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Evaluation of the Get Active Questionnaire in Community-Dwelling Older Adults

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23 Abstract

24 *Background:* Physical activity screening prior to starting a physical activity program is important to identify
25 if there are any underlying health conditions. However, many older adults do not complete such
26 assessments prior to beginning their physical activity program. This project compared the Canadian Society
27 for Exercise Physiology's newly developed Get Active Questionnaire (GAQ) to a standardized exercise stress
28 test in terms of screening out versus screening in false positive GAQ tests. *Methods:* A convenience sample
29 of community-dwelling adults (male n=58, female n=54) aged 75 ±7 years from London, Ontario was used.
30 Participants completed a physical exam and physical activity screening session (i.e. stress test and GAQ) at
31 a research laboratory which routinely conducts community-based referrals. One week after the initial visit,
32 participants returned to the study site, completed the GAQ and were asked questions about their
33 perceptions of physical activity screening by a research assistant. *Results:* The GAQ 'screened in'
34 participants, but it did not provide the same precision of 'screening out' at-risk individuals as an exercise
35 stress test; the GAQ reduced false positives versus the stress test, yet there was a large proportion of high
36 false negative results reported. *Conclusions:* The GAQ shows promise in physical activity screening in older
37 adults to engage in exercise safely. However, the lack of precision in physical activity screening out at-risk
38 populations requires further evaluation. Questionnaires like the GAQ should be evaluated in a larger study
39 population at various time points to further assess the validity and reliability of physical activity screening
40 tools.

41 **Keywords:** Physical activity screening, stress test, physical activity, self-screening, aging

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48 **Introduction**

49 Evolving pre-participation physical activity screening recommendations seek to simplify the screening
50 process and mitigate potential barriers to adopting a physically active lifestyle (Riebe, 2015). One barrier
51 identified is the high rate of false-positive physical activity tests. To address this potential barrier, the Canadian
52 Society for Exercise Physiology (CSEP) assembled an expert group to develop a new physical activity readiness
53 assessment tool that is user-friendly, evidence-based, and seeks to safely encourage and 'screen-in' as many
54 people as possible to regular healthful physical activity (<http://www.csep.ca/home>). As such, it is important to
55 promote physical activity for older adults to maintain and improve health outcomes in this population (Nelson
56 et al., 2007). However, there is a small risk of adverse events in some populations. Over 80% of Canadians
57 greater than 65 years of age have one or more chronic condition (Gilmour and Park, 2006). It has been
58 suggested that existing physical activity screening tools are ineffective in correctly identifying the extremely
59 small number of individuals (often older adults) who are at risk for sudden death during exercise (Morey and
60 Sullivan, 2003; Goodman et al., 2016) and are also associated with high false positive results; potentially
61 exposing older adults to further unnecessary testing, undue stress; potentially negatively impacting physical
62 activity participation (Gill et al., 2000). A recent systematic review (Doma et al., 2017) indicated the limitations
63 of current physical activity screening tools after observing poor psychometric properties throughout physical
64 activity questionnaires. Therefore, and not surprisingly, there is a need for user-friendly physical activity
65 screening tools that can both identify exercise-related risk factors and facilitate the safe exercise participation
66 by older adults (Petrella and Wight, 2000; Resnick et al., 2008; Chodzko-Zajko et al., 2009). Medical clearance
67 prior to physical activity participation has been recommended for adults regardless of risk status (Eves and
68 Davidson, 2011). As physical activity screening tools continue to be revised (i.e., the Physical Activity Readiness
69 Questionnaire (PARQ+) demonstrated a reduced number of exclusions in older adults), there is insufficient data
70 to exclude any specific age-group from physical activity (Goodman et al., 2016). Further, most physical activity
71 screening tools do not provide instructions or a suggested age-range of users. In addition, older adult memory

recall while completing questionnaires has been found to have inconsistent reliability and validity findings (Forsen et al., 2010). Thus, older adults may have unique risk factors and/or have a distinct interpretation of pre-physical activity screening tools. Therefore, the purpose of this study was to evaluate the psychometric properties (test-retest reliability and criterion-related validity) of the newly developed Get Active Questionnaire (GAQ) in community-dwelling in older adults.

Materials & Methods

Ethics

All experimental procedures were approved by the University of Western Ontario Ethics Committee for Research on Human Subjects (Protocol #108058). Each volunteer provided written, informed consent prior to participation in the study.

Setting

Data collection, administration of the GAQ, and stress testing took place at the research laboratory at the Western Centre for Public Health and Family Medicine, Western University, London, Ontario. The laboratory routinely conducts physical activity screening for community-based referrals.

