

The Psychometric Properties of the Arabic Version of the Tilburg Frailty Indicator

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Abstract

Frailty is a loss of human function in one or more physical, psychological, or social aspects. The purpose of this study was to establish the reliability and validity of the Arabic (Jordan) version of the Tilburg Frailty Indicator (TFI) in older Jordanian adults. A total of 109 participants from Irbid, Jordan were recruited. Reliability tests were conducted by determining the KR-20 values. The total score of the Arabic (Jordan) version of the TFI had good reliability (KR 20 = 0.77) and good convergent and divergent validity with the corresponding scales: physical-TFI and the SF36-physical function ($r = -0.317$), psychological-TFI and GDS ($r = 0.458$), and social-TFI and the SF 36-social function ($r = -0.304$). The Arabic (Jordan) version of the TFI is reliable and valid for use in Jordanian population.

Keywords: frailty, tilburg, indicator, arabic, psychometric properties

1. The Psychometric Properties of the Arabic Version of the Tilburg Frailty Indicator

Comprehensive, scholarly geriatric studies have not been widely conducted in Jordan to explore and assess the challenges and obstacles that older adults face in their later lives. Furthermore, the frailty concept has never been explored or addressed in Jordan. The definition of frailty varies in the field and ranges from defining the condition using the physical domain only to defining it using multi-dimensional domains (i.e., physical, psychological, social, and environmental). The frailty concept can be very useful as a way to understand the various factors that contribute to disease in older adults and could be a key indicator of how successful health interventions are in preventing and treating frailty in older adults. The frailty concept can also be used in developing effective policies and procedures for providing healthcare to older adults in Jordan. A reliable and valid frailty instrument for use with the Jordanian population would be beneficial for identifying older adults who are frail and selecting appropriate interventions such as providing in-home nursing care rather than moving an individual to institutional care.

The use of the term “frailty” is being debated in the current frailty literature. Some researchers define ‘multidimensional frailty’ as a distinct and separate concept from physical or uni-dimensional frailty. Physical frailty denotes the following biomedical indicators postulated by Fried and colleagues (2001): weight loss, slow walking, weakness, fatigue, and physical inactivity. The term ‘multidimensional frailty’ means that one or more of several domains; including physical, psychological, and social; could have a disturbance or loss in its human functions, as postulated by Gobbens et al. (2010a). Figure 1 displays the components used from the integral conceptual model of frailty (Gobbens, Luijkx, Wijnen-Sponselee, & Schols, 2010c) to validating the TFI among community-dwelling older adults in Jordan.

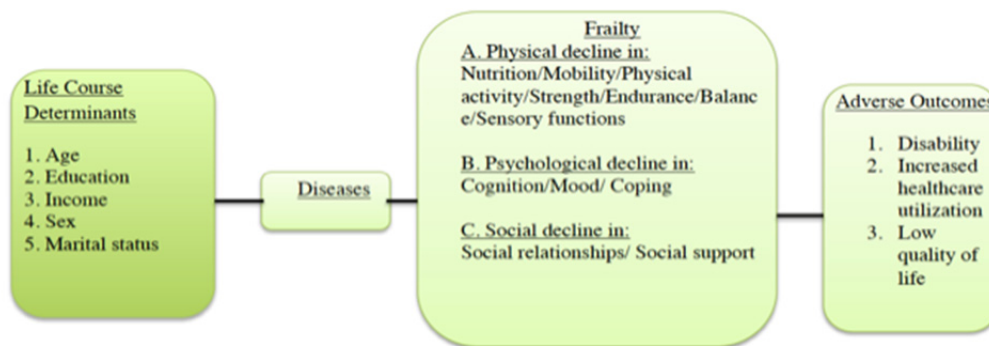


Figure 1. The components used from the integral conceptual model of frailty to validating the TFI among community-dwelling older adults in Jordan

2. Methods

2.1 Research Design, Sampling, Setting, Recruitment, and Data Collection

A descriptive, correlational, cross-sectional design was utilized to establish the reliability and validity of the Arabic Version-Tilburg Frailty Indicator (TFI) for use with Jordanian community-dwelling older adults. A total of 109 Jordanian participants from Irbid, a governorate located in the north of Jordan, was recruited for the study through home visits. Inclusion criteria were: participants who are Jordanians, aged 60 years old and older, and living at their own community-dwellings in the Irbid governorate. Exclusion criteria included Participants with cognitive impairment as determined by the Montreal Cognitive Assessment (MoCA) or people living at nursing homes or rental apartments. Institutional Review Board (IRB) approval has been obtained from both the Universities in the U.S. and Jordan.

