Assessment of frailty in community-dwelling older adults residents in the Lazio region (Italy): A model to plan regional community-based services

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ABSTRACT

Purpose of the study: The prevalence of frailty is expected to increase worldwide in parallel with demographic ageing. Despite this, little is known about the prevalence in different populations particularly community-based samples. This cross-sectional study evaluates the prevalence of frailty in a community-dwelling older adult population and describes a methodology to plan community-based interventions.

Methodology: A random sample of 1331 older adults, resident in the Lazio-Region of Italy, were screened by trained public health nurses (PHNs) by administering a validated questionnaire (the Functional Geriatric Evaluation questionnaire). Prevalence of frailty was calculated using the Final Synthetic Score derived from the questionnaire’s Final Score. Variables associated with frailty were selected through univariate and multivariate statistical analysis.

Results: Prevalence of frail (FS ≥ 10, <50) and very frail (FS < 10) individuals was 13.9% and 7.6% respectively. Variables associated with frailty were age (older than 85 years), disability, living alone or the presence of a paid carer, lower education and neurological disorders like stroke, dementia, Parkinson disease and other neuropsychiatric diseases; Anaemia or cancer were also associated with a higher prevalence of frailty.

Discussion: The study provide a comprehensive picture of the prevalence of frailty and factors associated to this condition in community-dwelling older adults. On the basis of the study results, a plan of community-based services could address the needs of care of the elderly population. A trained team of PHNs may be the most appropriate personnel to carry out multidimensional frailty assessment in this setting.

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1 Introduction

Population ageing is associated with a rise in the prevalence of non-communicable diseases, increasing care needs and mortality (Prince et al., 2015). A strong shift from hospital-based to community-based care is suggested to address the burden of multi-morbidity and its effects on adverse healthcare outcomes.
including hospitalisation and particularly the increasing demand for Long-term care (LTC) resulting from this demographic shift (Banerjee, 2014). However, how best to access community care services remains unclear. The current model of care in Italy is focused on established diseases and/or disability, despite the increasing need for preventive approaches that may slow functional decline for many older adults. There is interest in the role played by frailty in this process especially whether intervention can prevent or indeed reverse frailty.

Even if consensus on the exact definition is still lacking (Bergman et al., 2007; Fried et al., 2001; Gobbens, Luijckx, Wijnen-Sponselee, & Schols, 2007; Gobbens, Luijckx, Wijnen-Sponselee, & Schols, 2010; Rockwood, 2005), frailty is a syndrome associated with onset of functional decline in older people (Buckinx et al., 2015). Regardless of the definition applied or the assessment tool used, the costs to the individual and society are of concern. It is therefore essential for public health strategies to set up a model based on the assessment of frailty in order to prevent or delay functional decline in the older population. To achieve this, health agencies must determine the prevalence of frailty in community samples, work that is to be addressed in the planned ADVANTAGE study (#724099) as part of the European Commission’s funded Joint Action on Frailty. What is known about the prevalence of frailty in community samples in Italy comes mainly from multinational studies (Hartgen, Kowal, Strulik, Chattejji, & Vollmer, 2013). Assessing other methods of determining frailty is important so that the implementation of community-based strategies is tailored to regional practice. In Italy, assessment may best be implemented by Public Health Nurses (PHN) as in other European countries such as Ireland (O’Caoimh et al., 2014; O’Caoimh et al., 2015a), where PHNs screen for frailty using a selection of community-specific screening instruments (O’Caoimh et al., 2015b).

The aim of this study was to determine the prevalence of frailty in older community-dwelling residents in the Lazio region of Italy and to describe factors associated with this condition in order to plan for adequate services. The proposed assessment model could be a reference for other regional services in Italy and inform the Joint Action on Frailty in Europe.

