The Italian Version of the Tilburg Frailty Indicator: Analysis of Psychometric

(Article begins on next page)

23 June 2024

Page Proof Instructions and Queries

Journal Title: ROA

Article Number: 606192

Greetings, and thank you for publishing with SAGE. We have prepared this page proof for your review. Please respond to each of the below queries by digitally marking this PDF using Adobe Reader.

Click "Comment" in the upper right corner of Adobe Reader to access the mark-up tools as follows:

For textual edits, please use the "Annotations" tools. Please refrain from using the two tools crossed out below, as data loss can occur when using these tools.
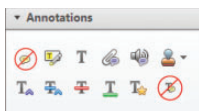
For formatting requests, questions, or other complicated changes, please insert a comment using "Drawing Markups."

Detailed annotation guidelines can be viewed at: http://www.sagepub.com/repository/binaries/pdfs/AnnotationGuidelines.pdf
Adobe Reader can be downloaded (free) at: http://www.adobe.com/products/reader.html.

No.	Query
	Please confirm that all author information, including names, affiliations, sequence, and contact details, is correct.
	Please review the entire document for typographical errors, mathematical errors, and any other necessary corrections; check headings, tables, and figures.
	Please confirm that the Funding and Conflict of Interest statements are accurate.
	Please confirm you have reviewed this proof to your satisfaction and understand this is your final opportunity for review prior to publication.
AQ: 1	Please replace "xxxx et al., xxxx" with appropriate author name throughout article.
AQ: 2	Please replace "xxxx xxxx" with appropriate word throughout article.
AQ: 3	Please provide publisher location for reference European Commission. (2013). Eu employment and social situation, quarterly review, special supplement on demographic trends. Author.

AQ: 4	Please provide publisher location for reference Eurostat, European Commission. (2013). Active ageing and solidarity between generations. A statistical portrait of the European Union 2012. Author.
AQ: 5	Please provide volume number and page range for the reference "Freitag, S., Schmidt, S., & Gobbens, R. J. (2015). Tilburg Frailty Indicator: German translation and psychometric testing. Zeitschrift fur Gerontologie und Geriatrie. doi:10.1007/ s00391-015-0889-9."
AQ: 6	Please provide page range for reference Mannocci, A., Di Thiene, D., Del Cimmuto, A., Masala, D., Boccia, A., & De Vito, E. (2012). International Physical Activity Questionnaire: Validation and assessment in an Italian sample. Italian Journal of Public Health, 7.
AQ: 7	Please replace " xxxx, xxxx, xxxx, & xxxx. xxxx xxxx xxxx xxxx. xxxx xxxx xxxx (xxxx xxxx)." With appropriate reference details throughout article.

The Italian Version of the Tilburg Frailty Indicator: Analysis of Psychometric Properties

A. Mulasso[1], M. Roppolo[1,2], R. J. Gobbens[3,4], and E. Rabaglietti[1]

Abstract

This study aims to assess the reliability, construct validity (convergent/divergent), and criterion validity of the Italian version of the Tilburg Frailty Indicator (TFI). TFI is a self-report questionnaire for screening frailty in older adults. Two hundred and sixty-seven community-dwelling older adults were involved. Psychometric properties were analyzed using validated instruments. Adverse outcomes such as disability, falls, and visits to a general practitioner were detected. Participants were mainly women (59.9%), with a mean age of 73.4 years (*SD* = 6.0). Internal consistency reliability was acceptable. Construct validity was good, since each item of the TFI correlated as expected with corresponding frailty measures. Convergent and divergent validity were adequate for all the domains of the TFI. Criterion validity was excellent for disability and mediocre for the other two

[1] Department of Psychology, University of Torino, Torino, Italy
[2] Department of Developmental Psychology, Rijksuniversiteit Groningen, Groningen, The Netherlands
[3] Faculty of Health, Sports and Social Work, Inholland University of Applied Sciences, Diemen, Amsterdam, The Netherlands
[4] Zonnehuisgroep Amstelland, Avenue of the Masters Healing 114, Amstelveen, The Netherlands

Corresponding Author:
Mattia Roppolo, Department of Psychology, University of Torino, Via Verdi, 10, 10124 Torino, Italy.
Email: mattia.roppolo@unito.it

outcomes. This study supports the validity of the Italian TFI and offers to clinicians and scientists a multidimensional instrument for identifying frail individuals in the Italian context.

Keywords

questionnaire, validation, frailty measure, screening

Introduction

The European population is aging rapidly, due to increasing life expectancy and to the lower fertility rate. Italy is one of the "oldest" countries in the world, 20.6% of the population being over the age of 65 in 2012, with 6.1% 80 years or older (European Commission, 2013). The increasing age is associated with higher prevalence of physical and mental disorders, with negative consequences for the individual's quality of life and increased pressure on health-related services (Eurostat, European Commission, 2012). In this context, the adoption of preventive strategies and indicators of early signs of functional decline are greatly needed. The precursor state of poor clinical outcomes, such as loss of autonomy in daily life, falls, cognitive decline, hospitalization, institutionalization, or increased risk of death, has been recognized in the concept of frailty (Fried et al., 2001; van Kan et al., 2010).

In the recent years, frailty has been defined in various ways. Some authors (Carriere, Colvez, Favier, Jeandel, & Blain, 2005; Fried et al., 2001) considered frailty as a single dimensional construct focused mainly on physical functioning and on the biological/physiological state. This view of frailty has been widely criticized for its inability to capture the complexity and uniqueness of the frailty status at the individual level. This may result in fragmentation of care and health-related treatments (Gobbens, Luijkx, Wijnen-Sponselee, & Schols, 2010b; Markle-Reid & Browne, 2003). As a consequence, several researchers (Gobbens, van Assen, Luijkx, Wijnen-Sponselee, & Schols, 2010; Markle-Reid & Browne, 2003; Walston et al., 2006) supported a multidimensional concept of frailty based on several domains (e.g., physical, psychological, social, and environmental) of individual functioning. For instance, Gobbens, Luijkx, Wijnen-Sponselee, and Schols (2010a) defined frailty as "a dynamic state affecting an individual who experiences losses in one or more domains of human functioning" with consequently higher risk for adverse outcomes. Based on this integral

conceptual definition of frailty, a new instrument named the Tilburg Frailty Indicator (TFI; Gobbens et al., 2010, 2010b) has been recently developed. The TFI is a self-report and user-friendly questionnaire to evaluate frailty in community-dwelling older adults. The TFI is easy and simple to administer and provides a total score of frailty.

