Original Article

Home visits: A new screening tool for frailty? A retrospective exploratory study

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Abstract

Background: In the United Kingdom, the new NHS contract for primary care mandates that practices use the Electronic Frailty Index (EFI) to screen for frailty and apply clinical judgment, based on knowledge of the patient, to decide whether they have a diagnosis of frailty. EFI has not yet been validated for this purpose. Many primary care clinicians would agree that although not formally investigated, there seems to be a strong association between being housebound or in institutional care and having a diagnosis of frailty. Although being housebound or in institutional care is not commonly coded in primary care computer record systems (IT), this cohort of patients do require home visits if they become unwell. Home visits are coded and it is simple to run a search on primary care IT to generate a list of older people who have received a home over given period. **Aim:** This study assessed whether being housebound and requiring home visits could form a new screening tool for frailty. **Design and Setting:** Retrospective cohort study from 1/3/15 to 29/2/16. Primary care, South Devon. **Method:** Medical records of 154 patients over 65 years of age were evaluated. Patients were divided into two groups: a group ($n = 82$) that had received a home visit and a second group consisting of a randomized sample of patients ($n = 72$) with similar baseline characteristics who had not. Patient records were analyzed by two clinicians to determine whether a frailty syndrome was present. Researchers were blinded to each other's results. An arbitrator determined the frailty status on disagreement. **Results:** Home visits have a sensitivity of 87.23% [95% confidence interval (CI): 74.35%–95.17%] and specificity of 61.68% (95% CI: 51.78%–70.92%). For frailty, Cohen's Kappa showed fair interobserver reliability. **Conclusion:** This study suggests that home visits are a good screen for frailty; the data are easy to retrieve from primary care IT and could be used as a valid screening tool to assist with identifying frailty in primary care.

Keywords: Domiciliary visit, frailty, home visit, house call, screen, screening tool

How This Fits In

In the United Kingdom, the NHS contract for primary care has suggested using the Electronic Frailty Index (EFI) to generate a list of patients who may be frail and ask clinicians to apply clinical judgment to assess whether they have a diagnosis of frailty. However, EFI has not yet been validated as a screening tool for this specific purpose. This research demonstrates that being housebound or in institutional care – and therefore requiring a home visit from primary care clinicians – is a reliable screen for frailty. To clinicians, this seems intuitive; housebound or institutionalized older people, requiring numerous home visits due to physical or functional decline, are highly likely to have a diagnosis of frailty. Furthermore, clinicians now have an easily identifiable patient cohort with frailty to work with, a challenge in the past. These data can easily be collated by running a search of patients who were home visited using primary care IT and could be a very effective and efficient way of identifying patients and meeting primary care contract requirements.

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Introduction

Frailty is a clinically recognized state of increased vulnerability, resulting from aging and is associated with a decline in physiological reserve.[1] A long-term condition in its own right, patients with frailty are at dramatic risk of deterioration after seemingly minor physiological insults.[1]

In the United Kingdom, 18% of the population are 65 years or older and 2.4% of the population are 85 years or older.[2] Studies in the United Kingdom and the United States have shown an overall frailty prevalence of 6%–14% in 65+-year-olds.[3,4] However, these studies demonstrate that the prevalence of frailty exponentially increases with age, such that in those 60–69 years of age the frailty prevalence is 3.2%–6.5%; increasing to 25%–30% in 80- to 89-year-olds; but could be anywhere between 25% and 60% in those over 90 years.[3,4] This is a problem that is set to grow, with the proportion of 65+-year-olds almost doubling by 2036 in the United Kingdom.[2]

Older people with frailty have a substantially increased risk of poor health outcomes such as falls, hospitalization, disability, long-term care, and death.[3-5] Diagnosis is crucial as it enables interventions to take place that improve outcomes such as the Comprehensive Geriatric Assessment and information sharing among the different providers involved in patient care.[1] Furthermore, patients with frailty are much more likely to have adverse events from medical interventions, such as starting a new drug or surgery. Knowledge of frailty may make a clinician think twice about certain interventions, enabling more informed decision-making.

There are two models for identifying frailty. The first is the frailty "phenotype" model[4] which defined frailty as with three or more out of the five characteristics: unintentional weight loss (10 lb in the past year), self-reported exhaustion, weakness (grip strength), slow walking speed, and low physical activity.[4] The second model is the cumulative deficit model proposed by Rockwood *et al.*,[6] which is based on counting the number of clinical deficits (symptoms, signs, conditions, and biochemical values) and using certain cut-offs to base a diagnosis of frailty on. Both have independently predicted falls, disability, hospitalization, institutionalization, and death.