2. Methods

A cross-sectional study was carried out between January and December 2014. A multidimensional screening instrument, previously validated for frailty screening within the primary care level, the Functional Geriatric Evaluation (FGE) questionnaire (Grauer & Birnbom 1975; Scarcella, Liotta, Marazzi, Carbini, & Palombi, 2005), was administered to a sample of older community-dwelling residents in the Lazio region of Italy. The study was approved by the Independent Ethical Committee of the University of Rome “Tor Vergata”. All participants signed informed consent to participate to the study; in case of patients with advanced mental impairment their closest relative signed assent. The questionnaire was administered by five nurses who underwent a two-day training course. These nurses also conducted a chart review of general practice notes that provided additional information on medical conditions. Based on the number of citizens over age 64 years residing in the Lazio region, for a precision of 3% with a 95% confidence limit, taking into account a refusal rate of 10%, we estimated 1400 citizens were required to power the study.

In order to generate a sample of citizens, representative of the elderly population in the Lazio Region, we utilized a selection process based on a per strata randomized design. Based on information available in the literature, municipalities of the Lazio region were classified according to four criteria, each of them divided in strata in order to avoid selection biases:

1) Population (strata: less than 20,000, 20–50,000, 50–100,000, more than 100,000);
2) Geography (plain, hill or mountainous regions);
3) Dependency-index (less than 48%, 48–50%, more than 50%);
4) Socio-economic status (high, medium, low) (CENSIS, 2002; ISTAT 2011; Regione Lazio, 2015).

According to this classification, 12 municipalities were chosen as representative of the region: each municipality refers to one Local Health Authority (LHA) except for the city of Rome, which refers to 5 LHAs; in this case one of the five was chosen on the basis of the previous four criteria. For each municipality the number of older adults to be selected was defined to ensure representation of all strata.

The General Practitioners (GPs) to be involved in the study were identified through randomization of the LHA list. In order to reach a target of 1260 interviews a total number of 77 GPs were contacted of which 8 refused and 69 accepted participation in the study. A maximum of 25 patients per GP were chosen through randomization of the GP’s list of patients over 64 years of age. Patients not residing at home were excluded from the selection process. After being selected, study candidates were contacted by phone by their GP in order to give initial consent to the interview that was administered in the GP’s outpatient facility or at the patient’s home if the patient was unable to travel.

The FGE questionnaire provides a multidimensional assessment linked to a bio-psycho-social definition of frailty. It contains four sections:

a) Demographic information;
b) Multidimensional evaluation (physical, mental and functional status, socio/economic resources, environment);
c) A list of diseases affecting patients compiled by GPs;
d) Basic Activities of Daily Living (BADL) (Katz, 1963) plus Instrumental Activities of Daily Living (IADL) (Lawton, 1969) to define the disability (moderate disability if the patient is not fully independent in performing IADL and severe disability if the patient is not fully independent in performing basic ADL).

Only section b contributes to the Final Score (FS), which ranges from –108 to 101. According to the FS the subject interviewed is classified through the Final Synthetic Score (FSS) as robust (FSS > 50), frail (FS ≥ 10 but < 50) or very frail (FS < 10) by the incidence of institutionalization or death, which is two and three times higher among frail and very frail individuals respectively, compared with robust individuals five years after the administration of the questionnaire (Scarcella et al., 2005).

Statistical analysis was performed using SPSS 20.0. After calculation of the prevalence of frail and very frail individuals, the association between the FSS and variables in the questionnaire that did not contribute to the FS were analyzed. Univariate and multivariate analysis was performed in order to identify the pattern of variables associated with a frail or very frail status (bivariate Spearman’s correlations for the continuous variables or Chi-square on contingency tables for the categorical ones and forward stepwise multivariate logistic regression analysis with the FSS dichotomized into “frail” and “very frail” versus robust as the outcome variable). Finally, the variables that showed a statistically significant association with the FSS in the multivariate analysis were included in the final model described through a two-dimensional Multiple Correspondences Analysis (MCA) (Costa, Santos, Cunha, Cotter, & Sousa, 2013) MCA allows for the analysis of categorical or categorized variables encompassing more than two categorical variables. Results were interpreted based on the relative positions of the points and their distribution into a two-dimensional visual outcome. This technique allows the association:
between FSS categories and specific categories of other variables to be included in the model.