Sample

A convenience sample of community-dwelling adults (male $n=58$, female $n=54$) aged 75 ± 7 years in the City of London, Ontario was used. All individuals over 50 years of age who presented to the lab for either an annual physical activity program stress test or prior to beginning a physical activity program at the Canadian Center for Activity and Aging or the Retirement Research Association at Western University were eligible for the study. Recruitment was conducted by the stress test assistant. Exclusion criteria included a score less than 24 on the Mini Mental State Examination (MMSE) and those living in institutional settings, such as nursing homes or chronic care facilities.

95 The sample size calculation for the test-retest reliability was calculated to be 80, based on the
96 approximation of intraclass correlations (ICC) (with Fisher's z transformation) and using a confidence interval of
97 0.05 and a reliability coefficient of 0.90 (Streiner and Norman, 1995). A recruitment size goal of 120
98 participants was used to account for an anticipated 20% non-responsive rate. The sample size for validity
99 assessment included all participants completing the GAQ.

100 Data collection took place over a seven-month period (June –December 2016). Participants were asked
101 to participate in two sessions. On the first day, participants self-completed the GAQ in the presence of the
102 stress test technician/research assistant and then underwent a stress test. The first day (i.e., session one) was
103 estimated to take approximately one hour. Seven days later, participants returned to the laboratory to
104 complete the self-completed GAQ a second time. One week was determined to be of sufficient duration
105 whereby participants were unlikely to recall their previous responses and there was a low risk of additional
106 adverse event occurrence during this period.

107 ***Stress Test Assessment***

108 Participants underwent pre-stress test assessments for self-reported health status, anthropometrics,
109 resting blood pressure, cognition (Mini-Mental Status Examination [MMSE] and Montreal Cognitive
110 Assessment [MoCA]) and recent self-reported health status (diagnosed conditions, medication use, etc.).
111 Participants then underwent a graded-exercise treadmill test. Post-stress test, participants were given the
112 results (and compared to age-matched normative data) and provided a training heart rate to guide their
113 exercise intensity during their physical activity program.

114 ***Get Active Questionnaire***

115 The GAQ is a two-page document consisting of four questions on the first page with direction to assess
116 current physical activity and advice to proceed onto page two. A second, 'Reference Document' is intended to
117 provide advice on what to do in the case of a 'Yes' response to the questionnaire. The GAQ was developed by
118 an expert panel from a CSEP member survey to be administered via paper version to the general public (of all

ages) independently, and/or administered by qualified exercise professionals and healthcare providers
(<http://www.csep.ca/home>).

Statistical Analyses

Descriptive statistics were calculated for all variables of interest prior to conducting the main analyses. Specifically, means and standard deviations were calculated for continuous variables and frequency counts and percentages were calculated for categorical variables. For all analyses, interpretation of results was primarily based on estimation and associated 95% confidence intervals (CIs); two-sided P values less than 0.05 were reported as statistically significant. Analyses were performed using SAS version 9.4 (SAS Institute Inc., Cary, NC). The following reliability and validity analyses were conducted with visit one data.

Test–retest Reliability of GAQ Items

Test-retest reliability refers to agreement among measurements on the same participants at different time points (Koopse and Weiss, 2003). For all categorical (binary) variables from the GAQ, including the “Preparing to Become More Active” questions, the “Declaration” items and the “Reference Document” questions, test-retest reliability was assessed using the kappa statistic (κ) and associated 95% CIs (Cohen, 1960). For continuous variables from the GAQ, which included the “Assess your Current Physical Activity” questions (Table 1), test-retest reliability was assessed using intraclass correlation coefficients (ICCs) and 95% CIs obtained with Fisher’s z transformation (Donner and Zou, 2002). Guidelines from Landis and Koch (1977) were used for interpreting the strength of agreement for kappa values and intraclass correlation coefficients. Exact p-values were calculated for both kappa and ICC statistics.

Risk Level Assignment

A self-screen variable (i.e., ‘screen in’ vs. ‘screen out’) was derived from the GAQ and this was compared with a screening variable that was derived from objectively measured items from the stress test (also coded as ‘screen in’ vs. ‘screen out’). A ‘screen in’ could indicate an individual could safely proceed to

become more physically active or continue with physical activity; in contrast, a 'screen out' indicates that an individual should not proceed with becoming more physically active or continuing with physical activity until further consultation (i.e., with a healthcare provider (HCP) or a qualified exercise professional (QEP)).

