Horizon Scan Report 0026 **Date: 5 November 2012**

Diagnostic Technology: Screening instruments for frailty in primary care

Clinical Question:

What is the diagnostic value of screening instruments for frailty in primary care?

Background, Current Practice and Advantages over Existing Technology:

Frailty is a commonly used term indicating older persons at increased risk for adverse outcomes such as onset of disability, morbidity, institutionalization or mortality (1). They may lack the reserve to deal with physical and psychological stressors (2). Although there is a universal recognition of the frailty syndrome by clinicians who care for older people, there is still a lack of consensus on definition of frailty and clinical assessment tools. Frailty can be considered as a loss of resources in several domains of functioning (2). However, assessing this formally is problematic. A Comprehensive Geriatric Assessment (CGA), which is a multilevel evaluation of an older individual's functional status, cognition, psychological status, social support, nutritional status, co-morbidity and medications, is a recommended component in the care for older patients. This is very time-consuming, however, and is not practical for primary care settings. An alternative two-step approach could use a pre-screening tool to identify those patients who would benefit from further assessment by full CGA. General practitioners could integrate these short screening tools in their daily practice, and continue testing or refer if further assessment is needed.

Details of Technology:

Pre-screening for frailty is a brief assessment conducted to determine whether further assessment is indicated. It involves a short evaluation that is not intended to be diagnostic, and does not replace, but rather optimizes CGA by selecting those senior patients who may benefit from an intensive assessment (3). The most important characteristic of a short pre-screening tool is the ability to exclude the presence of risk of frailty, with a high sensitivity. False-negative test results will lead to false reassurance. Several screening instruments have been developed. We will describe the following instruments, that we have selected for their relevance to primary care: Emergency Admission Risk Likelihood Index, SHARE-Frailty Instrument, Sherbrooke Postal Questionnaire, Tilburg Frailty Indicator, Identification of Seniors at Risk, 8-item Runciman questionnaire, 7-item Rowland questionnaire, abbreviated Comprehensive Geriatric Assessment, G-8, Groningen Frailty Indicator and Vulnerable Elders Survey-13.

Table 1 Number of items per domain for each instrument

Instrument	Domain													
	age	self-perceived health	physical items	IADL	ADL	cognition	psychological	social	nutrition-weight	medication	use of medical services (hospital or GP)	history of falls	total number of items	number of domains
EARLI		1	3			1					1		6	4
SHARE-FI			5						1				6	2
SPQ			3			1		1		1			6	4
TFI		1	6			1	3	3	1				15	6
ISAR	1		1	1	1	1				1	1		6 +	7

													age	
8-item Runciman			3	2	1	1						1	8	5
7-item Rowland			1	3	2						1		7	4
aCGA				4	3	4	4						15	4
G-8	1	1	1			x*	1		3	1			7 + age	7
GFI		1	5	1	2	1	2	3					15	7
VES-13	1	1	7	3	1								13	5

*Combined question about depression and dementia.

Patient Group and Use:

- Older people considered to be at risk for frailty by a primary care provider (e.g. GP, nurse, social worker).
- To identify frail elderly in primary care who could benefit from further assessment by means of a full CGA.
- To avoid costs and unnecessary assessment of healthy subjects, valid and low-cost tools are needed to screen elderly people who are particularly at risk of developing adverse outcomes.

Importance:

A recent UK study investigated the prevalence of frailty among 638 community-dwelling people aged 64-74 years, using diagnostic criteria based on the Fried frailty model (4, 5). It found frailty prevalence rates of 8.5% for women and 4.1% for men. Using data from the US Cardiovascular Health Study, the Fried investigators recorded a frailty prevalence of 6.9% in a cohort of 5,201 men and women aged 65 years or above (4). Moreover, the prevalence of frailty increased with age, from 3% in the youngest age group (65-70 years) to 26% in the oldest age group (85-89 years). The three-year frailty incidence rate was 7%.

Frailty is a common and potentially reversible state. Screening for frailty potentially offers opportunities to initiate intervention programs. The early stages of frailty are more commonly seen in community-dwelling elderly. Consequently, screening for frailty should be carried out or start in primary care settings (4, 6).

Previous Research:

There have been several recent reviews of screening instruments for frailty, with differing endpoints (7-12).