However, these models are not always practical in primary care. The phenotype model is time-consuming and requires equipment and trained personnel that are not found in primary care. At the time of embarking upon this study, the cumulative deficit model had not been embedded into primary care IT systems, confining it to research setting as well.[4,6]

There is another key point to note with these models; the patients in both models were diagnosed with frailty on the grounds that they had an increased probability of falls, hospitalization, institutionalization, and death.[4,6] However, having an increased probability of the above outcomes does not inevitably mean the patient is frail. For example, patients with incurable cancer will all have an increased probability of falls, mortality, hospitalization, institutionalization, and death. Some may have coexisting frailty. Many may not. There is also a dissonance in these models between the *definition* of frailty – a state of reduced physiological reserve where minor stressors trigger a dramatic deterioration in function – and the *diagnostic criteria* for frailty. One might reflect that to meet the definition for frailty the patient must suffer an acute functional decline from a minor stressor or be judged to be at high risk of an acute functional decline from minor stressors. This is different to looking at a cohort of patients in the Cardiovascular Health Study in the United States[4] and the Canadian Study of Health and Ageing,[6] applying diagnostic criteria, and evaluating whether this increases probability of falls, mortality, hospitalization, institutionalization, and death.

In 2014, the British Geriatric Society (BGS) offered a more intuitive way to think about frailty.[1] They suggested five frailty syndromes, that if present (and the clinical picture fit), should make a clinician strongly consider a diagnosis of frailty. These syndromes include recurrent falls, acute or worsening immobility, acute or worsening incontinence, delirium, and susceptibility to side effects of multiple medications.[1]

To clinicians, the "syndrome approach" to frailty makes sense and is best illustrated using falls as an example. The ability of a person to remain upright is the result of complex, highly integrated feedback pathways, across multiple body systems. Massive quantities of information are relayed across different parts of the body, enabling micro-adjustments to be made to the position of body in three-dimensional (3D) space, keeping it upright. It follows that if there are impairments in multiple body systems, the probability of falling increases. When there is a "critical mass" of impairments, the human body will not be able to maintain its position in 3D space and a fall will result (the "falls threshold"). Patients who are near their falls threshold clearly have reduced compensatory mechanisms across multiple systems, meaning that a minor stressor will trigger the fall. This is *the definition* of frailty. Furthermore, there are studies demonstrating outcomes of hospitalization, institutionalization, morbidity, and mortality in older people with falls,[7-9] delirium,[10,11] incontinence[12] immobility,[13,14] and adverse drug reactions.[15]

BGS also advocated screening tests for frailty. Examples include PRISMA 7 (sensitivity 83%, specificity 83%), gait speed (sensitivity 99%, specificity 64%), and timed get-up-and-go-test of 10 s (sensitivity 93%, specificity 62%).[16] However, these tests were compared against phenotype model as the reference test. This had a slightly lower frailty prevalence than other studies[3,4] and, as discussed earlier, is slightly challenged in terms of diagnosing "true frailty" as per its definition. PRISMA 7, gait speed, and timed-up-and-go test are seldom used in primary care due to the demands on clinician time.

In 2017, NHS England included frailty as a feature in the new primary care contract. General Practice (GP) surgeries were to use the Electronic Frailty Index (EFI), or other validated tools, as a

method to screen for frailty and code patients accordingly.[17] EFI is based on the cumulative deficit model of frailty; as comorbidity increases, the probability of frailty increases.[18] There are 36 conditions (mostly diseases), each given a score of 1, which is summed and then decimalized. For example, if a patient has one condition, they score 1/36. If they have three conditions they score 3/36 and so on. The scores are decimalized, and if the EFI score is 0.24–0.36, the patient is said to have "moderate frailty." Higher than 0.36, patients are said to have "severe frailty."[18] It should be emphasized that the terms "moderate" or "severe" frailty in this context are misnomers; they are categorized according to EFI rather than diagnoses of frailty.

This was recognized in the primary care contract, which also required general practitioners to create a list of patients in their surgeries with moderate and severe frailty and then apply clinical judgment to determine whether they are actually severely frail.[17]

However, there are problems with this model of care. EFI will only return a moderate or severe score if a patient has a certain number of deficits. Some patients with very few deficits may have severe frailty. For example, a patient with advanced dementia, in a nursing home, and dependent on care will return and EFI score of 4/36 or 0.11 would be classified as not frail. This patient may well have coexisting frailty (as per the definition of frailty) yet not feature on the list of patients created by EFI.

There is a need in primary care for an easy-to-administer screen for frailty and an easily identifiable patient cohort to screen within. Anecdotally, it would seem that many older people with a diagnosis of frailty are housebound or in institutional care. When this group become unwell in a primary care setting, a clinician will undertake a home visit; they are simply too functionally impaired and it is unreasonable to expect them to attend surgery. This study assessed whether the need for a home visit could in itself form a new screening tool for frailty.

