JAMDA xxx (2018) 1–4

JAMDA

journal homepage: www.jamda.com

Original Study—Brief Report

Are the Kihon Checklist and the Kaigo-Yobo Checklist Compatible With the Frailty Index?

Gotaro Kojima MD [a,b,*], Yu Taniguchi PhD [b], Akihiko Kitamura MD, PhD [b], Shoji Shinkai MD, PhD, MPH [b]

[a] *Department of Primary Care and Population Health, University College London, London, United Kingdom*
[b] *Research Team for Social Participation and Community Health, Tokyo Metropolitan Institute of Gerontology, Tokyo, Japan*

Keywords:
Frailty
Kihon Checklist
Kaigo-Yobo Checklist
Frailty Index

A B S T R A C T

Objectives: To explore comparability of Kihon Checklist (KCL) and Kaigo-Yobo Checklist (KYCL) to Frailty Index (FI) in predicting risks of long-term care insurance (LTCI) certification and/or mortality over 3 years.
Design: Prospective cohort study.
Setting and Participants: 1023 Japanese community-dwelling older adults from the Kusatsu Longitudinal Study of Aging and Health.
Measures: Frailty status was quantified at baseline using KCL, KYCL, and 32-deficit and 68-deficit FI. Relationships of the measures were examined using Spearman rank correlation coefficients. Cox regression models examined the risk of new certification of LTCI or mortality according to KCL, KYCL, and FI. Predictive abilities of KCL and KYCL were compared with FI using area under the receiver operating characteristic curve (AUC), C statistics, net reclassification improvement (NRI), and integrated discrimination improvement (IDI).
Results: Mean age was 74.7 years and 57.6% were women. KCL and KYCL were significantly correlated to 32-FI ($r = 0.60$ and 0.36, respectively) and to 68-FI ($r = 0.88$ and 0.61, respectively). During the follow-up period, 92 participants (9%) were newly certified for LTCI or died. Fully adjusted Cox models showed that higher KCL, KYCL, 32-FI, and 68-FI were all significantly associated with elevated risks [hazard ratio (HR) = 1.03, 95% CI = 1.01-1.04, $P < .001$; HR = 1.04, 95% CI = 1.02-1.05, $P < .001$; HR = 1.03, 95% CI = 1.01-1.05, $P = .001$; HR = 1.04, 95% CI = 1.02-1.06, $P < .001$, respectively, per 1/100 increase of max score]. AUC and C-statistics of KCL and KYCL were not different statistically from those of 32-FI and 68-FI. Predictive abilities of KCL were superior to 32-FI in NRI and IDI but inferior to 68-FI in category-free NRI, and those of KYCL were superior to 32-FI in IDI but inferior to 68-FI in NRI.
Conclusions: Although KCL and KYCL include smaller numbers of items than standard FI, both tools were shown to be highly correlated with FI, significant predictors of LTCI certification and/or mortality, and compatible to FI in the risk prediction.

There is a growing number of studies regarding frailty in the literature. Although the concept of frailty has been widely accepted as a state of increased vulnerability to negative health outcomes, consensus regarding its standard definition has not been reached.[1] Among the various frailty criteria proposed, the Kihon Checklist (KCL) and the Kaigo-Yobo Checklist (KYCL) have increasingly been used as frailty assessment tools.[2–7] KCL and KYCL are both simple yes/no questionnaires of 25 and 15 items, respectively, comprehensively covering multiple domains of important geriatric syndromes. These indices, initially developed in Japan, have now been translated into English and other languages and used in non-Japanese populations.[8–13] Previous studies attempted to validate KCL and KYCL as frailty assessment tools and showed that both were highly correlated to frailty status[3,4] defined by the Fried phenotype,[14] currently the most frequently used frailty criteria.[15]

The authors declare no conflicts of interest.

Funding sources: This study was supported by grants from Tokyo Metropolitan Institute of Gerontology, JST/RISTEX, Grants-In-Aid for Scientific Research (B) JP20390190, (B) JP21390212, (B) JP24390173, and (B) JP26310111 from the Ministry of Education, Culture, Sports, Science and Technology, Japan.

* Address correspondence to Gotaro Kojima, MD, Department of Primary Care and Population Health University College London (Royal Free Campus) Rowland Hill Street, London NW3 2PF, United Kingdom.
E-mail address: gotarokojima@yahoo.co.jp (G. Kojima).

https://doi.org/10.1016/j.jamda.2018.05.012
1525-8610/

The Fried phenotype operationalizes frailty as a biological syndrome, characterized by 5 specific physical symptoms: shrinking, exhaustion, weakness, slowness, and low physical activity.[14] There is another commonly used frailty operationalization: the Frailty Index (FI).[16] This approach, in contrast, considers disabilities, comorbidities, symptoms, and signs as deficits, and can quantify frailty status on a FI.[16] In that KCL and KYCL include a wide range of activities of daily living (ADL), instrumental ADL, physical function, nutritional status, oral function, housebound status, cognitive function, and depressive symptoms that can be used as a deficit to construct the FI, both indices may be more comparable to the conceptualization of the FI.[3,17,18] However, most of the previous studies using KCL or KYCL stratified the continuous total scores by cut-points and defined categorized frailty status, such as robust, prefrail, and frail, or nonfrail and frail, based on the frailty phenotype.[18] To our knowledge, there have been no studies in the literature comparing KCL and KYCL with the FI in risk prediction or discrimination. Thus we aimed to explore the potentials of KCL and KYCL as a FI and examined their comparability in relation to a standard FI in predicting risks of long-term care insurance (LTCI) certification and/or mortality in an older Japanese population.