Other reviews focus on the identification of frailty, and are not restricted to screening tools (13-15). According to de Vries et al. (14) the Frailty Index seems to be the most suitable instrument to measure frailty, but this tool is complex, and it has not been validated in a primary health-care setting.

Only one review focused on short screening tools (16) and only the most recent review focused on screening tools for frailty in primary care (17). From the latter, two instruments seem potentially suitable, the Tilburg Frailty Indicator and the SHARE-FI, but have not been validated in primary health care settings.

We identified 11 screening instruments which are potentially suitable for primary care. We included instruments that were tested in an ED setting, because the ED can be a primary care setting in some countries. Also settings that were restricted to cancer patients were included, because they are part of a primary care population.

Of the 11 screening instruments, six were tested in primary care settings, four in ED/hospital settings, and four in cancer patients. Only one instrument (Vulnerable Elders Survey) was validated in all three settings. The Groningen Frailty Indicator was tested in community-dwelling and cancer patients.

Since there is no gold standard to measure frailty, surrogate outcome measures are used including ED-admission/hospitalization, development of disabilities, functional decline, mortality and change in Comprehensive Geriatric Assessment.

Instruments tested in primary care settings

The **EARLI (Emergency Admission Risk Likelihood Index)** is a simple six-item tool with questions about heart problems, leg ulcers, mobility, memory, recent hospitalization and general health status.

It was developed in a pilot study and then validated (N=3032 patients from general practices,) in the UK (18). The instrument had high negative predictive value for emergency admission within the next year (NPV = 85%) at cut-off ≥ 6 (maximum score 29) and sensitivity and specificity were both 64%.

The **SHARE Frailty Instrument (SHARE-FI)** (19) is based on five items, namely physical exhaustion, loss of weight, strength of grip (using a dynamometer), walking speed and difficulties in the activities of daily living. When data is entered into a freely accessed web-based calculator, patients are classified into three levels of frailty: "non-frail", "pre-frail" and "frail". Compared with the "non-frail" group, the odds ratios for mortality in women were 2.1 for the "pre-frail" and 4.8 for the "frail" group; among men, these odds ratios were 3.0 and 6.9, respectively.

The **Sherbrooke Postal Questionnaire (SPQ)** is a self-administered questionnaire (20). It comprises six items concerning the person's immediate circle, medication, walking, eyesight and memory. Based on a community sample of people aged over 75 years from Quebec, Canada (n=842 subjects), the sensitivity and specificity of the SPQ compared to CGA carried out by a nurse at home, were 75% and 52%, respectively. A study of community-dwelling people aged 70 years and older (n=430) (21) which compared the Groningen Frailty Indicator, the Tilburg Frailty Indicator and the SPQ, found that the SPQ had the highest sensitivity (83%) for detecting development of disabilities. However, the specificity was only 48%.

The **Tilburg Frailty Indicator (TFI)** (22) is a self-administered questionnaire requiring 14 min on average to administer. It comprises 15 items subdivided into three domains: physical, psychological and social. Predictive (concurrent) validity of the TFI and its physical domain was good to excellent (Area Under Curve > 0.7 to AUC > 0.8) for the adverse outcomes of disability, receiving personal care, receiving nursing and informal care, and fair for hospitalization and general practitioner visits (AUC > 0.6). The predictive validity of the TFI was tested in a representative sample of 430 community-dwelling persons aged 70 years and older. Sensitivity and specificity for development of disabilities were 62% and 71%, for mortality 67% and 61%, and for hospital admission 53% and 65% (21).

Instruments tested in ED settings

The **Identification of Seniors at Risk (ISAR)** screening tool was developed to identify seniors in an ED setting at high risk of subsequent functional decline (including institutionalization and death). It consists of six self-report questions about functional dependence. The cut-off point is 2, indicating that patients with a score ≥ 2 are at risk of adverse health outcomes, including decrease in functional status. Sensitivity (72%), specificity (58%) and AUC (0.71) were fair for predicting functional decline (N = 1673) (23).
The ISAR has been validated in several studies for its ability to predict adverse outcomes. It is difficult to compare these studies, because of different outcome measures (24-29). Although not validated for settings other than the ED, the ISAR scale may have potential in outpatient clinics or primary care settings.