Method

The study participants were registered at a GP surgery in Devon between 1st March 2015 and 29th February 2016. The GP surgery was in the fourth more deprived decile on the Index of Multiple Deprivation score, and during this period there was approximately 3,000 registered patients, of which 470 (15%) were 65 years of age and older.

A home visit group (n = 82) was identified, containing all the patients who had received a home visit during the study period. This was compared against a randomly selected sample of patients (n = 72) with similar baseline characteristics who had not had a home visit. This was achieved by stratifying the home visit patients by sex (male versus female) and age cohorts. Random selection was achieved using a random numbers generator.

Two clinicians independently examined the medical records of each of the sampled patient for the defined study period to see whether one or more of the BGS frailty syndromes were present. If a frailty syndrome was found, clinical judgment was applied to determine whether the patient had a diagnosis of frailty. If they did, they were recorded as such. This meant that the BGS frailty syndromes were used as the reference test.

One clinician was employed by the GP surgery and could not be blinded to whether the patient had a home visit during the study period. The second clinician was independent of the GP surgery and had no knowledge whether a patient had a home visit during the study period. If there was a disagreement between the two clinicians of the patient's frailty diagnosis, a third clinician (arbitrator), who worked at the practice, was asked to review the patient's medical records and determine their frailty diagnosis. All clinicians were blinded to each other's diagnosis of frailty.

The results were analyzed using the statistical software Stata version 14 (StataCorp, 2015).[19] Inter-rater reliability was assessed using Cohen's Kappa statistic. However, the 95% confidence intervals (CIs) for sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) were calculated in the statistical software R[20] using the package bdpv.[21]

Due to the sampling method used in this study, it was possible that the proportion of participants who were diagnosed as frail were not representative of the actual proportion of frail patients within the practice. Therefore, to calculate the PPV and NPV, we considered the prevalence estimates from the English Longitudinal Study of Aging (ELSA)[3] for 65 years and older, which was 14% (95% CI: 12%–16%) based on 5,450 participants.

Results

Baseline characteristics are shown in Table 1. As patients who did not have a home visit were randomly selected to ensure these groups were balanced by age and sex, there was reasonable balance in the number frequencies and proportions by home visit. This was also true within the clinician diagnosis of frailty, where there appeared to be reasonable agreement by age, but less by sex.

When comparing the presence of the number of frailty syndromes between the two original clinicians, the agreement was 68.2% (105 patients) with a Kappa coefficient of 0.40. When comparing the binary outcome of clinical diagnosis of frailty (i.e., a patient has at least one frailty syndromes), the agreement was 81.2% (125 patients) and the Kappa coefficient was 0.58. Essentially, the evidence suggests that there is a fair agreement between the two clinicians.

The results in Table 2 compare the clinical diagnosis of frailty with home visits. The values in the table are based on the arbitrated scores. The sensitivity was estimated as 87.23% (95% CI: 74.35%–95.17%) and the specificity was 61.68% (95% CI: 51.78%–70.92%).

To estimate the PPV and NNP, we used the estimates from ELSA study,[3] as we believed these values were more representative of the English population where this screening tool would be applied to. Table 3 shows the estimates for the NPV and PPV for the prevalence reported. The NPV appears to decrease as the prevalence increases, whereas the PPV increases as the prevalence increases.

Discussion

Summary

The results show that home visits offer an 87.2% sensitivity (95% CI: 74.35%–95.17%) and 61.7% specificity (95% CI: 51.78%–70.92%).

Comparison with existing literature

This compares favorably with other screening tools available such as PRISMA 7 (sensitivity 83%, specificity 83%), gait speed (sensitivity 99%, specificity 64%), and timed get-up-and-go-test of 10 s (sensitivity 93%, specificity 62%).[6]

Strengths and limitations

Even if the lower CIs (sensitivity 74% and specificity 52%) are correct, this test requires no examination, questionnaire, or scoring system and is easy to administer: the simple act of a GP making the decision to home visit a patient could automatically act as a mental prompt to evaluate for frailty. The population assessed in the study was representative of most of the rest of the United Kingdom.

The change in NPV and PPV would indicate that any interpretation and subsequent action by clinicians may be dependent on the patient's age. However, as the study is based on a relatively small sample of participants and the age range did not match the ELSA study, these estimates should be viewed with caution. Especially for the NPV of 90 years or older, as the 95% CI was 55%–85%.