In the Italian context, the screening for frailty in older adults is currently based exclusively on a single domain evaluation, typically the physical dimension, or on a multidimensional way using multiple measures. As a result, a comprehensive multidimensional instrument for frailty screening is currently lacking in Italy. The translation and cross-cultural adaptation of the TFI in the Italian context were the necessary first step for using the TFI in Italy and have already been completed (xxxx et al., xxxx xxxx). The Italian version of the TFI has been judged favorably by the experts involved in the process of translation and adaptation, by the author of the original TFI, and by the participants at the pretest phase, who declared it clear, simple, and comprehensible.

Therefore, the aim of this study was to evaluate the psychometric properties of the Italian version of TFI, as expressed by its reliability, construct validity, and criterion validity, in a sample of Italian community-dwelling older adults.

Material and Method

Study Population and Procedures

Two hundred and sixty-seven older adults were involved in the present study. In total, 498 older adults were contacted, of whom 190 (38%) were not willing to participate, 23 (5%) were classified as not eligible due to severe physical restrictions, and 18 (4%) did not complete the study. The final response rate was 53%. The inclusion criteria were the following: (i) they were aged 65 years and older, (ii) they were able to understand and speak Italian, (iii) they were not institutionalized, (iv) there were no contraindications to the administration of physical measures (e.g., upper or lower extremity fractures, recent surgical operations), and (v) they were able to walk independently with or without assistive devices.

Participants were recruited on a voluntary basis through local seniors associations (e.g., recreational centers, cultural centers) located in xxxx xxxx. A list of seniors' associations located in the area of interest was prepared. A preliminary meeting in which researchers presented the study was organized in each of the available associations. No randomization or

stratification strategies for the recruitment of participants were performed. All the study's participants lived in xxxx xxxx and were retired. They did not receive any incentives or reward for participating. Participants provided written informed consent according to Italian law and the ethical code of the American Psychological Association (2002).

After the preliminary meeting, individuals who were interested in participating and falling within the inclusion criteria were invited to fill out autonomously the questionnaires at their home. Completing the questionnaires required about 15 min. One week after, all participants were invited to return the questionnaires and, at the same time, to execute cognitive and physical tests. Completing these tests took on an average of 15 min. The tests were always administered in the same order and individually for each participant by qualified and trained staff, consisting of a psychologist and an expert in physical activity for older adults. In the first part, the psychologist asked each participant about difficulties encountered in filling out the questionnaires and checked for any missing answers. If any were found, he asked the participant to complete them. Then the psychologist administered the cognitive test. In the second part, the expert in physical activity administered the physical measures. Cognitive and physical tests were executed in two separate rooms and in the presence of an operator.

Measures

Frailty: The TFI. The TFI is a self-report questionnaire for the screening of frailty, composed of two parts. Part A contains 10 questions on determinants of frailty (e.g., gender, age, marital status, level of education, and lifestyle), and part B includes 15 items on components of frailty belonging to three domains of human functioning—physical, psychological, and social. The physical domain comprises of eight questions related to physical activity, unexplained weight loss, difficulty in walking, balance, vision problems, hearing problems, strength in hands, and physical tiredness. The question about physical activity replaced the question on physical health, as proposed in previous studies (Gobbens, Luijkx, & van Assen, 2013; Gobbens et al., 2010). The psychological domain includes 4 items about cognition, depressive symptoms, anxiety, and coping. The social domain consists of three questions related to living alone, social relations, and social support. Eleven questions of Part B have two categories of answer: "yes" and "no," while the others have three: "yes," "sometimes," and "no," dichotomized in 0 and 1. The total score of the TFI is between 0 and 15: Score ranges from 0 to 8 for the physical domain, from 0 to 4 for the psychological domain, and from 0 to

3 for the social domain. Higher scores correspond to a more serious frailty status. In terms of sensitivity and specificity for negative outcomes, the best cutoff value that distinguishes frail from robust individuals is 5 (Gobbens et al., 2010).

Corresponding frailty measures. A pool of questionnaires and physical/cognitive tests investigating the same construct of each TFI item were selected to evaluate construct validity of the Italian version of the TFI. Specifically, the physical frailty components were investigated using the following instruments: (i) The International Physical Activity Questionnaire (IPAQ, 7-item; Craig et al., 2003; Mannocci et al., 2012) is among the most common instruments to measure the amount of physical activity affected in 1 week. The physical activity was reported as continuous measure, computed according to the indications reported in the Guidelines for Data Processing and Analysis of the IPAQ (2005). The unit of measurement adopted was the metabolic units (METs, metabolic equivalents of oxygen consumption) per min/week. (ii) The body mass index (BMI) was computed as weight divided by squared height (kg/m^2). (iii) The Timed Up and Go (TUG) test (Podsiadlo & Richardson, 1991) is a mobility measure requiring a subject to rise from a chair, walk 3 m, turn round a cone, walk back, and sit down. It was performed once, in addition to an untimed trial (Podsiadlo & Richardson, 1991). Timing started upon the instructor's "Go" and stopped when the subject returned to the initial position. TUG values for healthy older adults in the range from 70 to 79 years old are 9.2 s (8.2–10.2; Bohannon, 2006a). (iv) The One Leg Standing (OLS) test (Bohannon, 2006b) is a balance test that measures the time a subject is able to stand on one leg without support. The test was performed once for each lower limb and stopped when 60 s were elapsed. If the stance foot shifted or the lifted foot was placed on the ground, the time was stopped. The best value between right and left lower limbs was used in the analysis (Michikawa, Nishiwaki, Takebayashi, & Toyama, 2009). (v) Two questions to determine sensory impairments were asked: "How do you assess your hearing" (categories of answer: "good," "acceptable," and "poor") and "How often do you come into situations in which you find your vision is bad?" (categories of answer: "never," "sometimes," and "often"). (vi) The grip strength test was measured in kilogram using the Smedley digital hand dynamometer (model 12-0286) that has demonstrated a good level of test–retest reliability (Metter, Talbot, Schrager, & Conwit, 2002). Three attempts of maximal isometric hand grip strength were executed, alternating sides, and the best value of the six measurements was used in statistical analysis (Roberts et al., 2011). (vii) Two items of the Center for Epidemiologic

Studies–Depression (CES-D) Scale (Radloff, 1977), "I felt that everything I did was an effort" and "I could not get going."