For the self-screen variable derived from the GAQ, the declaration questions were used to determine 'screen in' versus 'screen out' status. An individual was classified as a 'screen out' if they checked *any* of the following two possible responses to the Declaration section of the GAQ (note: 'questions' always refer to the questions listed on page one of the GAQ):

- 1) I answered YES to any question and I have *not* consulted a Health Care Provider (HCP) or Qualified Exercise Professional (QEP) about becoming more physically active; *or*
- 2) I would like to consult a QEP about becoming more physically active.

In contrast, an individual would be classified as a 'screen in' if they checked *any* of the following *three* possible responses to the Declaration:

- 1) I answered NO to all questions;
- 2) I answered YES to any question and I have consulted a HCP and/or QEP who has recommended I become more physically active; *or*
- 3) I am comfortable with becoming more physically active on my own without consulting a HCP and/or QEP.

Note: the item 'I am comfortable with becoming more physically active on my own without consulting a HCP and/or QEP' superseded any other responses (i.e., if this was selected then the individual was automatically classified as a 'screen in').

For the stress test-determined screen variable, several objective items were used to determine 'screen in'/'screen out' status. An individual was classified as a 'screen out' if any of the following were indicated:

- 1) Heart problems reported to technician prior to stress test (i.e., chest pain, tightness or angina);
- 2) Individual did not proceed with a stress test or had a non-normal stress test (i.e., results from stress test were equivocal, abnormal, inconclusive or other significant findings were noted);

- 3) Stopping the stress test for any of the following reasons: lightheaded/dizzy, chest pain, physician's discretion, ECG changes, hypertension, or hypotension;
- 4) Hypertension (defined as systolic blood pressure, BP ≥ 180 mmHg and/or diastolic BP ≥ 110 mmHg) observed based on average of BP measurements taken during the stress test (including 2nd and 3rd measurements at rest plus post-stress test recovery BP measurements taken at 2 minutes, 4 minutes, 6 minutes, 8 minutes, and 10 minutes post-stress test) (Bloodpressureuk.org, n.d.); or
- 5) Hypotension (defined as SBP < 100 mmHg and/or DBP < 60 mmHg) observed based on the same measurements used to determine hypertension.

After the GAQ self-screen and stress test-determined screen variables were created, a two by two table was generated to evaluate the performance of the self-screening via the GAQ versus the stress test-determined physical activity screening. The exercise stress test has been deemed as the gold standard measurement for cardiorespiratory fitness (Lafountain et al., 2016). From a two by two table (Table 2), the each variable was to be examined (Koepsell and Weiss, 2003).

GAQ Item Validation

The same approach outlined above for evaluating the GAQ as a physical activity screening tool was taken to evaluate validity of two individual items from the GAQ (Questions 1A and 1B) related to cardiovascular disease. Question 1A from the GAQ ("Have you experienced ANY of the following within the past six months?... A diagnosis of heart disease or stroke, or pain/discomfort/pressure in your chest during activities of daily living or during physical activity?) was compared against a derived variable from the stress tests that indicated chest pain or ECG changes as a reason for having to stop the stress test. Question 1B from the GAQ ("Have you experienced ANY of the following within the past six months?... A diagnosis of high blood pressure (BP) and/or a resting BP of 160/90 mmHg or higher?") was compared with a derived variable from the stress tests that indicated if someone had high blood pressure per whether they had a measured BP of $\geq 160/90$ mmHg (taken from the average calculated from the second and third BP readings done at rest) or reported taking a blood pressure medication.

192 Results

193 Of the 119 individuals presenting to the lab, 113 agreed to participate. None of the participants were
194 excluded to participate based on the exclusion criteria listed earlier. Both study sessions were completed by
195 112 of the participants (99% completion rate). One participant did not complete the GAQ due to time
196 constraints. Participant characteristics are presented in Table 3.

197 *Test–retest Reliability of GAQ Items*

198 The following guidelines were adopted for interpreting the strength of agreement for κ values and
199 intraclass correlation coefficients (Landis and Koch, 1977): <0.00 represents poor agreement; 0.00 to 0.20
200 represents slight agreement; 0.21 to 0.4 represents fair agreement; 0.41 to 0.6 represents moderate
201 agreement; 0.61 to 0.8 represents substantial agreement; >0.80 represents almost perfect agreement. While
202 we did test for statistical significance at the 5% level, interpretation of results should be primarily focused on
203 the magnitude of the coefficients, which demonstrate the strength of agreement, regardless of statistical
204 significance.