Older Jordanian adults who were interested in participating in the study were contacted to indicate their interest in participating in the study through home visits, and then an exploratory letter was provided to them accordingly. The trained data collectors conducted face-to-face interviews with participants in a private room at the interviewees’ homes after they agree to participate in the study. Consent forms were handed to or read aloud and explained to the participants at the beginning of the interview.

2.2 Translation and Cultural Adaptation of the Arabic version-TFI

Permission from the original author of the TFI has been obtained to translate the TFI into Arabic and to use it in Jordan with the Jordanian older adult population. Two translators who are fluent in both English and Arabic and are also from the nursing discipline translated the instrument forward into Arabic, and two other translators who are fluent in both Arabic and English and from outside of the nursing discipline translated the instrument backward into English. The four translators discussed and reconciled the differences between the two versions of the TFI to reach agreement on the final Arabic version-TFI. In order to ensure that the final Arabic version-TFI was culturally appropriate, a panel of two-bilingual experts was assigned to assess and discuss the consistency of words and expressions used in the final version.

2.3 Data Analysis Procedures

2.3.1 Item Analysis Using KR-20

Because of the Arabic version-TFI’s dichotomous items, KR-20 (Allen & Yen, 2001; Kuder & Richardson, 1937) was calculated for each subscale to examine the internal consistency for dichotomous variables. Correlation matrices using tetrachoric coefficients was presented. Pearson’s correlations was estimated to explore whether the subscales were highly correlated or not. In regard to the validity of the Arabic version-TFI, the following validity aspects were used: face, content, construct, (convergent and divergent), and known group differences. Face validity was established through consultations with experts in the field. The content validity was guided using the method reported by Polit and Beck (2012) in which each item is rated on a four-point scale of relevance (1 = not relevant, 2 = somewhat relevant, 3 = quite relevant, 4 = highly relevant) by at least 3 experts. An excellent content validity score would be a score of at least 0.90 for S-CVI and at least 0.78 for I-CVI (Polit & Beck, 2012).

The construct validity was checked through a three-step process as follows: (1) Inter-item correlations using the correlation matrix (Tetrachoric) of each sub-scale of the Arabic version-TFI, in which inter-item correlations

between 0.30 and 0.70 (Ferketich, 1991) or even higher than 0.70 (Thomas McCoy, personal communication, December 6, 2014) were desirable. (2) Convergent validity is how two instruments measuring the same construct could correlate positively with each other (McDowell, 2006). Divergent validity is the absence of a correlation between a certain scale and other scales measuring different constructs (Faries & Yalcin, 2007). If correlations between the same components in both presumed scales measuring the same construct equal or exceed 0.4, they are considered evidence for convergent validity, whereas values equal to or less than 0.3 are evidence of divergent validity (Faries & Yalcin, 2007). Faries and Yalcin (2007) also reported that correlations between 0.3 and 0.4 are not regarded to either convergent or divergent validity. (3) The known group difference method was used to examine construct validity. Independent t tests were conducted to determine if statistically significant differences existed between the mean frailty scores of older adults aged 60–70 years and those aged 71 or older, males and females, and older adults who had comorbidities and those without comorbidities. A two-sided p-value < 0.05 was considered statistically significant. All analyses were performed using SPSS v23.0 (SPSS Inc., Chicago, IL).

3. Results

3.1 Characteristics of Sample

A total of 109 study participants were recruited from Irbid city in the northern part of the Hashemite Kingdom of Jordan. The participants were recruited through home visits. Table 1 displays the demographic characteristics of the study population. The mean age of study participants was 67.57 years (SD = 6.95) ranging from 60 to 88 years old. The majority of participants were male (61.5%), married (66.1%), living with spouse and children (45.9%), having vision impairment (53.2%), and had total monthly household income below 450 Jordanian Dinars or \$634.56 (40.4%). Over half of the participants (51.4 %) had less than 12 years of formal education.

