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# Treadmill Measured vs. Questionnaire Estimated Changes in Walking Ability in Patients With Peripheral Artery Disease

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► **To cite this version:**

Samir Henni, Myriam Ammi, Yves Semporé, Jeanne Hersant, Geoffrey Zegar, et al.. Treadmill Measured vs. Questionnaire Estimated Changes in Walking Ability in Patients With Peripheral Artery Disease. *European Journal of Vascular and Endovascular Surgery*, 2019, 57 (5), pp.676-684. 10.1016/j.ejvs.2018.11.015 . hal-02616931

**HAL Id: hal-02616931**

**<https://univ-angers.hal.science/hal-02616931>**

Submitted on 22 Oct 2021

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1 **Treadmill-measured versus questionnaire-estimated changes in walking ability in patients**  
2 **with peripheral artery disease**

3

4 **ARTICLE CATEGORY:** Original article

5 **SHORT TITLE:** WELCH vs. treadmill changes in walking impairment

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17 **Word Count:** 4110 (including the 25 references) + 2 tables + 5 figures.

18 **WHAT THIS STUDY ADDS**

19 In patients with peripheral artery disease, the Walking Estimated-Limitation Calculated by  
20 History (WELCH) questionnaire score correlates with the treadmill maximal walking time. The  
21 changes in WELCH score tend to decrease more than the objective changes in walking  
22 impairment, particularly with a longer a test-retest interval. After revascularisation, a short-lived  
23 “honeymoon” (overestimation of the objectively measured change on the treadmill) is observed.  
24 For long test-retest intervals, self-reported worsening according to the WELCH score should  
25 probably be confirmed on the treadmill before a decision to revascularise is taken. Whether other  
26 questionnaires estimating walking impairment face the same issue remains to be determined.

27

28 **ABSTRACT**

29 **Introduction:** Determining the maximal walking time (MWT) using the treadmill test is the  
30 gold-standard method for evaluating walking capacity and treatment effect in patients with  
31 peripheral arterial disease (PAD). However, self-reported functional disability is important when  
32 assessing the quality of life. We compared changes in the Walking Estimated Limitation  
33 Calculated by History (WELCH) questionnaire scores with the MWT.

34 **Methods:** A transversal study was performed among patients with intermittent claudication. The  
35 treadmill test (3.2 km/h; 10% grade) and WELCH questionnaire were administered to all patients  
36 for objective evaluation of walking capacity. Given the log-normal distribution of these  
37 parameters in PAD patients, a log transformation was applied to the WELCH score (LnW) and  
38 maximal walking time (LnT). The responsiveness of the WELCH score was determined using  
39 mean changes and correlation coefficients of LnW and LnT changes. The effect of time on the  
40 “Estimated minus Real” (E-R) changes (LnW-change minus LnT-change) was assessed after  
41 categorization of patients into various test–retest intervals. Patients who underwent lower-limb  
42 revascularisation between the two tests and those who underwent medical treatment only were  
43 analysed.

44 **Results:** Correlation coefficients between LnW and LnT for tests 1 and 2 were  $r = 0.514$  and  $r =$   
45  $0.503$ , respectively ( $P < 0.001$ , for both). Correlation for LnW-change vs. LnT-change was  $0.384$   
46 ( $P < 0.001$ ). E-R was positive only early after surgery. E-R was negative for all test–retest  
47 intervals  $>1$  year in revascularised and non-revascularised patients.

48 **Conclusions:** Changes in WELCH scores correlated with changes observed on the treadmill in  
49 patients with intermittent claudication. For long test-retest intervals, WELCH changes tended to

50 overestimate the worsening of walking impairment as compared with the measured difference  
51 observed in both revascularised and non-revascularised patients. A short-lived “honeymoon”  
52 (overestimation of the benefit for the shortest test-retest interval) was observed only in  
53 revascularised patients.