205 Test-retest reliability was only possible for eight of the nine items representing the “Preparing to
206 Become More Active” questions on page one of the GAQ. There were no individuals who said ‘yes’ for the
207 concussion question (1F) at visit one, thus it was not possible to calculate reliability for that item. Of the eight
208 questions evaluated, there was substantial agreement for six of the questions and fair agreement for the other
209 two (Table 4). All questions were statistically significant, testing at $\alpha = 0.05$ (i.e., for each question, the null
210 hypothesis of $\kappa = 0$ (no agreement) was rejected; all p-values were < 0.05). The questions that were shown to
211 be most reliable were: “Do you have any other medical condition that affects your ability to be physically
212 active?”; “...Dizziness or light-headedness during physical activity?”; and “...Diagnosis of heart disease or stroke,
213 or pain/discomfort/pressure in your chest during activities of daily living or during physical activity?”. The least
214 reliable question was “...Shortness of breath at rest”.

215 For the GAQ section on assessing current physical activity levels, intraclass correlation coefficients
216 (ICCs) were produced for reliability between the two visits (Table 3). For the question “*On how many*
217 *days/week do you typically do moderate-to-vigorous-intensity aerobic physical activity?*”, there was almost
218 perfect agreement. The question “*On days that you do at least moderate intensity aerobic physical activity, for*
219 *how many min do you do this activity?*” had moderate agreement; and the third question, derived from the
220 first two questions, had agreement as expected, which was in-between perfect and moderate agreement (i.e.,
221 substantial agreement). According to participant self-completed physically activity levels, 78 participants (70%)
222 were meeting Canada’s Physical Activity Guidelines (mean: 3.4 days per week, mean: 55 minutes per day,
223 mean: 203 minutes per week).

224 Evidence for test-retest reliability was poor for the “Declaration” questions (Table 5). Questions
225 ranged from slight agreement ($\kappa=0.16$) to substantial agreement ($\kappa=0.61$), with three of the five questions
226 having kappa values in only the slight or fair agreement range.

227 Of the seven questions from the reference document that could be evaluated (Table 6) there was
228 perfect agreement for one question (“*Loss of consciousness/fainting for any reason?*”), where only one person
229 reported YES to that question (at both time points). There was almost perfect agreement for two questions,
230 substantial agreement for three questions, and moderate agreement for one question. All questions were
231 statistically significant, testing at $\alpha = 0.05$ (i.e., for each question, the null hypothesis of $\kappa = 0$ (no
232 agreement) was rejected). The questions that showed almost perfect agreement were also two of the most
233 reliable items on page 1 (1A and 1C ‘*Diagnosis of cardiovascular disease or stroke or chest pain in activities of*
234 *daily living or during physical activity*’ and ‘*Dizziness or light-headedness during physical activity?*’) The least
235 reliable question from the reference document section was “*...Any other medical condition that affects your*
236 *ability to be physically active?*”

237 **Risk Assignment**

238 Risk assignment for physical activity participation based on self- (GAQ) and objective (stress test)
239 physical activity screening is presented in Table 7. Six participants screened themselves out, with 103 screening
240 themselves in. Based on the stress test criteria, 18 participants were 'screened out' and 91 were 'screened in';
241 thus, the prevalence of the outcome of interest, 'screening out' via stress test, was 16.5%. Reasons for stress
242 test screen-outs are listed in Table 8.

243 Overall, the results indicate that the GAQ performs well in accurately screening older adults into physical
244 activity participation, but did not perform well in 'screening out'. Of the 18 individuals who were 'screened out'
245 via the stress test, only 1 individual was also 'screened out' using the GAQ. Specifically, the GAQ had low
246 sensitivity (0.06) but high specificity (0.95). Similarly, the GAQ had low positive predictive value (0.17) but high
247 negative predictive value (0.84). Lastly, the GAQ demonstrated low false positive probability at 0.05 (i.e., very
248 few individuals who were true negative responders ['screened in' via stress test] had a positive test result on
249 the GAQ ['screened out' via GAQ]), but high false negative probability at 0.94 (i.e., most individuals who were
250 true positive responders ['screened out' via stress test] had a negative test result on the GAQ ['screened in' via
251 GAQ]). The GAQ 'screened in' 18 of 19 participants, when in fact the objective measure or gold standard (i.e.,
252 the stress test) indicated that the individuals should not be. The accuracy or correct classification rate of the
253 GAQ, that is proportion of observations for which the test result (GAQ) and gold standard (stress test) agree,
254 was 79.8%.