Table 1. Demographic characteristics of Jordanian community-dwelling older adults (N=109)

Characteristics	N(%) or Mean (SD)*
Age (yrs.)	67.5714 (6.95)
60-70 years old	72 (66.1)
>70 years old	33 (30.3)
Refuse to answer	3 (2.7)
Do not know	1 (0.9)
Gender	
Male	67 (61.5)
Female	42 (38.5)
Marital status	
Single	11 (10.1)
Married	72 (66.1)
Divorced	3 (2.8)
Widow	20 (18.3)
Missing	3 (2.8)
Education	
No school	31 (28.4)
Basic (8 Grade)	16 (14.7)
Primary (10 Grade)	9 (8.3)
Secondary (12 Grade)	8 (7.3)
Diploma	6 (5.5)
University	27 (24.8)
Refuse to answer	12 (11.0)

Income	
Less than 450 JOD	44 (40.4)
450-650 JOD	21 (19.3)
650-950 JOD	15 (13.8)
More than 950 JOD	10 (9.2)
Do not know	3 (2.8)
Refuse to answer	16 (14.7)
Living with who	
Alone	18 (16.5)
Spouse only	7 (6.4)
Spouse and children only	50 (45.9)
Spouse, children, and siblings only	17 (15.6)
Others	17 (15.6)
Hospitalized during last year	34 (31.2)
Comorbidities	
Have no or one disease	34 (31.2)
Have ≥ 2 diseases	75 (68.8)
Geriatric Depression Scale	6.2243 (3.51)
SF 36- Physical Function	54.6729 (27.25)
SF 36- Social Function	58.1776 (22.98)
Missing	2 (1.83)
TFI – Physical domain	3.7196 (2.33)
TFI – Psychological domain	1.9720 (1.02)
TFI – Social domain	1.3551 (0.94)
TFI Total Score	7.0467 (3.39)

Note. *SD: Standard Deviation.

**COPD: Constructive Obstructive Pulmonary Disease.

***TFI: Tilburg Frailty Indicator.

3.2 Reliability

3.2.1 KR 20 Values

The internal consistency of the subscale and total scores of the TFI were as follows: 0.74 (Physical-TFI), 0.46 (Psychological-TFI), 0.39 (Social-TFI), and 0.77 (Total-TFI). There is no TFI item that can be removed to achieve a higher KR 20 for the total score based on the Point-Biserial correlation values, which are shown in Table 2.

Table 2. Pearson’s correlations of Subscale to Subscale and Subscale to Total Score of TFI

The TFI domain	Physical-TFI	Psychological-TFI	Social-TFI	Total score	N
Physical-TFI	0.744	0.441**	0.306**	0.903**	109
Psychological-TFI		0.464	0.377**	0.710**	109
Social-TFI			0.388	0.601**	109
Total score				0.771	109

Note. **p < 0.01; Bold italics=KR 20 values.

3.2.2 Pearson’s Correlation Coefficients

Pearson’s correlation coefficients between the sub-scales of TFI ranged from 0.31 to 0.44 (p < 0.01). These correlations show that the subscales of TFI are moderately and positively correlated with each other. Nunnally and Bernstein (1994) reported that subscale-to-subscale correlations of 0.40 to 0.65 are acceptable. The three subscales of the TFI had desirable subscale-to-subscale (Pearson’s coefficients) correlations. Pertaining to subscale-to-total correlations, the three subscales of the TFI were highly correlated to the total TFI score ranging from 0.60 to 0.90 (Table 2).