With regard to the psychological components, the following corresponding measures were used. (i) The Mini Mental State Examination (MMSE; Folstein, Folstein, & McHugh, 1975) to evaluate the cognitive functioning. The MMSE is composed of seven domains and its score ranges from 0 to 30. The higher is the score, the better is the level of cognitive functioning. In this study, the internal consistency is acceptable ($\alpha = .65$). (ii) The CES-D Scale (10-item; Andresen, Malmgren, Carter, & Patrick, 1994; Radloff, 1977) to investigate the common symptoms of depression occurred within the past week. Score ranges from 0 (no presence of depressive symptomatology) to 30 (severe depressive symptoms). In this sample, the internal consistency was high ($\alpha = .80$). (iii) The Anxiety subscale of the Hospital Anxiety and Depression Scale (HADS-A, 7-item; Costantini et al., 1999; Zigmond & Snaith, 1983) to assess anxiety. The score ranges between 0 and 21. Higher scores represent greater symptom severity. A Cronbach's α of .83 was obtained in this study. (iv) The Coping Orientation to Problems Experienced (COPE, 8-item), Active coping and Planning subscales (Carver, Scheier, & Weintraub, 1989; Sica et al., 2008) to measure coping responses. The sum score for these two scales ranges from 8 to 32, with higher scores corresponding to better coping behavior. In this study, considering the two scales, the internal consistency was $\alpha = .88$ ($\alpha = .72$ for Active coping subscale and $\alpha = .85$ for Planning subscale).

Concerning the social components, the following measures were administered: (i) one question for living alone "Do you live alone at present or with others?" (ii) the Loneliness Scale (11-item; de Jong Gierveld & Kamphuls, 1985; de Jong Gierveld & van Tilburg, 1999) to investigate emotional and social loneliness. The possible score ranges from 11 to 33, with lower scores corresponding to stronger loneliness feeling. In this study, the internal consistency was good ($\alpha = .79$); and (iii) the Lubben Social Network Scale (LSNS, 6-item; Lubben, 1988; Postacchini, Giuli, & Spazzafumo, 2009) to evaluate social support. The minimum score is 0 and the maximum is 30. The higher the score, the greater is the level of social support. A Cronbach's α of .77 was obtained in this study.

Adverse outcomes. To investigate disability, the Groningen Activity Restriction Scale (GARS; Kempen & Suurmeijer, 1990; Suurmeijer et al., 1994) was used. The GARS is a nondisease-specific questionnaire composed of 18 items about basic and instrumental activities of daily living. Each item has four response categories, with a total score ranging from 18 (absence of

disability) to 72 (severe disability). The GARS is a valid and reliable scale (Suurmeijer et al., 1994), commonly administered to the aged population (Faber, Bosscher, Chin, & van Wieringen, 2006). The internal consistency obtained in this study was optimal ($\alpha = .90$).

Lastly, the number of visits to general practitioner and the number of falls were investigated using these questions: "How many times have you visited or been visited by a general practitioner in the last 12 months?" (categories of answer: "never," "1 to 5 times," "6 to 10 times," "11 to 15 times," and ">15 times") and "How many times have you fallen in the last 12 months?" (categories of answer: "never," "1 time," "2 times," "3 times," and ">3 times").

Statistical Analysis

All the analyses were conducted with Statistical Package for Social Sciences (SPSS), Version 20.0 (SPSS, Inc., Chicago, IL). Statistical significance level was fixed at $\alpha < .05$ for all tests.

Analyses of descriptive and frequencies were performed for all the study's variables. Relationships among the TFI domains were analyzed using Pearson's correlations. Reliability was assessed by Cronbach's α and the corrected item-total correlations for each item of the TFI with domains of the TFI. Construct validity was examined correlating each item of the TFI with the corresponding frailty measure that investigates the same construct. Evidence for construct validity was obtained if each item of the TFI correlates significantly and with the expected sign with the corresponding frailty measure. Convergent and divergent validity were obtained by computing correlations between the TFI domains and each of the other frailty measures. A TFI domain has convergent validity if the correlations with the corresponding measures are significant and with the expected sign and has divergent validity if the correlation with that domain is higher compared to the correlation obtained with the two other domains. For all the correlation analyses, the Pearson's coefficient, with a one-tailed test, was applied. Lastly, criterion validity was determined by the receiver operating characteristic (ROC) analyses through the evaluation of the areas under the curves (AUCs) with 95% confidence intervals. The ROC analyses were applied to adverse geriatric outcomes—disability, falls, and visits to general practitioner. For each outcome, sensitivity and specificity were calculated at the cut points of the TFI and the physical domain of the TFI that gave the best values.

Results

Participants Characteristics

Of the 267 participants, 160 (59.9%) were women. The mean age of the whole sample was 73.4 ($SD = 6.0$, range 65–90), women averaging 73.2 ($SD = 6.2$) years old and men 73.8 ($SD = 5.7$) years old. Most of the participants were born in the north of Italy (59.9%), were married (66.3%), had a level of attainment corresponding to secondary school (43.1%), and carried out a nonmanual job (55.0%). A high number of participants referred to having one or more chronic diseases (70.4%) and to taking some medication on a regular basis (88.4%). The mean TFI total score was 4.40 ($SD = 2.56$, range 0–12) with a prevalence of frail subjects of 44.6% ($n = 119$, TFI score ≥ 5). Items with highest prevalence were "poor eyesight" (46.4%, Q16) in the physical domain, "feeling nervous or anxious" (69.3%, Q21) and "feeling down" (61.0%, Q20) in the psychological domain, and "lack of people around" (53.2%, Q24) in the social domain. The characteristics of the sample are summarized in Tables 1 and 2.

Reliability

The Cronbach's α of .66 for the total TFI was considered acceptable. The values of internal consistency were .57, .51, and .36 for physical, psychological, and social domain, respectively. Table 3 shows the corrected item-total correlations for each item of the TFI with the domains of TFI. In general, each item presented acceptable values of correlation with its corresponding domain. Some exceptions should be mentioned. The items on unexplained weight loss (Q12), poor hearing (Q15), poor vision (Q16), problems with memory (Q19), able to deal with problems (Q22), living alone (Q23), and social support (Q25) correlated poorly or did not correlate significantly with its domain.