Methods

Study Setting and Population

The Kusatsu Longitudinal Study of Aging and Health is a cohort study of community-dwelling adults aged ≥65 in Kusatsu town, Japan.[19–21] Briefly, the study was launched in 2001 and has been following up on the participants by annual health checkups and biennial health monitoring surveys.

Among 1254 individuals who participated in the health checkup in July 2014, a total of 1048 (83.6%) completed both KCL and KCYL questionnaires. Three participants who did not have enough deficit data to construct a FI, 4 who were already certified for the LTCI by 2014, and 18 who moved out or were lost for follow-up were excluded, leaving 1023 participants (81.6%) as the final analytic sample. This study was approved by the ethics committee at Tokyo Metropolitan Institute of Gerontology, and all participants provided written informed consent.

Frailty Assessment

Kihon Checklist

This 25-item yes/no questionnaire covers a wide range of domains: ADL (n = 3), instrumental ADL (n = 3), social activities (n = 4), cognitive function (n = 3), depressive symptoms (n = 5), fall-related issues (n = 2), nutritional status (n = 2), and oral function (n = 3).[22] One point is given to each item and the total score ranges from 0 to 25, with a higher score indicative of greater frailty.

Kaigo-Yobo Checklist

KYCL is another yes/no questionnaire of 15 items: ADL (n = 1), social activities (n = 5), fall-related issues (n = 3), nutritional status (n = 4), vision (n = 1), and hospitalization (n = 1).[19] The total score ranges from 0 to 15, with a higher score indicative of greater frailty.

Frailty index

Two sets of FI (32 and 68 deficits) were generated according to the standard procedure.[23] The first FI consisted of 32 deficits (32-FI) that were not included in KCL or KYCL. The second FI was based on these 32 deficits as well as 25 deficits from KCL and 15 deficits from KYCL. Four deficits from KYCL were excluded as identical or similar to items included in KCL, leaving 68 items (68-FI) (Supplementary Table 1).

Follow-Up and Outcomes

The participants were followed up through December 2017, for the composite outcome of newly certified LTCI or mortality. LTCI is a mandatory system of national social insurance that provides various types of formal care and support to eligible older adults aged ≥65 with disabilities.[24,25] The certification processes include functional disability assessment and a reference letter from attending doctors.[26] For a participant who was certified for LTCI and died during the follow-up period, LTCI certification was used as an event. An LTCI application date was used for the LTCI certification outcome. These outcomes were monitored using the local resident registries and LTCI system databases.

Covariates

Baseline covariates used for adjustment were age, gender, smoking, alcohol use, and education, all of which were considered to have effects on the relationship between frailty and loss of independency.

Statistical Analysis

Relationships among KCL, KYCL, 32-FI, and 68-FI were examined using Spearman rank correlation coefficients because distribution of the 4 indices was similarly skewed to the right.

Cox regression models examined the risk of new certification of LTCI or mortality according to KCL, KYCL, 32-FI, and 68-FI. For comparison, hazard ratios (HRs) and 95% confidence intervals (CIs) for these frailty measures were calculated per 1/100 of the maximum scores (0.25 for KCL, 0.15 for KYCL, and 0.01 for FI).

Predictive abilities of KCL and KYCL were separately compared with 32-FI using 3 measures: (1) changes in the area under the receiver operating characteristic (ROC) curve (AUC) and C statistics, (2) categorical and category-free net reclassification improvement (NRI), and (3) integrated discrimination improvement (IDI).[27] The ROC curves were depicted for KCL, KYCL, 32-FI, and 68-FI, for each of which AUC was calculated. C statistics adjusted for age and gender, and ones adjusted for age, gender, education, smoking, and alcohol use were calculated. NRI quantifies how better KCL or KYCL correctly reclassified individuals with and without the events, which were LTCI certification or mortality in this case. Cut points for the predicted probability quartiles of 32-FI were used for the categorical NRI. IDI is the difference of 2 models' discrimination slopes, which are calculated as a difference of mean predicted probabilities between those with and without events.

All statistical analyses were conducted using StataSE 14 (StataCorp LP, College Station, TX) and SAS software (version 9.4, SAS institute, Cary, NC). Statistical significance was based on 2-tailed P value of $< .05$.

Results

Mean age was 74.7 years, and 57.6% were women. Mean scores of KCL and KYCL were 3.7 and 1.5, respectively. Means of 32-FI and 68-FI were 0.15 and 0.14, respectively.

Both KCL and KYCL were significantly correlated to 32-FI, with correlation coefficients of 0.60 and 0.36 (both $P < .0001$). Correlation between KCL and KYCL was also significant (Spearman rho = 0.52, $P < .0001$). 68-FI, which combined all components of the 3 others, was significantly associated with KCL, KYCL, and 32-FI (Spearman rho = 0.88, 0.61, and 0.87, all $P < .0001$).

During the follow-up period, 92 participants (9%) were newly certified for LTCI (n = 52) or died (n = 40). Higher KCL, KYCL, 32-FI, and 68-FI were all significantly associated with elevated risks of LTCI certification or mortality (fully adjusted models: HR = 1.03, HR = 1.04, HR = 1.03, HR = 1.04, respectively, all $P < .001$) (Table 1).