3.2.3 The inter-Item (Tetrachoric) Correlations

Tetrachoric correlations of dichotomous items of the TFI were calculated using Mplus (Table 3). Tetrachoric correlation coefficients aim to quantify association and similarity of category definitions (Uebersax, 2015). Tetrachoric correlation coefficients of physical domain-TFI ranged from 0.03 to 0.77, psychological domain-TFI from 0.03 to 0.73, and social domain-TFI from 0.01 to 0.52. The item of weight loss (PH2) from the physical domain did not adequately correlate with the two items of feeling physically healthy (PH1, r = 0.14) and the item of difficulty in maintaining balance (PH4, r = 0.03). Regarding the psychological domain, the item of the ability to remember things (PS1) did not correlate adequately with the item of the ability to adjust with problems well (PS4, r = 0.03). Lastly, the item of feeling alone (SO2) did not adequately correlate with the item of having enough social support (SO3, r = 0.01).

Table 3. Tetrachoric correlation coefficients of dichotomous items of the TFI

	PH1	PH2	PH3	PH3	PH4	PH5	PH6	PH7	PH8	PS1	PS2	PS3	PS4	SO1	SO2	SO3
PH1	1															
PH2	.14	1														
PH3	.77	.27	1													
PH4	.43	.03	.59	1												
PH5	.41	.38	.40	.34	1											
PH6	.50	.28	.41	.29	.25	1										
PH7	.44	.63	.60	.47	.44	.45	1									
PH8	.35	.26	.40	.64	.59	.50	.46	1								
PS1	.18	.11	.13	.19	.50	.20	.27	.23	1							
PS2	.42	.25	.56	.28	.22	.37	.57	.20	.41	1						
PS3	.66	.20	.34	.30	.40	.48	.28	.54	.44	.73	1					
PS4	.37	.07	.48	.35	.11	.24	.12	.09	.03	.20	.24	1				
SO1	.06	.33	.04	.04	.19	.23	.08	.08	.09	.38	.30	.24	1			
SO2	.22	.13	.32	.45	.47	.28	.48	.41	.00	.57	.61	.09	.32	1		
SO3	.23	.17	.26	.13	.35	.16	.26	.09	.13	.20	.37	.25	.52	.01	1	

Note. PH: Physical-TFI; PS: Psychological-TFI; SO: Social-TFI.

3.2.4 Item to Total (Point-Biserial) Correlations

Corrected item-total correlations of each sub-scale of the Arabic version-TFI are considered as acceptable if these correlations have ≥ 0.30 (Polit & Beck, 2012) or ≥ 0.20 (Thomas McCoy, personal communication, December 6, 2014). All items of the TFI had acceptable positive Point-Biserial correlations except the item of psychological domain regarding the ability to remember things ($r = 0.18$) in the psychological domain and the item of social domain regarding receiving social support ($r = 0.19$) in the social domain (Table 4).

Table 4. Construct validity (convergent and divergent validity): Pearson correlations of frailty domains with other corresponding measures

Corresponding measures/TFI domains	Physical-TFI	Psychological-TFI	Social-TFI	Total-TFI
SF36-Physical Function	-0.317**	-0.337**	-0.130	-0.355**
GDS	0.408**	0.458**	0.356**	0.517**
SF36-Social Function	-0.458**	-0.381**	-0.304**	-0.516**

Note. TFI: Tilburg Frailty Indicator; GDS: Geriatric Depression Scale; ** $p < 0.01$.

3.2.5 Face and Content Validity

It is achieved through consultations with healthcare providers at primary healthcare centers, nursing faculty members who are experts in geriatric care, and elderly people visiting primary healthcare centers. The content validity was evaluated using the Scale-Content Validity Index (S-CVI) and the Item-Content Validity Index (I-CVI). The S-CVI of Arabic version-TFI was 96.7%. The Arabic version-TFI had 100% on I-CVI for all its items except the two items of the social domain regarding feeling alone (75%) and receiving social support (75%).

3.2.6 Construct Validity: Convergent validity/Divergent validity

The correlations between the physical-TFI and the Physical Function of SF 36 was -0.317 ($p < 0.01$), psychological-TFI and GDS was 0.46 ($p < 0.01$), and social-TFI and the Social Function of SF 36 was -0.30 ($p < 0.01$). The correlations between the Physical Function of the SF 36, the GDS, the Social Function of the SF 36 and the total scores of the TFI were -0.36 ($p < 0.01$), 0.52 ($p < 0.01$), and -0.52 ($p < 0.01$), respectively (Table 4).