Construct Validity

The correlations between frailty domains were all statistically significant ($p < .001$), and correlation coefficients were .31 between physical and psychological, .25 between physical and social, and .24 between psychological and social domains. The results of construct validity are reported in Table 4. All the items of TFI correlated significantly and with the expected sign with their corresponding frailty measure. Correlation values ranged from .11 of item related to being able to cope (Q22) to 1.00 of item on living alone (Q23).

Table 1. Characteristics of Participants.

Variable	n (%)	Mean (SD)
Age, years		73.4 (6.0)
Gender, n (%) of female	160 (59.9)	
Place of birth		
North Italy	160 (59.9)	
Central Italy	17 (6.4)	
Islands or South Italy	84 (31.5)	
Foreign countries	6 (2.2)	
Marital status		
Married	177 (66.3)	
Not married	9 (3.4)	
Widowed	67 (25.1)	
Divorced	14 (5.2)	
Level of education		
Primary school, 5 years	77 (28.8)	
Secondary school, 8 years	115 (43.1)	
High school diploma, 13 years	54 (20.2)	
University degree, 18 years	21 (7.9)	
Past job, n (%) of manual workers	120 (45.0)	
Lifestyle		
Healthy	119 (44.6)	
More or less healthy	142 (53.2)	
Unhealthy	6 (2.2)	
Chronic disease, n (%) of yes	188 (70.4)	
Life events, n (%) of yes		
Loss of somebody close	64 (24.0)	
Serious disease	35 (13.1)	
Serious disease in somebody close	76 (28.5)	
End of importance relationship	10 (3.7)	
Traffic accident	4 (1.5)	
Crime	21 (7.9)	
Satisfaction of housing environment, n (%) of yes	252 (94.4)	
Pharmacotherapy, n (%) of yes	236 (88.4)	

Note. N = 267. SD = standard deviation.

Table 5 shows the correlation results of the TFI domains with other frailty measures. Convergent validity of the physical TFI domain was confirmed by significance and with the expected sign correlations on all the frailty measures. Divergent validity of this domain was good, with the exception of the physical tiredness measure (2 items of CES-D) that also correlated significantly with the psychological domain. With respect to psychological domain,

Table 2. Characteristics of Participants on Components of Frailty, Corresponding Frailty Measures, and Adverse Outcomes.

Variable	n (%)	Mean (SD)
TFI, $\alpha = .66$		4.40 (2.56)
TFI Physical domain, $\alpha = .57$		1.88 (1.61)
Q11. Physically inactive	36 (13.5)	
Q12. Unintentionally weight loss	11 (4.1)	
Q13. Difficulty in walking	37 (13.9)	
Q14. Difficulty in maintaining balance	44 (16.5)	
Q15. Poor hearing	79 (29.6)	
Q16. Poor eyesight	124 (46.4)	
Q17. Lack of strength in hands	67 (25.1)	
Q18. Physical tiredness	101 (37.8)	
TFI Psychological domain, $\alpha = .51$		1.47 (0.99)
Q19. Problems with memory	32 (12.0)	
Q20. Feeling down	163 (61.0)	
Q21. Feeling nervous or anxious	185 (69.3)	
Q22. Able to deal with problems	13 (4.9)	
TFI Social domain, $\alpha = .36$		1.06 (0.91)
Q23. Living alone	79 (29.6)	
Q24. Lack of people around	142 (53.2)	
Q25. Lack of support from others	61 (22.8)	
Physical activity, IPAQ, MET, min/week		2,083.69 (1,862.09)
BMI, kg/m^2		26.34 (4.80)
Mobility, TUG, s		9.84 (3.30)
Balance, OLS, s		26.08 (22.45)
Hearing		
Good	139 (52.1)	
Acceptable	97 (36.3)	
Poor	31 (11.6)	
Poor vision		
Never	92 (34.5)	
Sometimes	137 (51.3)	
Often	38 (14.2)	
Handgrip, kg		25.78 (8.70)
Physical tiredness		1.12 (1.43)
Cognition, MMSE, $\alpha = .65$		27.43 (3.07)
Depression, CES-D, $\alpha = .80$		6.69 (5.34)
Anxiety, HADS-A, $\alpha = .83$		5.50 (3.84)
Coping, COPE, $\alpha = .88$		24.19 (6.16)
Active coping, $\alpha = .72$		12.20 (3.07)
Planning, $\alpha = .85$		11.99 (3.50)

(continued)

Table 2. (continued)

Variable	n (%)	Mean (SD)
Living alone	79 (29.6)	
Loneliness, Loneliness Scale, α = .79		26.98 (4.50)
Social support, LSNS, α = .77		15.76 (4.95)
Disability, GARS, α = .90		21.19 (5.77)
≥29	27 (10.1)	
Visits to general practitioner, n (%) of yes	255 (95.5)	
1–5	160 (62.7)	
6–10	57 (22. 4)	
11–15	27 (10.6)	
>15	11 (4.3)	
Falls, n (%) of yes	48 (18.0)	
1	32 (66.7)	
2	14 (29.2)	
3	2 (4.2)	
>3	—	

Note. N = 267. SD = standard deviation; TFI = Tilburg Frailty Indicator; TUG = Timed Up and Go; OLS = One Leg Standing; HADS-A = Anxiety subscale of the Hospital Anxiety and Depression Scale; COPE = Coping Orientation to Problems Experienced; GARS = Groningen Activity Restriction Scale; IPAQ = International Physical Activity Questionnaire; MET = metabolic equivalents; BMI = body mass index; MMSE = Mini Mental State Examination; CES-D = Center for Epidemiologic Studies–Depression; LSNS = Lubben Social Network Scale.

convergent and divergent validity were fairly good; two exceptions were found in the MMSE and the COPE measures that had higher correlations with the social and the physical domain, respectively, rather than the psychological domain of frailty. The social domain showed both good convergent and divergent validity, since it correlated significantly and with the expected sign with the two social measures (Loneliness Scale and LSNS), and the two social measures did not correlate or correlated less with the other two frailty domains.

Criterion Validity

In Table 6, the results of ROC analyses of the total TFI and the physical TFI for outcomes disability, falls, and visits to general practitioner are reported. The criterion validity of the total TFI and the physical TFI was excellent for disability, as demonstrated by the AUC higher than .80; and mediocre for falls, presenting an AUC of .61, whereas the total TFI and the physical TFI

Table 3. Reliability: Corrected Item-Total Correlations of TFI Items With the Domains of TFI.