54 **KEYWORDS:** Peripheral artery disease; Walking impairment; Treadmill test; Questionnaire;  
55 Revascularisation

56

57 **INTRODUCTION**

58 Estimation of walking impairment through standard questionnaires is easy, can be routinely  
59 performed and scored, and is of major interest in patients with peripheral artery disease (PAD)  
60 and claudication.<sup>1</sup> Questionnaire scores are generally validated against different objective  
61 measurements of walking ability.<sup>2-4</sup> The effect of time between the two evaluations, specifically  
62 from the lower-limb revascularisation procedure upon the concordance of subjective to objective  
63 changes, has not been analysed. The “walking estimated limitation calculated by history”  
64 (WELCH) questionnaire<sup>5</sup> is a relatively simple tool to self-report walking limitations in PAD. It  
65 can be self-administered and compares favourably with previously proposed available tools.<sup>2,6</sup> It  
66 is currently available in different languages and is easy to use in routine practice.<sup>7-9</sup> Correlation of  
67 between the WELCH score and objective measures of walking capacity ranges from 0.58 to  
68 0.82,<sup>6,8,9</sup> and it is not impaired by age.<sup>2</sup> To date, the reliability and sensitivity to changes of the  
69 WELCH have not been studied extensively. The effect of the test-retest interval on WELCH  
70 changes compared with the changes in treadmill measured maximal walking time (MWT) is  
71 unknown.

72 This study determined whether the WELCH questionnaire was sensitive to changes in walking  
73 capacity and how the WELCH score changes compared with objectively measured MWT  
74 changes. Next, we aimed to determine whether the relationship between WELCH and MWT  
75 changes varied with the test-retest interval and if there was a difference between the two tests in  
76 patients that did not undergo revascularisation between the two estimates (medical treatment  
77 only) and in those subjected to arterial lower-limb revascularisation.

78 **MATERIALS AND METHODS**

79 A transversal study was performed among patients referred to our laboratory for walking  
80 test investigations. Most patients when primarily referred to us complained of claudication for  
81 months and most had previously benefited from optimal medical treatment for PAD. Retest visits  
82 were either based on the evaluation of residual limb or non-limb symptoms or sometimes on the  
83 surgeon's request for an objective evaluation of functional improvement. Eligibility included:  
84 age > 18 years, the ability to walk on a treadmill, the ability to understand the study goals and  
85 instructions of the tests, and self-completed questionnaires. The study was approved by the  
86 Institutional Review Board and was registered on CNIL (*Commission Nationale Informatique et*  
87 *Liberté*). It was performed according to the International Ethics Standards and conforms to the  
88 Helsinki Declaration. Patients were aware that the results were being recorded during treadmill  
89 tests and that this investigation could be used for research purposes and were informed of their  
90 right to oppose. All investigators participating in the study were informed on how to perform the  
91 investigations, complete the files, and score the questionnaires. The study was registered with  
92 ClinicalTrials.gov Identifier: NCT01424020.

### 93 **Completion of questionnaires**

94 Each patient was provided a pen and reading glasses (if needed) and received oral instructions for  
95 completing the questionnaire on arrival at the laboratory. Each patient self-completed the  
96 questionnaires while in the waiting room of the laboratory before the walking test was performed.  
97 The questionnaire included: date of the visit, history and on-going treatments, name and surname,  
98 age, sex, body weight, stature, active smoking, and the WELCH in French. The WELCH is a  
99 four-item questionnaire that can be self-administered. The original questionnaire was developed  
100 in French but is currently available in various languages. In brief, the first three items refer to the  
101 maximal time that can be sustained when walking at different walking speeds. Answers to each

102 item include proposals ranging from impossible (zero points) to 3 hours or more (7 points). The  
103 fourth and last item requires the patient to estimate his/her usual walking speed as compared to  
104 that of his/her siblings or of people of comparable age. Possible answers ranged from “much  
105 slower” (coefficient = 1) to “faster” (coefficient = 5). The WELCH score was calculated as  
106 follows. One is subtracted from the sum of the points of the three first items. The result of this  
107 subtraction was multiplied by the coefficient of item four. Assuming that patients can walk at  
108 least 30 seconds at a low speed, the final score ranges from zero (severe disability) to 100 (ability  
109 to walk faster than other people for at least 3 hours). Note that patients were never reminded of  
110 their answers to the previously completed WELCH questionnaires or their previous walking  
111 distance on the treadmill. A typical example of filling of the WELCH questionnaire is provided  
112 in Fig. 1.