The correlations of the physical domain of the TFI with the GDS and the SF36-Social Function instruments were 0.41 ($p < 0.01$) and -0.46 ($p < 0.01$), respectively. The correlations of the psychological domain of the TFI with each of the SF36-Physical Function and SF36-Social Function instruments were -0.34 ($p < 0.01$) and -0.38 ($p < 0.01$), respectively. The correlations of the social-TFI with the Physical Function of the SF 36 and the GDS were -0.13 (non significant) and 0.36 ($p < 0.01$), respectively (Table 4).

3.2.7 Known Group Differences

There was no statistically significant difference between the mean frailty scores of older adults aged 60-70 ($n = 72$, $M = 6.53$, $SD = 3.34$) and those aged 71 or older ($n = 33$, $M = 7.91$, $SD = 3.45$), $t(103) = -1.949$, $p = 0.054$). The effect size was 0.41. The 95% CI was -2.79 to 0.024. There was no statistically significant difference between the mean frailty scores of males ($n = 66$, $M = 6.5909$, $SD = 3.47$) and females ($n = 43$, $M = 7.6279$, $SD = 3.24$), $t(107) = -1.564$, $p = 0.121$). The effect size was 0.31. The 95% CI was -2.351 to 0.277. Although both two p values were not statistically significant, they had moderate effect size, which represented the magnitude of the difference between groups (Sullivan & Feinn, 2012). However, there was a statistically significant difference between the mean frailty scores of older adults who had comorbidities ($n = 75$, $M = 5.6471$, $SD = 3.70$) and those who did not have ($n = 34$, $M = 7.6133$, $SD = 3.10$), $t(107) = -2.887$, $p = 0.005$). The effect size was 0.576. The 95% CI was -3.32 to -0.62.

4. Discussion

4.1 Reliability of the TFI

The KR 20 values of the three subscales and the total scores of the Arabic version of the TFI were as follows: 0.744 (Physical-TFI), 0.46 (Psychological-TFI), 0.39 (Social-TFI), and 0.77 (Total-TFI). These KR 20 values mean that the Arabic version of the TFI and the physical domain of the instrument have good reliability. The KR 20 of the physical domain of the TFI means that this subscale measures the physical attribute only and does not measure other dimensions. The low KR 20 values of both the psychological domain (0.46) and the social domain (0.39) of the TFI indicate that both subscales could measure other dimensions.

The two low values of the reliability of both the psychological and social domains are in line with the results found in Gobbens et al. (2010b), Santiago et al. (2013), and Coelho et al. (2014). Gobbens and colleagues' study (2010b) reported a low reliability value of the social domain of the TFI (0.34), which is similar to the current KR 20 of the Arabic version TFI (KR 20 = 0.39). Santiago et al. (2013) reported low values for both the psychological (0.53) and the social (0.38) domains. Coelho et al. (2014) had similar results and found KR 20 values of 0.48 and 0.49 for the psychological and social domains respectively.

The number of items in a scale or subscale contributes considerably to the magnitude of the reliability. Therefore, the low reliability of the two subscales may be attributed to the small number of items included in the psychological (4 items) and social (3 items) domains. Both domains entail the salient components of both the psychological and social aspects of frailty, so using a reduced number of items is justified because it lessens the burden on the participants.

In the current study, the TFI had an adequate KR 20 value of 0.77, which indicates that the TFI measures one attribute, that is, the frailty concept. The value of reliability of the total items of the TFI is in line with the internal consistency of the TFI reported in previous studies: 0.72 and 0.68 to 0.72 for the total score and the TFI items, respectively (Uchmanowicz et al., 2014); 0.78 (Santiago et al., 2013); 0.79 (Metzelthin et al., 2010); and the Gobbens and colleagues' study (2010b) reported internal consistency estimates of the TFI domains above 0.70, except for the social domain (0.34). However, one study reported a KR20 of 0.78 (Coelho et al., 2014). Other studies have shown adequate Cronbach's alpha values above 0.70 (Coelho et al., 2014; Metzelthin et al., 2010; Santiago et al., 2013; Uchmanowicz et al., 2014). Comparing the KR 20 values of the Arabic version of the TFI to the previous studies, having a 0.77 of KR 20, as a total score, is regarded to the highest value of the reliability.

