR	Correlation Coefficient			1.000
		Sig. (2-tailed)			

**. Correlation is significant at the 0.01 level (2-tailed).
(N=21)

Figure 1: Finalized mSTIRS Screening Tool

Modified Screening Tool for Identifying at Risk Seniors (mSTIRS)		
	Yes	No
History of cognitive impairment or Mini-Cog assessment score of ≤ 2?	3	0
Before this injury/illness, did you require assistance on a regular basis?(home health, transportation, financial, etc.)	1	0
Do you have difficulty walking or require an assistive device?	1	0
Have you had a fall within the past 3 months?	1	0
Do you take prescrition medications?	1	0
Do you have a PCP?	0	1
Staff recommendations/concerns? □ Obesity □ Poor nutrition/weightloss □ Lack of Social Support □ Incontinence (urine or fecal) □ Anxiety/Depression □ Speech or hearing impairment □ Medication non-compliance □ Other:_____	1	0
Total Score:		

A score of 3 or more indicates a risk for unanticipated return visit.

Figure 2. Study Sample Flowchart