255 *GAQ Item Validation*

256 For the evaluation of Question 1a from the GAQ, only chest pain as a reason for stopping the stress test
257 was used as the objective measure for evaluation since there were no individuals who had ECG changes as a
258 reason for having to stop. Due to the small number of cases arising from both the GAQ item ("*A diagnosis of*
259 *heart disease or stroke, or pain/discomfort/pressure in your chest during activities of daily living or during*
260 *physical activity?*") and the stress test criterion (chest pain as a reason for stopping the stress test), this
261 precluded the ability to calculate sensitivity or positive predictive value (see Table 8a). Both the specificity and

negative predictive value were high at 0.95 and 0.99, respectively. The false positive probability was low (0.05), while the false negative probability was 1.0 (i.e., because there was only one individual who had chest pain indicated as a reason for stopping the stress test and this individual did not indicate any chest pain on the GAQ).

The GAQ item “A diagnosis of high blood pressure (BP) and/or a resting BP of 160/90 mmHg or higher?” had low sensitivity (0.18) but high specificity (0.94). Both the positive predictive value and negative predictive value were moderate at 0.67 and 0.62, respectively. The false positive probability was low at 0.06 but the false negative probability was high at 0.82 (Table 9b).

Discussion

The newly developed GAQ was added to the yearly stress test procedures of adults attending older adult physical activity programming in-order-to evaluate its effectiveness as a physical activity screening tool in community-dwelling adults of the older adult age-range. The present sample of adults were relatively healthy, independently living, and largely physically active. The psychometric properties of questionnaires are population specific, as such the generalizability of the results is limited to that description. However, as described below, the sample does have similar demographics as the Canadian older adult population. This study was conducted in London, Ontario, which is categorized as a Census Metropolitan Area (CMA, population greater than 100,000). According to the Portrait of Seniors in Canada 2006 report (Turcotte and Schellenberg, 2006), 70% of Canadians aged 65 years and older live in CMAs or urban centres (populations greater than 50,000). The average age of the present sample was 75 ± 7 years. Among the 65-year-and-older population in Canada, 43% are males, versus 52% in the present sample. The present sample with a mean BMI of 26.5 kg/m^2 would be categorized as overweight. However, from the 2008 Statistics Canada report on the estimates of obesity among of Canadian Adults (Government of Canada, 2008), the mean BMI of the adult population aged 65 to 79 years is 28 kg/m^2 . In the Canadian population, 76% of Seniors report having at least one chronic condition (Statistics Canada 2008). In the present sample, 72% reported having at least one chronic condition. The vast majority of older adults who participated in this study engaged in community-based physical activity

programming, similar to previous work in physical activity assessments (Davis et al., 2001). Due to the relatively healthy sample, this group may not necessarily be representative of the major chronic conditions reported by older Canadians (e.g. heart disease and cancers). However, hypertension and arthritis are the top two conditions reported by older Canadians (Canadian Institute for Health Information, 2011), similar to the present study sample. Based on mean MMSE and MoCA scores, the present sample had no cognitive impairments. Although, 20% of a subset of the sample (15/76) did self-report having memory complaints.

A majority of the self-completed GAQ screening questions demonstrate acceptable test-retest reliability over a one-week period. Of the eight questions evaluated from page one of the GAQ (that is all of the “*Prepare to Become More Active*” questions 1A-1F, 2, 3, 4), there was substantial agreement for six of the questions and fair agreement for the other two questions. The prevalence of some of the conditions/symptoms the GAQ seeks to screen for were low in the present sample and thus the non-variance for the dichotomous variables may have influenced the questions for which the test-retest reliability was lower. In addition, while the short time between administrations sought to minimize the occurrence of any adverse events or new diagnoses, the process of recall may have influenced the reported reliability estimates; as many participants would tell the research assistant that in the week following visit one, their memory was jarred to potentially relevant issues. The responses for how many times per week the older adults participate in physical activity were very reliable. However, the responses to how many minutes of physical activity was engaged in per those physically active days were less reliable. Based on feedback from participants and clarifications asked of the research assistant, the participants often indicated slight changes in their physical activity routines between the week prior to visit one and the subsequent week (visit two); and this often led to difficulty in understanding what to report and may have impacted the variability of the responses. Of the declaration options, the only option with substantial agreement was “*I answered NO to all questions*”. The remainder of the questions demonstrated slight to moderate agreement between the two test sessions. This may have been influenced by the unfamiliarity of the terms used in the questions (for example QEP), the number of and detail of the options, and some indication from feedback that the “*Check All That Apply*” instruction was often missed. In addition,

312 because a significant percentage of the present sample was already active, they may have had difficulty in
313 completing this section.