On the other hand, Pearson's correlation coefficients between the subscales of the Arabic version-TFI ranging from 0.306 to 0.441 ($p < 0.01$) support that the subscales are low to moderately correlated with each other, which makes using the KR 20 of the total score more reasonable. Additionally, the absence of the negative point-biserial correlations and having the correlations above 0.2 for all items except two (ability to remember things and having enough support from social context) show that all items are correlated with the total score of the TFI. Lastly, the prior TFI studies and the conceptual considerations developed by Gobbens and colleague (2010c)'s support adopting the KR 20 of the total TFI score, that is, 0.77. The Arabic version of the TFI tested in older Jordanian participants has yielded a good internal consistency as shown by the KR 20 value of 0.77.

4.2 Face and Content Validity

The face and content validity of the Arabic version of the TFI were assessed by a panel of Jordanian healthcare providers and experts. The panel also included health professionals, such as clinical nurse specialists and registered nurses. The members of the panel agreed on the importance of using the TFI for detecting the components of frailty in older adults, which indicates this instrument is suitable for use in the Jordanian culture.

Thirteen out of fifteen items of the Arabic version of the TFI had an Item-Content Validity Index (I-CVI) of 100%. Two items of the social domain, one about feeling alone and one regarding social support, had an I-CVI value of 75%. One panelist suggested that a reason for lack of agreement was that the Jordanian culture is a close-knit culture, that is, the older adults have social support always and they will not feel alone. Then, the two items of having social support and feeling alone will be responded in positive way. However, other panelists argued that the Jordanian culture has been undergoing change and most of the younger family members tend to work outside of the home, leading to leave older adults at home alone. Thus, the items of social support and feeling alone should still be addressed. The Scale-Content Validity Index of the Arabic version-TFI was 96.7%.

4.3 Construct Validity: Convergent and Divergent Validity

The values of the inter-item (Tetrachoric) correlations of the physical domain ranged from 0.14 to 0.77. The absence of negative correlations reveals that all of these items are consistent with the frailty concept in the Jordanian participants and none of them might measure a different concept or are not related to the frailty concept. The values are considered as low-moderate correlations. All of the inter-item (Tetrachoric) correlations of the physical domain were above 0.30 except for eight correlations (PH 1 and PH2; PH2 and PH3; PH2 and PH4; PH1 and PH5; PH2 and PH6; PH6 and PH4; PH6 and PH5; and PH2 and PH8). Half of the inter-item (Tetrachoric) correlations of the psychological domain were above 0.30, except for three correlations (PS2 and PS1; PS4 and PS2; and PS4 and PS3). Lastly, most of the inter-item (Tetrachoric) correlations of the social domain were above 0.30, except for one correlation (SO3 and SO2).

The variations in the values of the inter-item correlations may be explained by having a small sample size that would not capture the correlations among the dichotomous variables. However, the existence of positive

correlations within each of the three sub-scales indicates that the sub-scale correlations are correlated to each other. Hence, the most of the inter-item (Tetrachoric) correlations within each of the sub-scale are in line with convergent validity.

The inter-item (Tetrachoric) correlations between each of the items in one domain with each of the items in the other two different domains ranged from -0.07 to 0.61 and included three negative correlations. The existence of very low to moderate inter-item correlations between different domains is congruent with good divergent validity. The small sample size might have reduced the magnitude of the inter-item (Tetrachoric) correlations. As a result, most of the inter-item (Tetrachoric) correlations met the criterion of having a value of 0.30 or above within each of the subscales of the Arabic version of the Tilburg Frailty Indicator.

The physical domain of the TFI was negatively correlated with the Physical Function-SF 36. This was expected because the older adults who are physically frail will not be able to perceive their physical function positively. The value of correlation was 0.32, which could not be considered either convergent or divergent validity based on the Faries and Yalcin (2007) *s'* rule. However, obtaining a significant correlation of 0.30 (or 0.40) or above indicates generally meaningful or significant correlation (convergent) that two scales belong to the same concept in the Jordanian participants. The value of 0.32 is congruent with previous studies (Coelho et al., 2014; Gobbens et al., 2010; Santiago et al., 2013), reporting that the correlations of physical-TFI with other physical measures ranged from 0.12 to 0.48.