### 113 **Clinical data and investigations**

114 Patients were admitted to the test room and their usual walking speed was measured between two  
115 lines drawn on the floor separated by 10 meters, which were traced on the floor between the  
116 waiting room and the testing room. As in our previous studies, patients unable to walk 10 m in  
117 less than 15 seconds were considered unable to walk 3.2 km/h on the treadmill and underwent a  
118 specific protocol on the treadmill;<sup>10</sup> they were excluded from the study. Technicians, nurses, or  
119 physicians supervised the completion of the questionnaires and completed any eventual  
120 incomplete items or clinical characteristics from the patient’s most recent file or by immediate  
121 measurement. We systematically recorded the WELCH score, presence/absence of lower limb  
122 revascularisation (bypass surgery or angioplasty) in the past or since the first visit for returning  
123 patients, age, sex, body weight, stature, and the ankle to brachial systolic pressure index (ABI).



124 Last, we retrieved the type of revascularization for the revascularised patients from their medical  
125 file or from contact with the surgeon (from patients referred from private practice physicians).

126

### 127 **Treadmill test**

128 To assess walking capacity, all patients performed a standardised constant load treadmill test  
129 under medical supervision, at a constant speed of 3.2 km/h, at a 10% incline progressively  
130 reached in 1 minute. For patients who were able to walk 15 minutes (900 sec) at a constant  
131 workload, at minute 15, the protocol was changed to an incremental load protocol with steps of 1-  
132 minute duration until exhaustion or pain limitation.<sup>11</sup> The treadmill tests were performed by 12-  
133 lead ECG monitoring. The test variable used during the treadmill test was the MWT, defined as  
134 the time that severe claudication pain forced cessation of exercise or as the time that the test was  
135 interrupted for medical reasons (severe cardiac arrhythmia, abnormal repolarization, etc.).

### 136 **Data analysis**

137 From the laboratory database, patients who had undergone at least two different consecutive tests  
138 were selected. For patients who had performed multiple tests, only the last two visits were  
139 analysed because of data accessibility. We previously reported that in patients with limiting  
140 claudication both MWTs treadmill constant load tests<sup>12</sup> and WELCH scores<sup>6</sup> show a log-normal  
141 distribution in PAD patients complaining of exertional limb pain. Subsequently, the MWT and  
142 WELCH scores were log-transformed for analysis and were referred to as LnT and LnW,  
143 respectively. Changes in MWT and WELCH scores were calculated as the difference in the LnT  
144 or LnW determined in the second test from the respective LnT and LnW determined at the first

145 visit and were analysed for the whole population. From previous studies, we estimated the  
146 Spearman “ $r$ ” coefficients of the correlation between LnT and LnW changes to be .30. This was  
147 determined from previous studies, which showed the correlation of the walking impairment  
148 questionnaire score to maximal walking distance was .33,<sup>4</sup> and because the correlation of the  
149 WELCH score and treadmill MWT was found to range from .58–.61;<sup>6</sup> thus, the resulting  
150 estimation of the correlation to be expected for WELCH and MWT changes was the square of the  
151 “ $r$ ” correlation values: .34–.37. For the alpha two-tailed .05 and 80% power, the minimal  
152 observation number was 85.

153 Thereafter, patients were divided into two groups: patients who underwent medical treatment  
154 only between their two tests (non-revascularised group) and patients who had some form of lower  
155 limb revascularisation between their two tests (S group). In each group, time intervals were  
156 categorized into six test-retest intervals as follows: test-retest intervals ranging from 0 to <6 m, 6  
157 m to <12 m, 1 to <2 y, 2 to <3 y, 3 to <4 y, and 4 y or more. For each test-retest interval, the  
158 median duration of the test-retest interval was recorded. Within each interval, the mean and SEM  
159 of the difference between LnW-changes and LnT-changes was calculated. This difference was  
160 noted as E-R. In practice, E-R was assumed to reflect overestimation of the benefit or  
161 underestimation of the impairment (positive difference) or inverse underestimation of the benefit  
162 or overestimation of the impairment (negative difference) of the subjective estimation of walking  
163 impairment evolution (WELCH questionnaire) as compared to the “real” objective evolution in  
164 the MWT between the two visits. We performed a database analysis, on the observation of at  
165 least six non-revascularised and revascularised patients, in each test-retest interval.