314 The validity of physical activity screening tools is based on its accuracy in 'screening in' low risk
315 individuals and 'screening-out' high risk individuals. The present stress testing protocol allowed for the
316 objective validation of two of the "*Prepare to Become More Active*" items, namely 1A and 1B. Again, for the
317 item "*A diagnosis of heart disease or stroke, or pain/discomfort/pressure in your chest during activities of daily*
318 *living or during physical activity?*", sensitivity could not be calculated due to small numbers. However, the false
319 negative probability would suggest that this GAQ item did not correlate with individuals who experienced chest
320 pain during the graded treadmill stress test. However, it should be noted that it is possible that the stress test
321 identified a previously undiagnosed condition and the self-reported chest pain may have not been related to
322 cardiovascular disease (for example, musculoskeletal chest wall pain). Alternatively, the specificity was high for
323 this item. The validity of GAQ blood pressure question had low validity; that is the self-reporting of high blood
324 pressure was in conflict with the objective measures taken during the stress test (i.e. low sensitivity). The
325 participant responses may have been influenced by the common issue related to self-identification to the
326 presence of a chronic disease which is being treated with medication. That is, if the medication normalizes
327 blood pressure, some participants may have checked "No"; but the objective criteria included blood pressure
328 medications as an indication of having high blood pressure. It is also unknown if this sample properly
329 understood the second option of the questions, that is, "and/or a resting blood pressure of >160mmHg or
330 greater".

331 The GAQ is intended to prospectively assign physical activity participants to risk levels (that is,
332 appropriately 'screen-in' / 'screen out'). In the present sample (with responses by relatively healthy older
333 adults), the self-completion of the GAQ had poor risk assessment sensitivity when compared with the treadmill
334 stress test. This was supported by a poor positive predictive value and poor false negative probability.
335 However, consistent with reliability and item validity, the GAQ had good risk assessment specificity. Part of the
336 impetus for the development of GAQ was the issue of false positives with previous physical activity screening

337 tools (Cardinal et al., 1996). In a relatively healthy older adult sample completing the GAQ in the present
338 investigation, the false positives were low- however, the false negatives were high. These results should be
339 considered in light of the relatively low rates of high risk participants in the sample. In addition, the results are
340 dependent on our criteria for ‘screen in and out’; largely influenced by the declaration questions, which did not
341 have strong psychometric properties in this population. The authors report no conflicts of interest associated
342 with this manuscript.

343 **Conclusions**

344 The GAQ reduced false positive findings in an active, community-dwelling older adult population.
345 Unfortunately, the present sample had a high rate of false negative results. Although the GAQ ‘screens in’
346 many older adults to safely proceed and participate in physical activity, it does not ‘screen out’ individuals with
347 the same accuracy as the gold-standard stress test. Next steps include: obtaining a larger sample of older
348 adults, excluding questions identified as challenging or without a corresponding question in the standard stress
349 test data collection form, or changing the format of the GAQ. As well, long term data collection post-
350 questionnaire completion of those ‘screened in’ by the GAQ could provide evidence that may contribute to the
351 understanding of the practical and real-world impact the GAQ has in an older adult population.

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431 Table 1. Test-retest Reliability of the “Assess Your Current Physical Activity” Questions

Question	N	ICC (95% Confidence Interval)	P value
Days/Wk ^a	107	0.81 (0.73 to 0.87); almost perfect	p<0.001
Min/Day ^a	108	0.51 (0.37 to 0.64); moderate agreement	p<0.001
Min/Wk ^a	107	0.64 (0.51 to 0.74); substantial agreement	p<0.001

432 ICC = intraclass correlation coefficient**433** ^aRefers to at least moderate-intensity aerobic physical activity**434****435****436****437****438****439****440****441****442****443****444****445****446****447****448****449****450****451****452**

453 **Table 2. Stress-Test Derived Screening**

	Stress-Test Derived Screening		
Self-screen via GAQ	+ (Screen OUT)	- (Screen IN)	
+(Screen OUT)	a	b	a+b
-(Screen IN)	c	d	c+d
	a+c	b+d	N

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1. **Sensitivity (SN):** Calculated as $a / (a + c)$. This value answers the question: “When GAQ is truly positive (i.e., stress test = ‘Screen out’), how often does the GAQ detect this?”

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2. **Specificity (SP):** Calculated as $d / (b + d)$. This value answers the question: “When a stress test is truly negative (i.e., stress test = ‘Screen in’), how often does the GAQ detect this?”

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3. **Positive Predictive Value (PPV):** Calculated as $a / (a + b)$. This value answers the question: “If the result of the GAQ screen is positive (i.e., ‘Screen out’), how likely is it that the person would actually screen positive (i.e. ‘Screen out’) via the stress test?” Note: this depends on SN, SP and on the prevalence of the outcome of interest (i.e., stress test screen out) and low prevalence will lead to a poorer PPV.