The **8-item Runciman-** and the **7-item Rowland-questionnaires** were used in 2 studies with older patients admitted to the ED in Belgium and the Netherlands to compare their prognostic values to ISAR and TRST (Triage Risk Screening Tool) (28, 29).
The Runciman and Rowland questionnaires had relatively high sensitivity (56%-88%) but low specificity (61%-76%) for predicting ED readmission. The ideal cut-off scores, as determined by the AUC, were ≥4 for the questionnaire of Runciman, and ≥3 for the questionnaire of Rowland (28). The Rowland questionnaire seemed to be most appropriate for predicting ED readmission, with an acceptable number of false positives (25%). In the study by Buurman et al. (29), none of the instruments were able to clearly discriminate between patients with and without poor outcomes.

Instruments tested in cancer patients

The **aCGA (abbreviated Comprehensive Geriatric Assessment)**, was based on a chart review of over 500 cancer patients (70 years and older) presenting to a Cancer Center in Florida (30). The selection of items was based on psychometric criteria; those items within each scale that showed the highest item-to-total correlation were selected.
The aCGA is not a replacement for the entire CGA, but is designed to be a screening measure for applying the entire CGA (30, 31).

Soubeyran et al. proposed a new screening tool (generic name: G-8), which included 7 Mini Nutritional Assessment items and age, for a total score ranging from 0 (poor score) to 17 (good score) (32). Results suggested that the area under the curve (AUC) was maximized when the threshold was 14. When considering one or more impairment on the CGA as the reference test, a cut-off value of ≥ 14 for the G-8 tool provided a good sensitivity estimate (85%) without deteriorating the specificity excessively (65%) (n = 1668 cancer patients) (33).

Instruments tested in multiple settings

The **Groningen Frailty Indicator (GFI)** (34), consists of 15 items, and focuses on the loss of functions and resources in four domains of functioning: physical (9 items), cognitive (1 item), social (3 items), and psychological (2 items). Scores on the GFI range from 0 to 15. A total score ≥ 4 is considered as moderately to severely frail (34, 35).

A prospective study with 1-year follow-up among community-dwelling people, aged 70 or older, compared the accuracy of GFI, as well as TFI and SPQ on development of disabilities, hospital admission and mortality (21). Adjusted odds ratios show that those identified as frail by GFI (cut-off ≥ 4) have more than twice the risk (adjusted OR = 2.62) for developing disabilities compared to the non-frail group. Sensitivity and specificity for development of disabilities were 71% and 63%; regarding mortality, sensitivity and specificity were 73% and 54%. For hospital admission sensitivity and specificity were only 52 % and 55%.

Kellen et al. (3) found in their study of cancer patients (recruited in hospital and general practice) that the mean GFI score for the group was 4.2 (standard deviation: 2.55). The GFI classified 31% of the participants as being at high risk of vulnerability. The sensitivity of the GFI compared to CGA was poor (39%); likewise, the NPV was fair (40%).
The GFI has potential to identify older persons at risk, but its predictive power is poor.

The **Vulnerable Elders Survey (VES-13)** is a 13-item self-administered instrument (36).
The VES-13 has been recommended by the National Comprehensive Cancer Network (NCCN) as appropriate for screening older cancer patients for a full CGA. In cross-sectional studies in hospitalized and non-hospitalized older patients, that had as outcome a full CGA, sensitivity of VES-13 varied from 61% to 88%, specificity from 62% to 86% (3, 36-39). VES-13 has also been validated in prospective studies to predict functional decline and mortality. In community-dwelling patients and in trauma patients, higher VES-13 scores were associated with greater risk of death and decline (40, 41). VES-13 has also proved to be predictive of health care use (42).

Conclusions

Because there is no gold standard to measure frailty, and because different instruments have been tested in different settings and with different outcome measures, it was not possible to select one screening tool for the identification of frail older people.