TFI Questions	TFI Physical Domain		TFI Psychological Domain		TFI Social Domain	
	r	p	r	p	r	p
Physical domain						
Q11. Physically active	.33	<.001	.17	.003	.03	.280
Q12. Unexplained weight loss	.06	.172	−.04	.248	.05	.212
Q13. Difficulty in walking	.42	<.001	.23	<.001	.23	<.001
Q14. Difficulty in maintaining balance	.40	<.001	.22	<.001	.13	.019
Q15. Poor hearing	.08	.096	.05	.220	.09	.081
Q16. Poor vision	.23	<.001	.02	.379	.08	.089
Q17. Handgrip strength	.27	<.001	.16	.004	.16	.004
Q18. Physical tiredness	.48	<.001	.38	<.001	.21	<.001
Psychological domain						
Q19. Problems with memory	.17	.002	.14	.011	.03	.325
Q20. Feeling down	.24	<.001	.46	<.001	.28	<.001
Q21. Feeling nervous or anxious	.18	.001	.46	<.001	.17	.003
Q22. Able to deal with problems	.20	<.001	.20	.001	.08	.09
Social domain						
Q23. Living alone	.09	.075	.05	.220	.21	<.001
Q24. Social relations	.25	<.001	.30	<.001	.31	<.001
Q25. Social support	.15	.007	.11	.036	.11	.035

Note. TFI = Tilburg Frailty Indicator. *p* Values are one-tailed.

showed, respectively, mediocre and good AUCs for visits to general practitioner.

Discussion

After a careful procedure for translating and adapting the TFI to the Italian context (xxxx et al., xxxx xxxx), the present study analyzed the psychometric properties of the Italian version of the TFI in a sample of community-dwelling older adults. This sample was comparable in terms of gender distribution to the current picture of Italian aged population depicted by ISTAT (2011) in which there is a higher proportion of women than men. The TFI average score of 4.40 resulting from this study is similar to those obtained in other studies (Freitag, Schmidt, & Gobbens, 2015; Gobbens et al., 2010; Santiago, Luz, Mattos, Gobbens, & van Assen, 2013). The

Table 4. Construct Validity: Correlations Between TFI Questions and Their Corresponding Frailty Measure.

TFI Questions	Corresponding Frailty Measures	r	p Value[a]
Physical domain			
Q11. Physically active	IPAQ	−.20	<.001
Q12. Unexplained weight loss	BMI	−.12	.025
Q13. Difficulty in walking	TUG	.46	<.001
Q14. Difficulty in maintaining balance	OLS	−.33	<.001
Q15. Poor hearing	"How do you assess your hearing?"	.74	<.001
Q16. Poor vision	"How often do you come into situations in which you find your vision is bad?"	.58	<.001
Q17. Handgrip strength	Grip strength test	−.35	<.001
Q18. Physical tiredness	2 Items of CES-D	.47	<.001
Psychological domain			
Q19. Problems with memory	MMSE	−.16	.005
Q20. Feeling down	CES-D	.53	<.001
Q21. Feeling nervous or anxious	HADS-A	.46	<.001
Q22. Able to deal with problems	COPE	−.11	.042
Social domain			
Q23. Living alone	"Do you live alone at present or with others?"	1.00	<.001
Q24. Social relations	Loneliness Scale	−.28	<.001
Q25. Social support	LSNS	−.15	.006

Note. TFI = Tilburg Frailty Indicator; OLS = One Leg Standing; COPE = Coping Orientation to Problems Experienced; IPAQ = International Physical Activity Questionnaire; BMI = body mass index; TUG = Timed Up and Go; MMSE = Mini Mental State Examination; CES-D = Center for Epidemiologic Studies–Depression; HADS-A = Anxiety subscale of the Hospital Anxiety and Depression Scale; LSNS = Lubben Social Network Scale.
[a]p Values are one-tailed.

higher rate of affirmative answers for the Items Q20 ("feeling down") and Q21 ("feeling nervous or anxious") was obtained in comparison with data reported by previous TFI research (Freitag et al., 2015; Gobbens et al., 2010; Santiago et al., 2013). These findings are consistent with data of another study (Iani, Lauriola, & Costantini, 2014) conducted in an Italian sample.

Table 5. Convergent and Divergent Validity: Correlations of TFI Domains and Other Frailty Measures.

Other Frailty Measures	TFI Physical		TFI Psychological		TFI Social	
	r	p Value[a]	r	p Value[a]	r	p Value[a]
Physical domain						
IPAQ	−.25	<.001	−.09	.08	−.01	.433
BMI	.13	.014	.04	.283	.08	.085
TUG	.40	<.001	.15	.006	.13	.016
OLS	−.36	<.001	−.08	.100	−.19	.001
Grip strength test	−.34	<.001	−.26	<.001	−.23	<.001
2 Items of CES-D	.43	<.001	.44	<.001	.10	.060
Psychological domain						
MMSE	−.09	.083	−.10	.050	−.14	.009
CES-D	.40	<.001	.59	<.001	.30	<.001
HADS-A	.38	<.001	.56	<.001	.25	<.001
COPE	−.20	.001	−.14	.011	−.05	.214
Social domain						
Loneliness Scale	−.19	.001	−.15	.007	−.37	<.001
LSNS	−.05	.223	.03	.317	−.12	.028

Note. TFI = Tilburg Frailty Indicator; OLS = One Leg Standing; COPE = Coping Orientation to Problems Experienced; IPAQ = International Physical Activity Questionnaire; BMI = body mass index; TUG = Timed Up and Go; MMSE = Mini Mental State Examination; CES-D = Center for Epidemiologic Studies–Depression; HADS-A = Anxiety subscale of the Hospital Anxiety and Depression Scale; LSNS = Lubben Social Network Scale.
[a]p Values are one-tailed.

Analyses revealed satisfactory results in terms of reliability, construct validity, and criterion validity of the Italian version of the TFI. Specifically, the internal consistency was judged acceptable for the total TFI, while it was low for the single domains of the TFI, as evidenced by Cronbach's α and the corrected-item total correlations. These results are similar to those obtained for the original version of the TFI (Gobbens et al., 2010) and subsequent translated versions (Coelho, Santos, Paul, Gobbens, & Fernandes, 2014; Freitag et al., 2015; Santiago et al., 2013; Uchmanowicz et al., 2014). The authors of the TFI (Gobbens et al., 2010) emphasized that probably the addition of items for each domain of frailty would allow for higher values of internal consistency but at the expense of speed and ease of administration. For this reason, they preferred to maintain a limited number of items, not considering the low level of internal consistency for the single domains of frailty to be a problem.