## 166 **Statistical analysis**

167 Results are presented as mean±SEM when normally distributed, as median [25°–75° centiles]  
168 when appropriate, and as percentages. The unpaired t-test, Mann-Whitney test, and Chi-squared  
169 test were used to compare non-revascularised and revascularised patients. ANOVA with  
170 Dunnett’s post-hoc test was used to compare patients within different test-retest intervals with  
171 patients with the shortest (0 to <6 m) interval. Two-tailed paired t-tests were used for LnT and  
172 LnW to compare results of the first and second test, respectively. Correlation of the LnW-  
173 changes to LnT-changes was analysed for the whole population. Non-linear logarithmic models  
174 were chosen as apparent models that best fitted the values observed for mean E-R for the 6 test-  
175 retest intervals in non-revascularised and revascularised patients, respectively. Statistical analyses  
176 were performed using SPSS V15.0 (SPSS Inc. LEADTOOLS®, LEAD Technology Inc.). For all  
177 tests, a two-tailed p-value <.05 was used to indicate statistical significance.

178

## 179 **RESULTS**

180 This study included 346 consecutive patients with a mean age of 61.9 years; 87% were men. A  
181 flowchart of recruitment is presented in Fig. 2. Baseline characteristics of the study population  
182 are presented in Table 1. Among revascularised patients, 52 had an aortic and/or iliac  
183 angioplasty, 31 femoral and/or popliteal angioplasty, 14 aortic and/or iliac bypass surgery, and 12  
184 a femoral and/or popliteal bypass surgery between their two tests. No significant difference was  
185 found between non-revascularised and revascularised patients relative to morphology or  
186 treatments. However, at baseline, both PAD (lower ABI) and walking impairment were more  
187 severe (lower WELCH score and lower maximal walking time on treadmill) in revascularised  
188 than in non-revascularised patients. The WELSH scores of the 346 patients were 20 (10-33) vs.

189 22 (10-39) Wilcoxon  $P = 0.27$ , based on the first and second test, respectively. Table 2 reports the  
190 major characteristics of the revascularised and non-revascularised patients as a function of test-  
191 retest interval.

192 No complications were noted during the walking test, although 153 (44.2%) and 149 (43.1%) of  
193 patients reported dyspnoea, fatigue, or chest pain during tests one and two, respectively. Fifty-  
194 nine of the patients studied at test 1 and 94 of the patients studied on test 2 reached the  
195 incremental phase of the treadmill test (MWT >900 s).

196 The correlation coefficient between LnW and LnT was  $r = .514$  in test 1 and  $r = .503$  in test 2,  
197 respectively ( $p < .01$  for both) (Fig. 3). The correlation for LnW-change vs. LnT-change was .384  
198 ( $p < .01$ ).

199 The LnW and LnT values observed for the six test-retest intervals are shown in Fig. 4. On  
200 average, the revascularised patients showed an increase in walking time (LnT was 0.65 for the  
201 shortest Test-retest interval and 0.58 for the largest test-retest interval) after revascularisation,  
202 while the non-revascularised patients had minimal, if any, increase in walking time between their  
203 tests, irrelevant of the test-retest interval (LnT being slightly above or close to zero). Of note, in  
204 most patients, the first evaluation was performed while medical treatment was optimal and not  
205 when the diagnosis of PAD was determined. Therefore, non-revascularised patients generally  
206 presented stable, previously diagnosed, claudication. Only 18 patients were evaluated during the  
207 first test before the onset of medical therapy (start of antiplatelet and/or cholesterol lowering  
208 drugs) or before referral to a rehabilitation program. Furthermore, the change in self-reported  
209 evaluation of walking capacity (through the change in WELCH score) decreased with an increase  
210 in the test-retest interval. LnT started from 0.99 and decreased to  $-0.02$  in revascularised patients

211 and decreased from 0.01 to  $-0.53$  in non-revascularised patients. As a result, the E-R difference  
212 (Fig. 5) was negative in all except one case and roughly decreased with an increase in the test-  
213 retest intervals. The only exception was for the shortest interval corresponding to the pre- and  
214 early post-revascularisation estimation in the non-revascularised group. This was the only group  
215 where the subjective estimation of changes by the patients (LnW of the Welch score) was, on  
216 average, higher than the objective measurement of changes (LnT of the MWT on the treadmill).  
217 Note that the SEM of the 2–3-year interval was large given the limited number of observations ( $n$   
218 = 6).