In 2008, the European, Canadian and American Geriatric Advisory Panel (GAP), through a complete review of the literature on frailty, sketched out the "ideal" screening tool for frailty (1). According to their recommendations, it should include the five components listed in Table 3. None of the tools covers all 5 domains; two cover 4 domains (SHARE-FI and TFI); one covers 3 domains (GFI); three cover 2 domains (7-item Rowland, G-8 and VES-13). All the others cover only 1 domain and seem less appropriate. However, the ISAR (which appears to have reached the highest level of evidence in hospital setting) and the aCGA (frequently used in cancer patients) may have potential in primary care.

Overall eight of the identified tools may be good screening instruments: SHARE-FI, TFI, GFI, 7-item Rowland, G8, VES-13, ISAR, aCGA.

Cost-effectiveness and economic impact:

Research Questions:

- Which of the selected screening instruments (SHARE-FI, TFI, GFI, 7-item Rowland, G8, VES-13, ISAR, aCGA) is the best identifier of frail community-dwelling older people who could benefit from CGA?
- Which of these eight screening instruments can best predict adverse outcomes in community-dwelling older people?
- Which of these eight instruments is most feasible in general practice? This could include time needed to administer, whether self-administered, whether involves more than just the patient, and if any of the primary care team can administer it or only the GP.

Suggested next step:

Prospective study in community-dwelling older people and/or nursing home residents and/or cancer patients to compare the predictive abilities of these eight identified screening instruments, using outcomes of hospital admission, frequency of hospital admission/readmission, need for additional support in the home, nursing home admission, mortality, etc.

Expected outcomes:

A screening instrument for identifying the frail elderly that can be used in general practice and predicts useful clinical outcomes.

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Appendix:

Table 2 Studies comparing screening tools

screening tools	study	patient setting	outcome measure
GFI - aCGA - VES-13	Kellen et al. (3)	500 cancer patients	CGA
GFI - TFI - SPQ	Daniels et al (21)	community-dwelling persons 70 years and older	development of disabilities/hospital admission/ mortality
ISAR - TRST - Runciman - Rowland	Buurman et al (29)	patients 65 years and older who were to be released from an ED	recurrent ED visit/ subsequent hospitalization/ mortality (after 120 days)
	Moons et al (28)	patients 65 years and older who were to be released from an ED	readmission after 90 days
ISAR - TRST - VIP	Braes et al (26)	patients 65 years and older acutely admitted to hospital	functional decline
	Braes et al (27)	patients 65 years and older acutely admitted to hospital	functional decline

Table 3 Items of the ideal screening instrument described by the GAP (1) covered by each instrument

	Domain				
Instrument	fatigue reported by patient	physical performance	walking	number of comorbidities	nutritional state
EARLI			x		
SHARE-FI	x	x	x		x
SPQ			x		
TFI	x	x	x		x
ISAR		x			
8-item Runciman		x			
7-item Rowland		x	x		
aCGA		x			
G-8		x			x
GFI		x	x		x
VES-13		x	x		

Table 4 Overview of diagnostic indicators per instrument

Instrument	Setting	Outcome measure	Diagnostic indicators						Ref
			Se	Sp	PPV	NPV	AUC	OR (age-adjusted)	
EARLI	primary care - longitudinal	ED admission last 12 months	64%	64%	35 %	85%	/	/	Lyon et al (18)
SHARE-FI	primary care - longitudinal	mortality	/	/	/	/	/	women 2.1 - 4.8 men 3.0 - 6.9	Romero-Ortuno et al (19)
SPQ	primary care - longitudinal	functional decline	75%	52%	38 %	84%	/	/	Hebert et al (20)
		development of disabilities	83%	48%	34 %	89%	65 %	2.49	Daniels et al (21)
		hospital admission last 12 months	76%	44%	22 %	90%	60 %	2.42	Daniels et al (21)
		mortality	71%	41%	3%	98%	56 %	0.92	Daniels et al (21)
TFI	primary care - longitudinal	development of disabilities	62%	71%	40 %	85%	66 %	2.00	Daniels et al (21)
		hospital admission last 12 months	53%	65%	24 %	87%	60 %	2.59	Daniels et al (21)
		mortality	67%	61%	5%	98%	64 %	1.05	Daniels et al (21)
ISAR	ED - longitudinal	recurrent visit to the ED last 120 days	56%	54%	19 %	90%	59 %	/	Buurman et al (29)
		hospital admission last 120 days	65%	54%	22 %	88%	59 %	/	Buurman et al (29)
		mortality at 120 days	64%	51%	4%	98%	58 %	/	Buurman et al (29)
	ED - longitudinal	readmission at 14 days	100%	38%	15 %	100 %	70 %	/	Moons et al (28)
		readmission at 30 days	79%	37%	22 %	89%	61 %	/	Moons et al (28)
		readmission at 90 days	79%	41%	37 %	82%	63 %	/	Moons et al (28)
	ED - longitudinal	functional decline at 14 days	81%	36%	33 %	83%	58 %	/	Braes et al (27)
		functional decline at 30 days	79%	35%	27 %	85%	57 %	/	Braes et al (27)
		functional decline at 90 days	74%	36%	25	83%	55	/	Braes et al (27)