Table 6. Criterion Validity. Receiver Operating Characteristic Curve.

TFI	Cutoff	Adverse Outcomes	Sensitivity	Specificity	AUC (95% CI)
TFI	≥5	Disability	.85	.60	.83 [.75, .92]
	≥6		.78	.75	
TFI Physical	≥3		.85	.76	.87 [.81, .94]
TFI	≥4	Visits to general practitioner	.61	.58	.67 [.54, .80]
TFI Physical	≥1		.82	.67	.79 [.67, .90]
	≥2		.52	.83	
TFI	≥5	Falls	.56	.58	.61 [.52, .69]
TFI Physical	≥2		.63	.52	.61 [.52, .70]
	≥3		.48	.74	

Note. TFI = Tilburg Frailty Indicator; AUC = area under the curve; CI = confidence interval.

The construct validity of the Italian TFI is good, since each item of the TFI correlates significantly and with the expected sign with its corresponding frailty measure. With respect to the convergent validity, results are satisfactory, as shown by the correlations of the single domains of the TFI with other frailty measures. In regard to the nutrition component of frailty, it was found that the item on unexplained weight loss (Q12) and the BMI had a low correlation coefficient, as evidence that the two indicators tend to measure different aspects of the nutrition component of frailty. As Gobbens et al. (2010) observed in their work, the loss of weight is a change in weight, and not a "static" measure of weight, like BMI. Specifically, in our sample, it seems that the BMI may have a better role in the explanation of the physical frailty respect than weight loss, probably because also excessive weight, and not just weight loss, is to be interpreted as a sign of physical functional limitation. It may well be that in a more heterogeneous sample, including older individuals with a higher level of functional decline, the indicator of weight loss would be more appropriate to rate the nutrition component of physical frailty. It is suggested, for further analyses, to also include a greater number of older participants in order to verify the validity of such an item on the TFI domains. Regarding the divergent validity, results are good for the social domain, acceptable for the physical domain, and not completely satisfactory for the psychological domain. In the physical domain, it was observed that one physical measure (physical tiredness) has a slightly stronger correlation with the psychological domain than with the physical one. This is an expected finding, since physical tiredness has been evaluated using 2 items of the CES-D Scale, a questionnaire usually administered to assess a

psychological construct. Previously, Fried et al. (2001) used the same 2 items of the CES-D Scale for measuring poor endurance and energy component of the cycle of frailty, highlighting the relationship between self-reported exhaustion and the stage of exercise reached in graded exercise testing. For the psychological domain, two corresponding measures (the MMSE and the COPE) had slightly better correlations with other frailty domains than with the psychological one. Specifically, the MMSE showed a higher correlation with the social domain, explained by the well-known interrelated nature of cognitive functioning and social aspects (Cacioppo & Hawkley, 2009). Similarly, the COPE measure correlated slightly more strongly with the physical domain than the psychological one. This result can be explained by the strong association between physical frailty and psychological adjustment. In fact, a study of Lohr, Essex, and Klein (1988) found that positive-cognitive coping influences physical condition and, on the contrary, passive-cognitive coping has deleterious effects on it.

Finally, ROC analyses demonstrated that the TFI criterion validity is excellent for disability and mediocre for falls and visits to general practitioner. Taking into account the disability outcome, the score of the TFI that gave the best results in terms of sensitivity and specificity was 6. Using ≥ 6 as a cutoff for screening frail from robust individuals resulted in 30.7% of participants being considered frail, instead of 44.6% obtained with a cutoff ≥ 5, as suggested by Gobbens et al. (2010). Three previous studies on TFI have chosen 5 as cutoff, reporting the following prevalence data: 47.1% in a Dutch sample with a mean age of 80.3 years old (Gobbens et al., 2010), 40% in a Polish sample aged 68.2 years old (Uchmanowicz et al., 2014), and 35.6% and 31.7% in two groups of Brazilian older adults with a mean age of 69.8 and 71.3, respectively (Santiago et al., 2013). Instead, the study of Coelho et al. (2014) used 6 as cutoff for frailty, identifying 54.8% of participants (mean age of 79.2 years old) as frail. Differences in the participants' age and in the context of administration make comparisons of prevalence data measured with the TFI difficult. Certainly, in the Italian context, further investigations are needed in order to establish the best cutoff for the TFI. For the selection of the definitive cutoff point, the goal of the examination should also be taken into account. If the cutoff has to be a signal of an important and unrecoverable event, a lowest cutoff is recommended: Otherwise, if the impact on the outcome is low and a false positive is very costly in terms of intervention, a higher cutoff is more appropriate.

There are three noteworthy limitations in this study. Firstly, participants living in a small area of Italy were involved, making it impossible to generalize the results to the entire Italian aged population. Secondly, the cross-

sectional design of the research did not allow the study of the trajectories of frailty and adverse outcomes of frailty, not allowing for going into their causal relationship in more depth. Lastly, the corresponding measures for the TFI items on poor hearing and poor eyesight were self-report questions and not physical measurements as the other corresponding measures used for assessing physical frailty. As a consequence, the higher correlation values, in comparison to the other frailty measures, should be interpreted at the light of this consideration. Despite these limitations, the findings reported here are consistent with those achieved from validation analysis on the TFI in other languages (Coelho et al., 2014; Freitag et al., 2015; Gobbens et al., 2010; Santiago et al., 2013; Uchmanowicz et al., 2014) and appear to support the validity of the Italian version of the TFI. This study represents a key step of the process toward the adoption of a multidimensional, specific, cost-saving, easy, and self-report measure to assess frailty in the Italian context, useful for both clinical and scientific purposes.

However, larger and longitudinal studies are still needed in order to consider in greater depth the relationship between frailty and adverse outcomes in the short, medium, and long term. Furthermore, research efforts should also be focused on the identification of the best frailty cutoff for the Italian TFI and for each of the three frailty domains. Consequently, the TFI may be commonly adopted as a screening tool for frailty. Older adults who exceed the TFI cutoff (or one of the single domain cutoffs), on the one hand, could be subjected to a more detailed examination with physical and diagnostic tests, in order to better understand their health condition and, on the other hand, to undergo specific and targeted preventive interventions, based, for example, on physical, cognitive, psychological, or multitasking exercises, depending on the individual needs. Studies that investigate a TFI cutoff for identifying prefrail individuals are also suggested, since the likelihood of transitioning from the prefrailty status to the robust one is higher compared to that from frailty to robust (Gill, Gahbauer, Allore, & Han, 2006). Early detection of prefrail subjects should allow the implementation of targeted preventive interventions that will have greater cost-effectiveness with respect to interventions for frail individuals (Faber et al., 2006). Lastly, subsequent studies need to assess the psychometric properties of the Italian TFI in different settings (i.e., residential care facilities, hospitals) other than community.