219

## 220 **DISCUSSION**

221 The present study aimed to determine whether the WELCH questionnaire is sensitive to changes  
222 in walking capacity and how the WELCH score changes compared with objectively measured  
223 changes maximal walking time. We show that the WELCH score is as consistent in objective  
224 measurements as other more complex tools and is an easy-to-use instrument that can determine  
225 changes in the walking capacity of patients with PAD. The correlation coefficient that we  
226 identified ( $r = .38$ ) may appear low; however, it is higher than the objective and subjective  
227 instruments of other studies. A previous study that assessed the effect of an intervention and  
228 observed a larger range of change found a correlation of changes in the treadmill distance with  
229 changes in the distance sub-scores of the walking impairment questionnaire ranging from  $r = .31$   
230 to  $r = .34$ .<sup>13, 14</sup> Comparable results were reported with Short-form-36 physical summary score  
231 changes of  $r = .29$  or using the intermittent claudication questionnaire changes of  $0.38$ .<sup>13, 14</sup>

232 The original observation of the effect of interval duration on the relationship between WELCH  
233 and MWT changes in non-revascularised and patients is of specific importance. The non-  
234 revascularised patients showed no major differences in walking capacity (change in LnT close to  
235 zero) for the various time intervals, while changes in LnT were  $>0$  for all test-retest intervals in  
236 non-revascularised patients. While the shortest test-retest LnW interval was also close to zero,  
237 LnW decreased with longer test-retest intervals. Thus, the E-R decreased with the increase in the  
238 test-retest interval. We previously demonstrated that the WELCH was independent of age and our  
239 largest interval was only five years. Depression and anxiety are frequent symptoms in  
240 cardiovascular patients.<sup>15-17</sup> Whether mood changes could explain our results for long test-retest  
241 intervals remains to be determined. Overall, determining whether self-reported or treadmill-  
242 measured changes should prevail in the decision to revascularise a PAD patient is an open debate.

243 Another interesting observation is the initial transient overestimation (positive E-R) in  
244 revascularised patients. Conversely, “overestimation of the benefit” in revascularised patients  
245 could result from fear of a negative outcome before arterial revascularisation.<sup>18</sup> However, it is  
246 well known that initial excellent results one year after lower limb arterial revascularisation  
247 progressively worsen with time.<sup>19</sup> Subsequently, many patients become symptomatic again on a  
248 mid-term and long-term basis after arterial revascularisation, facing the same issues of chronic  
249 pain and disease as non-revascularised patients. Nonetheless, the positive E-R phenomenon is a  
250 short-lived honeymoon.

251 Determining the changes in walking ability and evolution of walking impairment in patients with  
252 PAD is of major importance in clinical routine trials and research trials. Laboratory investigations  
253 (among which treadmill testing is the recommended “gold standard”), are time consuming, and  
254 are not necessarily accessible to physicians in routine clinical settings. Furthermore, results are

255 influenced by the protocols used and may not optimally reflect overall walking impairment.

256 Although subjective, questionnaires are of interest when accounting for the perceived impact of

257 PAD in a patient's life. Various disease-specific or non-disease-specific tools are available. The

258 "walking impairment questionnaire", the "intermittent claudication questionnaire", the

259 "claudication scale", and the « vascular quality of life" questionnaires are generally considered

260 specific for patients with PAD.<sup>13, 20-22</sup> These questionnaires are long and impractical, with each

261 including >14 items. A shorter version of the original 25-item the « vascular quality of life" is

262 available, but it focuses on the impact of walking impairment on usual activities, rather than on

263 the severity of walking impairment itself.<sup>23</sup> Among these tools, the walking impairment

264 questionnaire is the most widely used tool with >150 references from a Medline search.