3. Results

The total number available was 1446, (21 per GP on average) of which 115 declined consent (7.8%), leaving 1331 for interview. The mean age of the sample included was 76.3 years (Standard Deviation (SD) ± 7.1). In all, 54.2% (n = 722) were female (mean age 76.7; SD ± 7.3) and 45.8% (n = 609) were males (mean age 75.9; SD ± 6.9). Those who refused participation, had similar demographic characteristics (age and sex) to those included; mean age 74.2 years (p = 0.086), 55.6% were female (p = 0.69). Although the percentage of males (42.8%) and the mean age of the sample (75.3 years) was lower in the Lazio region, the sample was considered representative of this region. The slight differences in age and gender distribution were not considered significant enough to affect study results. Other parameters were also consistent with the region. Older individuals living alone constituted 20.1% of the sample (n = 268); the percentage living alone increased with age from 11.9% among the youngest to 38.2% for those aged 86–90. The percentage living at home with a paid assistant was 2.9% (increasing to 19% among individuals aged over 90).

Levels of educational achievement, a proxy for socio/economic status, were low with 7.6% (n = 101) of participants left the school before reaching 10 years old. The cumulative percentage of individuals who did not continue beyond primary/middle school was 72.6%.

The prevalence of specific disease states is shown in Fig. 1. The prevalence of dementia was 4%, slightly lower than estimates for the general population, probably due to the high rates of institutionalization for demented patients. The overall prevalence of neurological disorders (cumulative index including stroke, Parkinson's disease, dementia irrespective of cause and other neuro-psychiatric disorders) was 15.8%. The prevalence of cancer and anaemia were 8.1% and 4.4% respectively. Comorbidity was highly prevalent with more than 80% of participants having two or more active diseases; the percentage decreased slightly among robust individuals (78.5%).

The prevalence of frail and very frail individuals as defined by the FS was 7.6% (95% CI:6.3–9.1) and 13.8% (95% CI:12.2–15.9) respectively. Frailty increased with age and reached a cumulative prevalence of 31.8% among participants aged over 74 years compared with 8.4% in the 65–74 age group.

Many variables excluded from the generation of the FS were associated with the level of frailty in the univariate analysis (Table 1), with the exception of some pathologies. In the multivariate analysis, comorbidity, education and age were associated with frailty, as well as the presence of neurological disorders, cancer, anaemia and disability in performing BADL/IADL (Table 2). Disability was the strongest determinant of frailty (OR 17.36; 95% confidence interval:11.73–25.70), while the association between comorbidity and frailty disappeared in the multivariate analysis (Table 2). However, disability was not unique to frail individuals with 170 (16.3%) participants scored as robust found to have moderate to severe disability. In the sample as a whole more disabled than frail subjects (422, 30.7% vs 287, 21.6%) were detected. Similarly, among participants with co-morbidities, 60.6% were classified as robust and without disability. Another important factor was the cohabitation variable: living with a spouse represented the strongest protective factor against frailty (OR 0.06; 95% CI:0.02–0.23). Higher education was also protective against frailty (OR 0.47;95CI: 0.26–0.83); Finally older age, (OR 1.23; 95% CI:1.06–1.42) and the presence of neurological disorders (OR 1.75; 95%CI: 1.23–2.48) were associated with a greater chance of being frail. Cancer and anaemia, even though associated with frailty in the multivariate analysis, were less helpful in defining frailty using MCA (average discrimination power equal to 0.011 and 0.003 respectively with no contribution in Dimension 2, while the minimum average discrimination power for the other variables included in the model was higher than 0.130–data not shown) and for this reason were excluded from the final MCA model.