Conclusion

In summary, the Italian TFI was demonstrated to be a valid and reliable instrument to detect frail individuals with a multidimensional approach;

however, further studies are suggested to increase the ability of the instrument to better differentiate levels of severity for frailty.

Acknowledgments

Declaration of Conflicting Interests

Funding

References

American Psychological Association. (2002). Ethical principles of psychologists and code of conduct. *American Psychologist*, *57*, 1060–1073.

Andresen, E. M., Malmgren, J. A., Carter, W. B., & Patrick, D. L. (1994). Screening for depression in well older adults: Evaluation of a short form of the CES-D. *American Journal of Preventive Medicine*, *10*, 77–84.

Bohannon, R. W. (2006a). Reference values for the Timed Up and Go test: A descriptive meta-analysis. *Journal of Geriatric Physical Therapy*, *29*, 64–68.

Bohannon, R. W. (2006b). Single limb stance times: A descriptive meta-analysis of data from individuals at least 60 years of age. *Topics in Geriatric Rehabilitation*, *22*, 70–77.

Cacioppo, J. T., & Hawkley, L. C. (2009). Perceived social isolation and cognition. *Trends in Cognitive Sciences*, *13*, 447–454. doi:S1364-6613(09)00147-8

Carriere, I., Colvez, A., Favier, F., Jeandel, C., & Blain, H. (2005). Hierarchical components of physical frailty predicted incidence of dependency in a cohort of

elderly women. *Journal of Clinical Epidemiology*, *58*, 1180–1187. doi:S0895-4356(05)00155-1

Carver, C. S., Scheier, M. F., & Weintraub, J. K. (1989). Assessing coping strategies: A theoretically based approach. *Journal of Personality and Social Psychology*, *56*, 267.

Coelho, T., Santos, R., Paul, C., Gobbens, R. J., & Fernandes, L. (2014). Portuguese version of the Tilburg Frailty Indicator: Transcultural adaptation and psychometric validation. *Geriatrics & Gerontology International*, *15*, 951–960. doi:10.1111/ggi.12373

Costantini, M., Musso, M., Viterbori, P., Bonci, F., Del Mastro, L., & Garrone, O. (1999). Detecting psychological distress in cancer patients: Validity of the Italian version of the Hospital Anxiety and Depression Scale. *Supportive Care in Cancer*, *7*, 121–127.

Craig, C. L., Marshall, A. L., Sjostrom, M., Bauman, A. E., Booth, M. L., & Ainsworth, B. E. (2003). International Physical Activity Questionnaire: 12-Country reliability and validity. *Medicine & Science in Sports & Exercise*, *35*, 1381–1395. doi:10.1249/01.MSS.0000078924.61453.FB

de Jong Gierveld, J., & Kamphuls, F. (1985). The development of a Rasch-type loneliness scale. *Applied Psychological Measurement*, *9*, 289–299.

de Jong Gierveld, J., & van Tilburg, T. (1999). *Manual of the loneliness scale 1999* (updated version 18.01.02). Amsterdam, The Netherlands: Department of Social Research Methodology, Vrije Universiteit Amsterdam.

European Commission. (2013). *EU employment and social situation, quarterly review. Special supplement on demographic trends*. Author.

Eurostat, European Commission. (2012). *Active ageing and solidarity between generations. A statistical portrait of the European Union 2012*. Author.

Faber, M. J., Bosscher, R. J., Chin, A. P. M. J., & van Wieringen, P. C. (2006). Effects of exercise programs on falls and mobility in frail and pre-frail older adults: A multicenter randomized controlled trial. *Archives of Physical Medicine and Rehabilitation*, *87*, 885–896. doi:S0003-9993(06)00351-0

Folstein, M. F., Folstein, S. E., & McHugh, P. R. (1975). "Mini-mental state". A practical method for grading the cognitive state of patients for the clinician. *Journal of Psychiatric Research*, *12*, 189–198. doi:0022-3956(75)90026-6

Freitag, S., Schmidt, S., & Gobbens, R. J. (2015). Tilburg Frailty Indicator: German translation and psychometric testing. *Zeitschrift fur Gerontologie und Geriatrie*. doi:10.1007/s00391-015-0889-9

Fried, L. P., Tangen, C. M., Walston, J., Newman, A. B., Hirsch, C., & Gottdiener, J. (2001). Frailty in older adults: Evidence for a phenotype. *The Journals of Gerontology. Series A, Biological Sciences and Medical Sciences*, *56*, M146–M156.

AQ3

AQ4

AQ5

Gill, T. M., Gahbauer, E. A., Allore, H. G., & Han, L. (2006). Transitions between frailty states among community-living older persons. *Archives of Internal Medicine*, *166*, 418–423. doi:166/4/418

Gobbens, R. J., Luijkx, K. G., & van Assen, M. A. (2013). Explaining quality of life of older people in the Netherlands using a multidimensional assessment of frailty. *Quality of Life Research*, *22*, 2051–2061. doi:10.1007/s11136-012-0341-1

Gobbens, R. J., Luijkx, K. G., Wijnen-Sponselee, M. T., & Schols, J. M. (2010a). In search of an integral conceptual definition of frailty: Opinions of experts. *Journal of the American Medical Directors Association*, *11*, 338–343. doi:S1525-8610(09)00348-X

Gobbens, R. J., Luijkx, K. G., Wijnen-Sponselee, M. T., & Schols, J. M. (2010b). Towards an integral conceptual model of frailty. *Journal of Nutrition Health and Aging*, *14*, 175–181.

Gobbens, R. J., van Assen, M. A., Luijkx, K. G., Wijnen-Sponselee, M. T., & Schols, J. M. (2010). The Tilburg Frailty Indicator: Psychometric properties. *Journal of the American Medical Directors Association*, *11*, 344–355. doi:S1525-8610(09)00406-X

Iani, L., Lauriola, M., & Costantini, M. (2014). A confirmatory bifactor analysis of the Hospital Anxiety and Depression Scale in an Italian community sample. *Health and Quality of Life Outcomes*, *12*, 84.