265 Unfortunately, the questionnaire is lengthy, subject to errors when self-completed, and cannot be

266 scored simply by mental calculations.<sup>24, 25</sup>

267 The fact that studied groups included different patients may represent an issue, with small clinical

268 differences between the groups. A prospective study with repeated measurements would be a

269 better approach; nevertheless, the feasibility of a prospective approach over a 4-year period is

270 tentative due to technical and financial reasons. In this transversal observational study, no

271 predefined visits were proposed according to a predefined interval to the patients. Thus, there

272 may be a bias with patients referred to us for multiple tests that are not comparable to general

273 PAD patients. A second issue involves the interval between tests that may slightly differ from the

274 interval between revascularisation and the second visit in the revascularised group. This is only

275 true for the largest test-retest interval because for the shortest intervals, the first visit generally

276 preceded the revascularisation by approximately a few weeks. A third limitation is that we did

277 not account for co-morbid conditions that may have occurred (or become exacerbated) between

278 the interval of the two tests because the data submitted for analysis focused only on vascular  
279 diseases. It cannot be excluded that the self-reported limitation could be influenced by an  
280 underlying cause (vascular vs. non-vascular) of the walking impairment. To date, the WELCH  
281 survey has not been tested in non-vascular populations. Obviously, the difference in self-reported  
282 and measured changes observed with test-retest interval in the revascularised group could also  
283 depend on a deterioration of the revascularisation with time in successful vs. unsuccessful  
284 revascularisation procedures. Unfortunately, we did not have access to primary patency of  
285 revascularisation. Of interest is the fact that the MWT difference between test 2 and test 1  
286 remained positive for revascularised patients, while the WELCH score difference was indeed  
287 positive for short test-retest intervals but decreased with larger intervals (Fig. 4). Furthermore, the  
288 time evolution in the self-reported vs. measured changes observed in the non-revascularised  
289 patients (Fig. 5) was similar to that of the revascularised patients, despite apparently comparable  
290 ABIs for the non-revascularised groups. Thus, it appears that the evolutions of differences in  
291 changes are unrelated to haemodynamic changes

292

## 293 **CONCLUSION**

294 The WELCH questionnaire is a valid tool to detect changes in the daily walking ability of  
295 patients with intermittent claudication. The self-reported WELCH score tends to decrease more  
296 than an objective measurement of walking impairment, especially if the test-retest interval is  
297 long. After revascularisation, a short-lived “honeymoon” (overestimation of the objectively  
298 measured change on the treadmill) may be observed. This honeymoon appears to last <1 year,



299 after which revascularised patients follow the same evolution as non-revascularised patients for  
300 large test-retest intervals.

301 In PAD patients, a self-reported worsening identified using the WELCH score during two  
302 consecutive visits >1 year apart should probably be systematically confirmed on a treadmill,  
303 before a decision to revascularise is taken. Whether other questionnaires aiming at estimating  
304 walking impairment face the same issue remains to be determined.

305

306 **Declaration of interest:** None

307 **Funding:** None

308 **Acknowledgments and Authors' contributions:** The authors thank Editage® for grammar and  
309 style reviewing. SH, PA, ASG collected the data, PA, SH conducted the analysis, wrote the draft  
310 of the paper. All authors reviewed results of the statistical analysis, and provided final approval  
311 of the manuscript.

312

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415

416 **TABLES**

417 **Table 1.** Baseline characteristics of the study population

Study population	No revascularisation	Revascularisation	P-value
Number of subjects	237	109	-
Age, mean (SD)	61.6 (9.3)	62.5 (9.6)	.400
Men, %	86.9	87.3	.952
Body mass index, mean (SD)	27.1 (4.4)	27.1 (4.6)	.891

Antiplatelet drugs	88.3	89.8	.638
Antihypertensive drugs	75.1	69.3	.293
Cholesterol-lowering drugs	79.9	81.6	.679
Anti-diabetic agents	24.7	26.6	.734
History of previous lower limb bypass	41.2	32.0	.101
Resting ankle-brachial index, mean (SD)	0.80 (0.22)	0.73 (0.21)	.004
Current smoker, %	34.9	36.6	.762
WELCH	22 [12-36]	18 [10-28]	.005
LnW	2.98 (0.84)	2.72 (0.84)	.005
Maximal walking time (s)	324 [209-756]	213 [150-345]	.001
LnT	5.90 (0.81)	5.51 (0.66)	.001

418 Results are mean (SD: Standard deviation) or Median [25-75 centiles] or percentages; WELCH =  
419 Walking estimated limitation calculated by history; LnW = logarithmic value of WELCH score;  
420 LnT = logarithmic value of walking time on treadmill

421

422

423 **Table 2.** Major characteristics of patients in each of the test-retest intervals of non-revascularised  
 424 (medically treated) and revascularised patients. Ankle-brachial index (ABI) is the value at first  
 425 visit