MCA allows us to draw a frailty axis between frail and very frail levels, positioned on the right side of the MCA visual outcome graph with variables more closely associated with frailty distributed along the axis i.e. the level of disability, the quality of cohabitants, age (higher than 85 years), the presence of one or more neurological disorder, and level of education (lowest) (presented in Fig. 2). At the left side of the figure, we found that being robust was associated with higher levels of education, younger age, and the absence of neurological disorders or disability. Between the frailty axis and the variables associated to be robust, several conditions associated with a progressive shift from robust to frail are displayed (living alone or with a cohabitant

![Fig. 1. Prevalence of diseases among the interviewed.](image)
other than spouse, age between 76 and 85 years and low education level). The overall picture shows that the frail condition was also associated with socio-economic factors like lower education and living alone while very frail individuals were associated with the highest level of disability and living with a paid carer. Older age and neurological disorders contributed to both conditions when they were present.

4. Discussion

The present study on frailty prevalence is to our knowledge one of the first carried out in Italy using a face-to-face validated questionnaire targeting a random sample considered to fully representative of community-dwelling older adults at a regional level. The prevalence of frailty as detected by the questionnaire can be considered a snapshot of the situation in the field. Data stemming from the study could serve as the basis for regional planning of social and health care services for older adults.

The percentage of frail individuals in our study was 21.5%. Generally the prevalence of frailty varies enormously according to the instrument used in the assessment: however, a multidimensional approach usually results in a higher and likely more accurate frailty prevalence than a mono-dimensional one (Syddall et al. 2010). Weighted frailty prevalence, as a multidimensional
The percentage of “very frail” in our study (7.6%) is in the lower range. Previous research suggests that the mortality rate of individuals classified as “very frail” by the FGE instrument is 56.95% (Scarcella et al., 2005) in the five years following the assessment indicating that more than half of those labelled as ‘very frail’ are within the last two years of their life, a time when care needs are maximized (Breyer, Lorenz, & Niebel, 2015; Moorin et al., 2012). The five-year cumulative death rate of individuals classified as “frail” with the FGE is 32.8%, which translates into an average annual death rate of approximately 6.5%, while the average annual death rate of a “robust” individual is 2.2%. The “risk” of receiving formal care services is increased by about 40% among those designated as “frail” compared to “robust” (Scarcella et al., 2005). Connecting these to the results found here suggests that individuals classified as “frail” can be expected to have an increase in care needs in the five years following assessment and cannot be considered as “robust” in terms of quality of life and risk for LTC. A systematic assessment of frailty carried out on a representative sample allows systems to predict the approximate number of individuals who will need care in the following years, making it possible to adequately plan services.

Disability remains the strongest indicator of frailty even if it does not consistently overlap with frailty (Fried et al., 2001; Gobbens et al., 2010). Frailty is also strongly related to social and economic factors: sometimes disability, particularly moderate disability, can be addressed through social and economic strategies that allow an individual to carry on an independent life despite their physical limitation. Social and economic factors such as the presence of a spouse at home or high educational attainment also act as strong protective factor against frailty, emphasising the need for multi-dimensional assessment. Understanding this provides useful information for planning care at the community level since acute healthcare services including emergency departments, are often considered inappropriate for management of frail patients (Rozzini, Sabatini, & Trabucchi, 2003; Latham & Ackroyd-Stolarz, 2014; Rashwan, Abo-Hamad, & Arisha, 2015). Co-morbidity also was not linked to frailty in our multivariate analysis probably due to the on-going high-level treatment of most chronic diseases in this developed region of Italy, minimizing their impact on daily life.

The analysis confirmed the higher prevalence of frailty among individuals older 75 years who remain the target of strategies to prevent and mitigate frailty. MCA showed markers that may be useful as indicators for public health services. Age greater than 85
years, the presence of one or more neurological diseases and/or moderate/high grade ADL disability, lack of economic resources and living alone or with a paid carer are all possible pointers to frailty and could suggest the need to screen, assess or monitor these patients.