					%		%		
	ED - longitudinal	readmission at 14 days	54	30%	5%	90%	42 %	/	Braes et al (26)
		readmission at 30 days	59%	30%	12 %	81%	45 %	/	Braes et al (26)
		readmission at 90 days	69%	33%	24 %	78%	51 %	/	Braes et al (26)
	ED - longitudinal	severe functional impairment	94%	58%	/	/	/	/	Dendukuri et al (25)
		frequent ED use or readmission	59-71%	57-60%	/	/	/	/	Dendukuri et al (25)
	ED - longitudinal	ED revisit at 180 days	/	/	/	/	/	2.07	Salvi et al (24)
		frequent ED return	/	/	/	/	/	4.69	Salvi et al (24)
		functional decline	/	/	/	/	/	2.18	Salvi et al (24)
	ED - longitudinal	functional decline	72%	58%	/	/	71 %	/	McCusker et al (23)
8-item Runciman	ED - longitudinal	recurrent visit to the ED last 120 days	85%	12%	14 %	83%	49 %	/	Buurman et al (29)
		hospital admission last 120 days	85%	12%	17 %	81%	48 %	/	Buurman et al (29)
		mortality at 120 days	78%	12%	2%	95%	44 %	/	Buurman et al (29)
	ED - longitudinal	readmission at 14 days	80%	60%	14 %	97%	71 %	/	Moons et al (28)
		readmission at 30 days	67%	61%	28 %	89%	70 %	/	Moons et al (28)
		readmission at 90 days	59%	64%	45 %	76%	68 %	/	Moons et al (28)
7-item Rowland	ED - longitudinal	recurrent visit to the ED last 120 days	23%	82%	18 %	86%	53 %	/	Buurman et al (29)
		hospital admission last 120 days	23%	83%	23 %	84%	54 %	/	Buurman et al (29)
		mortality at 120 days	27%	82%	4%	97%	54 %	/	Buurman et al (29)
	ED - longitudinal	readmission at 14 days	88%	72%	26 %	98%	74 %	/	Moons et al (28)
		readmission at 30 days	73%	75%	42 %	92%	72 %	/	Moons et al (28)
		readmission at 90 days	56%	76%	54 %	78%	63 %	/	Moons et al (28)

aCGA	cancer patients (hospital and GP) - cross-sectional	full CGA	51%	97%	97 %	48%	/	/	Kellen et al (3)
G-8	cancer patients - cross-sectional	full CGA	85%	65%	/	/	87 %	/	Bellera et al (43)
GFI	primary care - longitudinal	development of disabilities	71%	63%	38 %	87%	67 %	2.62	Daniels et al (21)
		hospital admission last 12 months	52%	55%	20 %	84%	54 %	1.33	Daniels et al (21)
		mortality	73%	54%	4%	98%	64 %	1.35	Daniels et al (21)
	cancer patients (hospital and GP) - cross-sectional	full CGA	39%	86%	86 %	40%	/	/	Kellen et al (3)
VES-13	cancer patients (ambulant) - cross-sectional	full CGA	88%	69%	68 %	88%	85 %	/	Owusu et al (39)
	cancer patients - cross-sectional	full CGA	87%	62%	/	/	/	/	Luciani et al (37)
	prostate cancer patients - cross-sectional	full CGA	73%	86%	/	/	90 %	/	Mohile et al (36)
	cancer patients (hospital and GP) - cross-sectional	full CGA	61%	78%	85 %	48%	/	/	Kellen et al (3)