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4. **Negative Predictive Value (NPV):** Calculated as $d / (c + d)$. This value answers the question: “If the result of a GAQ screen is negative (i.e., ‘Screen in’), how likely is it that the person would actually screen negative (i.e., ‘Screen in’) via the stress test?”

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5. **False positive probability:** Calculated as $b / (b + d)$ and defined as the proportion of true negative responders that have a positive test result for the GAQ.

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6. **False negative probability:** Calculated as $c / (a + c)$ and defined as the proportion of true positive responders that have a negative test result for the GAQ.

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7. **Accuracy or correct classification rate:** Calculated as $(a + d) / \text{Total } N$ and defined as the proportion of observations for which the stress test results and actual response on the GAQ agree.

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473 Table 3. Subject Characteristics

Variables	n	Mean $\pm$ SD
Sex		
Male	58 (52%)	
Female	54 (48%)	
Age		75 $\pm$ 7 years
50-54	0	
55-59	2 (2%)	
60-64	4 (4%)	
65-69	15 (13%)	
70-74	36 (32%)	
75-79	27 (24%)	
80-84	16 (14%)	
85-89	8 (7%)	
90+	4 (4%)	
BMI	111	26.5 $\pm$ 3.9kg/m ²
Currently Exercising (Self-report)		
Yes	105 (94%)	
No	6 (6%)	
Current Smoker		
Yes	6 (6%)	
No	99 (94%)	
Self-Reported Health Conditions		
High Cholesterol		
Yes	49 (44%)	
No	62 (56%)	
High Blood Pressure		
Yes	42 (38%)	
No	69 (62%)	
Heart Problems		
Yes	7 (6%)	
No	103 (94%)	
Type II Diabetes		
Yes	8 (7%)	
No	103 (93%)	
Lung Problems		
Yes	11 (10%)	
No	100 (90%)	
Joint Problems		
Yes	39 (35%)	
No	71 (65%)	
MoCA (/30)	98	26 $\pm$ 3
MMSE (/30)	100	29 $\pm$ 1

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476 Table 4. Test-retest Reliability of the “Prepare to Become More Active” Questions^a

Question	N	Frequency (visit 1) “No”	Frequency (visit 1) “Yes”	Kappa (95% Confidence Interval)	P value
1a	109	103	6	0.75 (0.49 to 1.00); substantial agreement	p<0.001
1b	108	96	12	0.70 (0.47 to 0.92); substantial agreement	p<0.001
1c	110	98	12	0.76 (0.55 to 0.96); substantial agreement	p<0.001
1d	109	104	5	0.32 (-0.16 to 0.80); fair agreement	p= 0.046
1e	109	106	3	0.49 (-0.11 to 1.00); fair agreement	p= 0.03
1f	109	108	1	--	--
2	108	90	18	0.72 (0.54 to 0.90); substantial agreement	p<0.001
3	110	103	7	0.64 (0.35 to 0.93); substantial agreement	p<0.001
4	108	99	9	0.76 (0.53 to 0.99); substantial agreement	p<0.001

^aFrom page 1 of the GAQ

488 Table 5. Test-retest Reliability of the “Declaration” Questions

Question	N	Frequency (Visit 1)		Kappa (95% Confidence Interval)	P value
		Not Checked	Checked		
1 ^a	107	54	53	0.61 (0.46 to 0.76); substantial agreement	p<0.001
2 ^b	107	85	22	0.35 (0.14 to 0.57); fair agreement	p<0.001
3 ^c	107	83	24	0.45 (0.24 to 0.67); moderate agreement	p<0.001
4 ^d	107	25	82	0.16 (-0.04 to 0.36); slight agreement	p=0.12
5 ^e	107	89	18	0.23 (-0.01 to 0.47); fair agreement	p = 0.03

489 ^a “I answered NO to all questions”**490** ^b “I answered YES to any question and I have consulted a HCP and/or QEP who has recommended that I**491** become more physically active”**492** ^c “I answered YES to any question and I have not consulted a HCP and/or QEP about becoming more physically**493** active”**494** ^d “I am comfortable with becoming more physically active on my own without consulting a HCP or QEP”**495** ^e “I would like to consult a QEP about becoming more physically active”**496****497****498****499****500****501****502****503****504**