There is increasing interest in frailty as a public health issue with many studies addressing this issue worldwide. To date these have mainly taken a mono-dimensional approach, targeting the physical dimensions of frailty (Akin et al., 2015; Buttery, Busch, Gaertner, Scheidt-Nave, & Fuchs, 2015; Chen et al., 2015; Jurschik et al., 2012; McCaul et al., 2015; Moreira & Laurenço 2013, Woo et al., 2015). This paper is based on a multidimensional approach to frailty, studied through the use of a multidimensional validated tool, the FGE, as several authors (Chen et al., 2015; Collard, Boter, Schoevers, & Oude Voshaar, 2012; Gobbens et al., 2010; Syddall et al., 2010) have suggested is the optimal approach irrespective of instrument used. Multidimensional approaches show some practical advantages in comparison with the mono-dimensional one. These include the holistic approach to individual care, the integration of social and health needs, and the consideration that the environment in which citizens live plays a major role in enabling an independent life.

The assessment was conducted by a team of nurses, trained to use the FGE. They also performed the chart review that provided additional information about the diseases affecting the patients. These can be considered a PHN team allow this is not a term used in Italy. However, the experience of such nurses or PHNs, devoted to assessing care needs in the community is already in place in other European countries and represents an effective model of care to be taken into account in the development of community-based programme. The CARTS programme in Ireland, Spain and Portugal achieved valuable results developing a frailty screening and assessment pathway coordinated by community nurses or PHNs (O’Caoimh et al., 2015c). The model of care based on the frailty assessment carried out by a PHN team, as designed by this study, should be tested on a larger scale and undergo a health technology assessment process in order to measure the cost-effectiveness of its implementation. It is worth of note an ongoing programme implemented in the framework of the European Innovation Partnership on Active and Healthy Ageing that points to the assessment of the impact of community-based programs on the prevention and mitigation of frailty based on the extensive assessment of frailty followed by social and/or health intervention (ElPorAHA, 2016). In EU countries there are community-based services that are implementing a proactive approach to the assessment of care needs among the elderly, especially the ones older than 74 y, as part of the care model in the community (Marazzi et al., 2015; Stuart & Weinrich, 2001). This kind of approach showed some positive impact, especially because it allows to reach also citizens who are not aware of being frail. However, in the perspective of extending this approach to the whole population of the older than 74 y, two things are likely to be crucial: 1) validate a questionnaire even shorter than the FGE for the assessment of frailty in community-dwelling older adults; 2) experiment the possibility of asking to the citizens’ relatives to administer the questionnaire, having tested the reliability of the result achieved by this assessment. Another crucial issue is the support of Information and Communication Technology (ICT) to the screening of frailty (Beard & Bloom, 2015). Many data flows are already available at national, regional and local level and they could be exploited to identify at least part of the frail population. However, the current experiences still show some limits, especially to identify the ones who are experiencing a moderate level of frailty (Cavazza & Malvi, 2014). Moreover, the issue of merging data from different sources is still a challenge even if it could represent one approach to the screening of frailty, together with the face to face interview. In this field, developments are expected in terms of protection of patients’ privacy as well as the possibility of utilize important information for planning of care services.

The main limitations of the study is that the FGE, while a validated instrument, is not widely used reducing the generalisability of the results.

5. Conclusions

This study presents the prevalence of frailty in an older, community-dwelling population in the Lazio region of Italy and suggests a pattern of conditions associated with frailty that may provide useful information to inform the development of health and social care services. The use of an operational definition of frailty related to the risk of death and projected use of care services could represent a useful tool in defining the care needs of community-dwelling older adults, especially if supported by a proactive targeting approach coordinated by a team of PHNs working with GPs. Further studies should explore the relationship between frailty and the consumption of health and social resources. These assessments are crucial for determining the cost-effectiveness of interventions to prevent and mitigate frailty, an approach which should be supported by comprehensive approaches to data collection (Marazzi et al., 2015).

Conflict of interest

The authors declare no conflict of interest.

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