	<b>Test-retest interval</b>	<b>Number of subjects</b>	<b>Age, mean</b>	<b>Men, %</b>	<b>BMI (kg/m<sup>2</sup>)</b>	<b>Ankle-brachial index</b>	<b>ABI change</b>	<b>Current smoker</b>
<b>No revascularisation</b>	0 to <6 m	47	60.0 (9.9)	74.5	26.2 (4.2)	0.78 (0.24)	0.01 (0.18)	36.2
	6 to <12 m	57	63.3 (8.5)	78.9	27.9 (4.6)	0.82 (0.20)	-0.01 (0.19)	22.9
	1 to <2 y	69	62.4 (8.9)	92.7	27.6 (4.2)	0.80 (0.24)	-0.04 (0.19)	27.5
	2 to <3 y	35	61.8 (10.7)	94.2	26.3 (4.7)	0.84 (0.19)	-0.05 (0.22)	14.3
	3 to <4 y	19	60.6 (8.5)	100	26.6 (3.8)	0.82 (0.17)	0.01 (0.15)	31.6
	4 y or more	10	56.7 (10.1)	100	26.8 (4.7)	0.68 (0.15)	-0.01 (0.14)	10.0
<b>Lower limb revascularisation</b>	0 to <6 m	34	60.5 (10.7)	76.4	26.6 (4.1)	0.68 (0.17)	0.19 (0.22)	32.4
	6 to <12 m	33	64.0 (8.5)	90.1	27.4 (4.8)	0.75 (0.20)	0.17 (0.27)	21.2
	1 to < 2 y	18	63.4 (10.0)	100	25.8 (4.7)	0.70 (0.28)	0.03 (0.21)	38.9
	2 to < 3 y	6	59.7 (8.8)	100	27.9 (4.3)	0.87 (0.24)	0.07 (0.26)	16.7
	3 to < 4 y	10	65.9 (8.1)	100	26.3 (3.1)	0.74 (0.16)	0.11 (0.12)	30.0
	4 y or more	8	64.5 (11.3)	100	30.2 (6.4)	0.83 (0.32)	0.03 (0.23)	12.5

426 *Results are expressed as mean (standard deviation (SD)) or percentage; BMI, body mass index;*  
427 *no significant change for any variable from the first group on non-revascularised and*  
428 *revascularised patients except for sex.*

429

### 430 **FIGURE LEGENDS**

431 **Fig. 1:** English version of the WELCH questionnaire with example of scoring

432 **Fig. 2:** Flowchart of database analysis and resulting study population

433 **Fig. 3:** Scatterplot of logarithmic transformed changes in WELCH score (LnW) and maximal  
434 walking time (LnT) in the first (test 1) and second (test 2) tests, in patients who received medical  
435 treatment (non-revascularised) or underwent revascularisation (revascularised) between tests one  
436 and two.

437 **Fig. 4:** Mean logarithmic transformed WELCH score (LnW) and maximal walking time (LnT)  
438 observed for the six test-retest intervals in patients who received medical treatment (non-  
439 revascularised : non-S) or revascularisation (S) between tests one and two.

440 **Fig. 5:** Changes (test 2-test 1) in logarithmic transformed WELCH scores (LnW) and maximal  
441 walking time (LnT) observed for the six test-retest intervals.  $R$  is the Spearman coefficient of  
442 correlation of the regression analysis of average LnW-changes and LnT changes. The grey zone  
443 is the “honeymoon period” during which the self-reported difference was superior to the  
444 measured difference in the treadmill test for patients with lower limb revascularisation. Each  
445 point indicates the mean and standard error of mean.

Please answer each of the following 4 items by placing an "X" in the box that best describes your situation. Please mark only one box per item. If you never perform an activity, estimate what it would be like if you did perform it. For the first 3 items, if you think that you would not be able to perform a specified task for at least 30 seconds without stopping to rest, please answer "impossible".

For each of the three following activities, how long can you perform the task easily on level ground & without stopping when ...

1/ ... walking slowly (slower than usual speed of relatives, friends, or other people of your own age)?

Impossible	30 seconds	1 minute	3 minutes	10 minutes	30 minutes	1 hour	3 hours or more
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
0	1	2	3	4	5	6	7

2/ ... walking normally (same as usual speed of relatives, friends, or other people of your own age)?