505 **Table 6. Test-retest Reliability of the “Reference Document” Questions**

Question	N	Frequency (Visit 1)		Kappa (95% Confidence Interval)	P value
		Not Checked	Checked		
1a	108	103	5	0.90 (0.72 to 1.00); almost perfect	p<0.001
1b	108	98	10	0.73 (0.48 to 0.98); substantial agreement	p<0.001
1c	108	99	9	0.87 (0.68 to 1.00); almost perfect	p<0.001
1d	108	104	4	--	--
1e	108	107	1	1.0 (1.0 to 1.0); perfect agreement	p = 0.01
1f	108	108	0	--	--
2	105	88	17	0.61 (0.39 to 0.83); substantial agreement	p<0.001
3	105	98	7	0.64 (0.35 to 0.93); substantial agreement	p<0.001
4	105	97	8	0.46 (0.14 to 0.78); moderate agreement	p<0.001

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508 Table 7. Risk Assignment for Self- and Objective Screening for Physical Activity

Self-screening for PA	Stress Test Screening for PA		
Frequency	Screen OUT	Screen IN	Total
Row Pct	(No PA)	(Yes PA)	
Col Pct	+	-	
Screen OUT (No PA)	1**	5	6
	16.67‡	83.33	5.50
+	5.56*	5.49	
	a (TP)	b (FP)	
Screen IN (Yes PA)	17	86**	103
	16.50	83.50§	94.50
-	94.44¶	94.51†	
	c (FN)	d (TN)	
Total	18	91	109**
	16.51	83.49	100.00
Frequency Missing = 3			

509**510** Notes:**511** TP = True positives; FP = False Positives; FN = False Negatives; TN = True Negatives.**512** *Sensitivity (SN) = $a / (a + c)$ **513** †Specificity (SP) = $d / (b + d)$ **514** ‡Positive Predictive Value (PPV) = $a / (a + b)$ **515** §Negative Predictive Value (NPV): = $d / (c + d)$ **516** || False positive probability = $b / (b + d)$ **517** ¶False negative probability = $c / (a + c)$ **518** ** Accuracy/correct classification rate = $(a + d) / N$ **519**

520 Table 8. List of Reasons for Objective Screen-outs

Reason for Screen Out	n*
Stress Test Impressions	8
Reason for stopping stress test: Light-headedness/Dizziness	1
Reason for stopping stress test: Chest Pain	1
Reported heart problems (i.e., Chest Pain/Tightness/Angina)	7
Hypotension (SBP<100 and/or DBP <60 mmHg via any measurements during stress test)	4

521 *Combined numbers are greater than the total number of objective screen-outs (n=19) because some
522 individuals had more than one of the above reasons per why they were classified as an objective screen-out.

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536 Table 9a. Item Validity for Question 1A “A diagnosis of heart disease or stroke, or pain/discomfort/pressure
537 in your chest during activities of daily living or during physical activity?”

Q1A0(GAQ-Dx of CVD or stroke OR chest pain/discomfort/pressure (past 6 months)	Chest pain -Reason for Stopping Stress Test		
Frequency	Yes +	No -	Total
Row Pct			
Col Pct			
Yes	0 0.00	5 100.00	5 4.81
+	0.00 <i>a (TP)</i>	4.85† <i>b (FP)</i>	
No	1 1.01	98 98.99†	99 95.19
-	100.00§ <i>c (FN)</i>	95.15* <i>d (TN)</i>	
Total	1 0.96	103 99.04	104 100.00
Frequency Missing = 8			

538 Notes:

539 TP = True positives; FP = False Positives; FN = False Negatives; TN = True Negatives.

540 *Specificity (SP) = $d / (b + d)$

541 †Negative Predictive Value (NPV): = $d / (c + d)$

542 ‡False positive probability = $b / (b + d)$

543 §False negative probability = $c / (a + c)$

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551 Table 9b. Item Validation for Q1B “A diagnosis of high blood pressure (BP) and/or a resting BP of 160/90
552 mmHg or higher?”

Q1B(GAQ-T0:Dx high BP/rest BP ≥160/90(past 6 mo))	Stress T Derived - High BP (≥ 160/90 mmHg resting measured OR on BP meds)		
Frequency	Yes +	No -	Total
Row Pct			
Col Pct			
Yes	8 66.67‡	4 33.33	12 11.01
+	17.78* a (TP)	6.25 b (FP)	
No	37 38.14	60 61.86§	97 88.99
-	82.22¶ c (FN)	93.75† d (TN)	
Total	45 41.28	64 58.72	109 100.00
Frequency Missing = 3			

553

554 Notes:

555 TP = True positives; FP = False Positives; FN = False Negatives; TN = True Negatives.

556 *Sensitivity (SN) = a / (a + c)

557 †Specificity (SP) = d / (b + d)

558 ‡Positive Predictive Value (PPV) = a / (a + b)

559 §Negative Predictive Value (NPV): = d / (c + d)

560 || False positive probability = b / (b + d)

561 ¶False negative probability = c / (a + c)

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