The correlation between the psychological-TFI with the GDS was 0.46 which met the cut-off of the Faries and Yalcin (2007) *s'* rule. This value is in concordance with the correlations between the psychological-TFI and other psychological measures reported in previous studies, which ranged from 0.26 to 0.58 (Coelho et al., 2014; Gobbens et al., 2010; Santiago et al., 2013). Hence, the findings of the current study show that the psychological-TFI has convergent validity. The correlation between the social-TFI and the Social Function-SF 36 was negative. This is expected since the older adults who are socially frail will not be able to view their social function in a positive way. Its value of 0.30 does not meet the requirement of the cut-off of the Faries and Yalcin (2007) *s'* rule. However, the correlation of the present study is close to the highest value (0.35) found in the correlations between the social-TFI and other social measures discussed in previous studies (Coelho et al., 2014; Gobbens et al., 2010; Santiago et al., 2013). Consequently, the psychological-TFI was shown to have convergent validity based on the Faries and Yalcin (2007) *s'* rule, and it was shown in both the physical and social domains of the TFI in previous TFI studies (Coelho et al., 2014; Gobbens et al., 2010; Santiago et al., 2013).

Vis-à-vis divergent validity, the results show that the physical-TFI was positively correlated with the GDS ($r = 0.41$) and negatively with the SF36-Social Function ($r = -0.46$). The significant correlation between depression and physical frailty can be explained by the significant prevalence and co-occurrence of frailty and depression in older adults (Buigues et al., 2015). In addition, cognition, including depression and anxiety, and physical frailty were found to be positively correlated with each other (Uchmanowicz & Gobbens, 2015). Based on these positive correlations, a significant correlation between the physical-TFI and GDS is expected. In spite of the fact that these correlations are not less than 0.30 and do not meet the requirement of the Faries and Yalcin (2007) *s'* cut-offs, which is not considered problematic, they are in line with taking into account the psychological aspect of frailty through the demonstration of significant correlations between depression and physical frailty. On the other hand, correlations of 0.41 and 0.46 are close to numerous previous studies that reported the correlations between the physical-TFI and other psychological and social scales (Coelho et al., 2014; Gobbens et al., 2010; Santiago et al., 2013). These correlations ranged from 0.24 to 0.58 for the physical-TFI and psychological scales and from 0.10 to 0.35 for the physical-TFI and social scales, which indicate that the physical, psychological, and social domains are correlated to each other and support the role of both the psychological and social domains as essential aspects of frailty.

Secondly, the psychological-TFI was correlated negatively with the Physical Function-SF36 ($r = -0.34$) and negatively with the Social Function-SF36 ($r = -0.381$) (Table 4). These negative correlations are expected because the participants with higher frailty scores have less ability on both the physical and social functions of the SF36. These correlations are significantly higher than those reported in the previous studies addressing the correlations between the psychological-TFI and other physical scales (Coelho et al., 2014; Gobbens et al., 2010; Santiago et al., 2013). These correlations ranged from 0.02 to 0.28 for the psychological-TFI and physical scales. On the other hand, the previous studies reported that correlations between the psychological-TFI and social scales ranged from 0.14 to 0.37, which are close to what was found in this study ($r = 0.38$).

These findings reveal that the psychological aspect of frailty may have a negative impact on the health-related quality of life for Jordanian older adults. Older Jordanian adults might not perceive themselves as being physically

healthy and socially active while being psychologically frail. The inability to remember things, the inability to adjust to problems, feeling depressed, and feeling anxious may prevent some older Jordanian adults from living comfortably and perceiving of a better health-related quality of life for themselves. It is not surprising that the psychological-TFI is significantly correlated with the physical and social functioning of the health-related quality of life measured by the SF-36. The finding of the current study is consistent with significant inverse correlations found between both of the SF 36 physical component scale (PCS) and the mental component scale (MCS) domain, and the TFI score (Uchmanowicz & Gobbens, 2015).