The study showed some variation in inter-observer reliability with a Cohen's Kappa that showed fair agreement. Two factors accounted for this. First, none of the patients had a coded diagnosis of frailty. This necessitated two clinicians retrospectively analyzing and interpreting primary care clinician's notes and deciding whether a frailty syndrome existed. Making that judgment was sometimes challenging and is perhaps easier to accomplish prospectively rather than retrospectively. In addition, one clinician knew the patient's home visiting status, which may bias results.

The study was also limited in that it only assessed for frailty during the study time period. In several subjects, frailty phenotypes had been noted in the few years prior to this but were not included in the study and discounted from analysis.

Another potential limitation was assessing for frailty using the five clinical syndromes. Frailty is defined as a state of increased vulnerability due to a decline in physiological reserve, and the direct care teams felt that several patients met this definition of frailty but did not exhibit one of the five clinical syndromes. For example, one patient in the home visit group was bedbound (no falls and no new/worsening immobility as already immobile), catheterized (so no worsening/new incontinence), and did not have any other frailty syndromes. They were classified according to study criteria as not frail.

Another difference between this screen and a previous systematic review of screening tests[16] is that the phenotype model[4] was used as the reference standard. This study used the BGS guidelines frailty syndromes as the reference standard.[1]

Implications for research and/or practice

Using home visits as a screen for frailty is intuitive as the need for a home visit is based on a clinician's judgment that the patient has reduced physical function. Given that frailty is defined as a state of reduced physiological reserve, it seems highly probable that patients requiring a home visit have coexisting frailty.

This would confer numerous benefits such as speeding up the diagnosis and initiation/referral for key interventions which are proven to improve clinical outcomes such as the Comprehensive Geriatric Assessment.[1]

This screen offers increased utility in a secondary care setting. For example, a GP referral that starts with "Many thanks for

Table 1: Characteristics of patients in each group

Demographics	Clinician diagnosis		Home visit	
	Not frail (*n*=107)	Frail (*n*=47)	No (*n*=72)	Yes (*n*=82)
Age in years				
Mean (SD)	80 (7.9)	84 (6.8)	80 (7.2)	83 (8.2)
Gender, *n* (%)				
Male	29 (67.4)	14 (32.56)	21 (48.8)	22 (51.2)
Female	78 (70.3)	33 (29.7)	51 (46.0)	60 (54.1)

SD: Standard deviation

Table 2: Comparison of the proportion of those with a clinical diagnosis of frailty and home visits

Frequency	Home visit		Total
	No	Yes	
Clinician diagnosis			
No	66	41	107
Yes	6	41	47
Total	72	82	154

Table 3: Negative and positive predictive values using the estimated prevalence from ELSA study

ELSA prevalence group	NPV		PPV	
	Est.	95% CI	Est	95% CI
60 years or older (14%)	96.7	(93.3–98.5)	27.0	(22.2–32.6)
60-69 years (6.5%)	98.6	(97.0-99.3)	13.7	(10.8-17.1)
90 years or older (65%)	72.2	(54.8-84.8)	80.9	(76.5-84.6)

ELSA: English Longitudinal Study of Aging; NPV: Negative predictive value; PPV: Positive predictive value; CI, confidence interval

seeing this patient who has had three home visits in the last two months…" increases the index of suspicion for a frailty syndrome. Another example is in orthogeriatrics, where knowledge of previous home visits might make a clinician more wary of the potential for a dramatic deterioration following an admission for fractured neck of femur.

Conclusion

This exploratory study demonstrates that if a primary care clinician decides that an older patient requires a home visit, this same judgment can be used as a screening tool for frailty, with a sensitivity and specificity that are comparable to some of the current screens for frailty. However, as these data are routinely gathered, there is no extra time burden to GPs or their computational systems needed and it also flags to patients who may require further assessment to diagnose frailty.

While the EFI score and the phenotype model have traditionally been used as reference standards for frailty, they do not actually diagnose the acute functional decline or the potential for an acute functional decline that is the defining feature of frailty. Although they do have a role in predicting outcomes such as falls, hospitalization, institutionalization, morbidity, and mortality.

The authors would suggest that the BGS's guideline on using frailty syndromes to diagnose frailty is intuitive. However, in addition to the five syndromes, we would suggest adding a sixth; that a clinician who has knowledge of the patient judges them to have reduced physiological reserve and is at risk of a dramatic deterioration in function.

It would strengthen the validity of the results to look across multiple GP practices to see whether the study findings are generalizable, and to compare home visits against EFI as a screen for frailty. In addition, it would be interesting to evaluate the BGS frailty syndromes using similar methodology and outcomes to the phenotype and cumulative deficit model to demonstrate non-inferiority.

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Conflicts of interest

There are no conflicts of interest.

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