Impossible	30 seconds	1 minute	3 minutes	10 minutes	30 minutes	1 hour	3 hours or more
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
0	1	2	3	4	5	6	7

3/ ... walking quickly (faster than usual speed of relatives, friends, or other people of your own age)?

Impossible	30 seconds	1 minute	3 minutes	10 minutes	30 minutes	1 hour	3 hours or more
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
0	1	2	3	4	5	6	7

Compared to the usual walking speed of your relatives, friends, or people of your own age, do you think that you personally usually walk ... (Tick only one box)

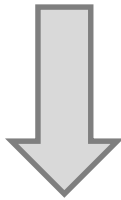
- much slower*  1
- moderately slower*  2
- a bit slower*  3
- at the same speed*  4
- faster*  5

THANK YOU: You should have 1 box per item ticked... please check.

$$\text{WELCH score} = [ (5 + 2 + 0) - 1 ] \cdot 3 = 18$$



2 054 patients  
(2 561 tests)

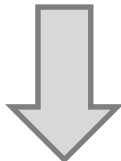


Underwent only one test

1 666 patients  
(1 666 tests)

**Multiple tests**

388 patients  
(892 tests)

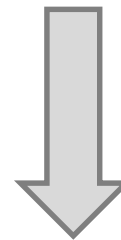


Underwent more than 2 tests

116 tests

**Only 2 tests**

388 patients  
(776 tests)



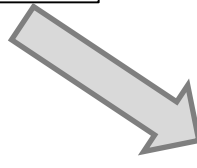
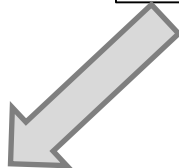
Non-standard tests or  
refusal to participate

42 patients  
(84 tests)

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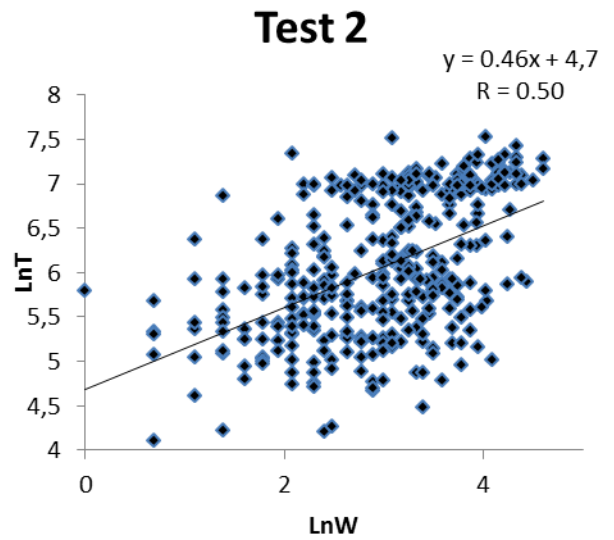
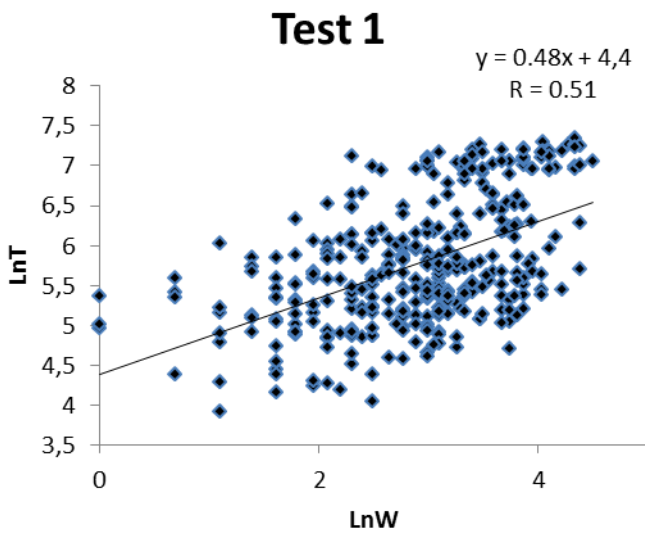
**Study population**

346 patients  
(692 tests)



No revascularisation  
N = 237

Revascularisation  
N = 109



## Difference between Test 2 and Test 1