IPAQ (Producer). (2005, December 2013). *Guidelines for data processing and analysis of the International Physical Activity Questionnaire (IPAQ)–short and long forms*. Retrieved from www.ipaq.ki.se/scoring.pdf

ISTAT. (2011). *15 Censimento generale della popolazione e delle abitazioni – 9 Ottobre 2011. Struttura demografica della popolazione. Dati definitivi*. Rome, Italy: Author.

Kempen, G. I., & Suurmeijer, T. P. (1990). The development of a hierarchical polychotomous ADL-IADL scale for noninstitutionalized elders. *The Gerontologist*, *30*, 497–502.

Lohr, M. J., Essex, M. J., & Klein, M. H. (1988). The relationships of coping responses to physical health status and life satisfaction among older women. *Journal of Gerontology*, *43*, P54–P60.

Lubben, J. E. (1988). Assessing social networks among elderly populations. *Family & Community Health*, *11*, 42–52.

Mannocci, A., Di Thiene, D., Del Cimmuto, A., Masala, D., Boccia, A., & De Vito, E. (2012). International Physical Activity Questionnaire: Validation and assessment in an Italian sample. *Italian Journal of Public Health*, *7*.

Markle-Reid, M., & Browne, G. (2003). Conceptualizations of frailty in relation to older adults. *Journal of Advanced Nursing*, *44*, 58–68. doi:10.1046/j.1365-2648.2003.02767.X

AQ6

Metter, E. J., Talbot, L. A., Schrager, M., & Conwit, R. (2002). Skeletal muscle strength as a predictor of all-cause mortality in healthy men. *The Journals of Gerontology. Series A, Biological Sciences and Medical Sciences*, *57*, B359–B365.

Michikawa, T., Nishiwaki, Y., Takebayashi, T., & Toyama, Y. (2009). One-leg standing test for elderly populations. *Journal of Orthopaedic Science*, *14*, 675–685. doi: 10.1007/s00776-009-1371-6

xxxx, xxxx, xxxx, & xxxx. xxxx xxxx xxxx xxxx. *xxxx xxxx xxxx* (xxxx xxxx).

Podsiadlo, D., & Richardson, S. (1991). The Timed "Up & Go": A test of basic functional mobility for frail elderly persons. *Journal of the American Geriatrics Society*, *39*, 142–148.

Postacchini, D., Giuli, C., & Spazzafumo, L. (2009). La valutazione multidimensionale dell'anziano ospedalizzato: Dati preliminari dell'U.O. di Geriatria dell'INRCA di Fermo. *Giornale di Gerontologia*, *57*, 57–64.

Radloff, L. S. (1977). The CES-D Scale: A self-report depression scale for research in the general population. *Applied Psychological Measurement*, *1*, 385–401.

Roberts, H. C., Denison, H. J., Martin, H. J., Patel, H. P., Syddall, H., & Cooper, C. (2011). A review of the measurement of grip strength in clinical and epidemiological studies: Towards a standardised approach. *Age and Ageing*, *40*, 423–429. doi:10.1093/ageing/afr051

Santiago, L. M., Luz, L. L., Mattos, I. E., Gobbens, R. J., & van Assen, M. A. (2013). Psychometric properties of the Brazilian version of the Tilburg Frailty Indicator (TFI). *Archives of Gerontology and Geriatrics*, *57*, 39–45. doi:S0167-4943(13)00033-2

Sica, C., Magni, C., Ghisi, M., Altoè, G., Sighinolfi, C., & Chiri, L. (2008). Coping Orientation to Problems Experienced-Nuova Versione Italiana (COPE-NVI): Uno strumento per la misura degli stili di coping. *Psicoterapia Cognitiva e Comportamentale*, *14*, 27.

Suurmeijer, T. P., Doeglas, D. M., Moum, T., Briancon, S., Krol, B., & Sanderman, R. (1994). The Groningen Activity Restriction Scale for measuring disability: Its utility in international comparisons. *American Journal of Public Health*, *84*, 1270–1273.

Uchmanowicz, I., Jankowska-Polanska, B., Loboz-Rudnicka, M., Manulik, S., Loboz-Grudzien, K., & Gobbens, R. J. (2014). Cross-cultural adaptation and reliability testing of the Tilburg Frailty Indicator for optimizing care of Polish patients with frailty syndrome. *Clinical Interventions in Aging*, *9*, 997–1001. doi:10.2147/CIA.S64853

van Kan, G. A., Rolland, Y., Houles, M., Gillette-Guyonnet, S., Soto, M., & Vellas, B. (2010). The assessment of frailty in older adults. *Clinics in Geriatric Medicine*, *26*, 275–286. doi:S0749-0690(10)00014-5

AQ7

Walston, J., Hadley, E. C., Ferrucci, L., Guralnik, J. M., Newman, A. B., & Studenski, S. A. (2006). Research agenda for frailty in older adults: Toward a better understanding of physiology and etiology: Summary from the American Geriatrics Society/National Institute on Aging Research Conference on Frailty in Older Adults. *Journal of the American Geriatrics Society*, *54*, 991–1001. doi:JGS745

Zigmond, A. S., & Snaith, R. P. (1983). The Hospital Anxiety and Depression Scale. *Acta Psychiatrica Scandinavica*, *67*, 361–370.

Author Biographies

Anna Mulasso is a PhD candidate in the Department of Psychology at the University of Torino (IT). Her research interests are focused on conceptualization and measurement of frailty and preventive interventions for older adults. She has recently published one book and some international papers on these themes.

Mattia Roppolo is a PhD candidate in the Department of Psychology at the University of Torino (IT) and Rijksuniversiteit of Groningen (NL). He is a member of the European Innovation Partnership on Active and Healthy Ageing. He studied health trends in aging with the use of a dynamic systems approach.

Robbert J. J. Gobbens is an associate professor multimorbidity at Inholland University of Applied Sciences in Amsterdam (NL). He has been involved in research on frail older people since 2005 and has recently published a number of international scientific articles on frailty. He has developed the Tilburg Frailty Indicator.

Emanuela Rabaglietti is a researcher of Developmental Psychology in the Department of Psychology at the University of Torino (IT). She has coordinated the project ACT ON AGEING, funded by Regione Piemonte (IT). She is responsible for an international consortium at the European Innovation Partnership on Active and Healthy Ageing.