Lastly, the social-TFI was correlated negatively with the Physical Function-SF36 ($r = 0.13$) and positively with the GDS ($r = 0.36$) (Table 4). The correlation between the social-TFI and the Physical Function-SF36 met the criteria of divergent validity based on the Faries and Yalcin (2007) s' cut-offs. However, based on the findings of this study, the divergent validity for the social domain of the TFI should be interpreted cautiously due to its low reliability. This correlation ($r = 0.13$) is consistent with low correlations between the social-TFI and physical scales reported in Coelho et al. (2014), Gobbens et al. (2010), and Santiago et al. (2013), which ranged from 0.00 to 0.20. The correlation between the social-TFI and the GDS ($r = 0.36$) is not regarded as having either convergent or divergent validity based on the Faries and Yalcin (2007) s' cut-off criteria. However, this value is close to the average of the correlations between the social-TFI and psychological scales (Coelho et al., 2014; Gobbens et al., 2010; Santiago et al., 2013), which ranged from 0.01 to 0.41. The variation in the correlations between the social-TFI and psychological scales might be attributed to the different corresponding or alternative scales used in different populations.

Known group difference was also used to support the construct validity of the Arabic version of the TFI. Comorbidities have been found in previous studies to be associated with frailty (Bergman et al., 2004; Chek Hooi et al., 2010; Gobbens et al., 2012a; Mitnitski, Mogilner, & Rockwood, 2001; Song, Mitnitski, & Rockwood, 2010; Theou, Rockwood, Mitnitski, & Rockwood, 2012). Therefore, the scores of the Arabic version of the TFI were expected to discriminate between the older adults with comorbidities and those who did not have comorbidities. The current study reveals that the differences in frailty scores were statistically significant between the older adults with comorbidities and those who did not have comorbidities ($t(107) = -2.887, p = 0.005$). Thus, known group difference in comorbidities was established in the current study.

4.4 Limitations

The results of this study have several limitations. First, the use of a convenience sample limits the generalizability of the findings to the target population. Second, the psychological and social domain of the Arabic version of the Tilburg Frailty Indicator had low reliability, so the results of the convergent validity must be interpreted with caution. The sample size of 109 participants is considered too small to conduct the construct validity (Factor Analysis) deemed necessary to validate a new instrument, such as the Arabic version of the Tilburg Frailty Indicator. A larger sample size is needed for dichotomous instruments (Flora & Curran, 2004). Lastly, the temporal stability or test-retest and the inter-rater reliability could be additional methods to measure the reliability of the Arabic version of the TFI in future research.

5. Conclusion

The results of the current study have shown that frailty, as a concept, should not be considered merely by physical indicators, but there are other salient aspects of frailty, such as psychological and social aspects, that go hand in hand with the physical indicators. In spite of the low reliability of the two domains, the psychological and social domains were positively and moderately correlated with the physical domain, demonstrating the multi-dimensional nature of the frailty concept. The existence of the low to moderate correlations between items of each of the physical, psychological, and social subscales of the Arabic version of the Tilburg Frailty Indicator supports Gobbens and colleagues' integral conceptual model of frailty.

The Tilburg Frailty Indicator is an emerging frailty instrument that has been translated for use in and validated in several countries in the past three years. The Arabic version of the TFI obtained a good reliability to screen frailty in older Jordanian adults. The face and content validity were adequately established through a panel of experts by assessing item and scale content indices. The construct validity was established in the three domains of the TFI, psychological, physical, and social, through exploring the correlations between domains and their corresponding and non-corresponding scales. Moreover, known group difference was established in comparing older adults with comorbidities and those without based on frailty scores obtained using the Arabic version of the TFI. The Arabic version of the TFI is the preliminarily step in guiding health providers to screen for frailty in Jordan. The Arabic version of the TFI could bring researchers closer to achieving this standard. Sustaining efforts to compare different frailty instruments in the literature using numerous literature reviews is indispensable for establishing the most

suitable frailty instruments.

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Competing Interests Statement

The author declares that there are no competing or potential conflicts of interest.

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