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Proposal for a Global Adherence Scale for Acute Conditions (GASAC): a prospective cohort study in two Emergency Departments

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Abstract

Background: Adherence in the context of patients with acute conditions is a major public health issue. It is neglected by the research community and no clinically validated generic scale exists to measure it.

Objective: To construct and validate a Global Adherence Scale usable in the context of Acute Conditions (GASAC) that takes into account adherence both to advice and to all types of prescriptions that the doctor may give. To measure adherence and to study its determinants.

Materials and method: We based the construction of the GASAC questionnaire on a theoretical model and a literature search. Then, between 2013 and 2014, we validated it in a prospective observational study in two hospital emergency departments. Patients were contacted by phone about one week after their consultation-to answer several questionnaires, including GASAC and the Girerd self-administered questionnaire about medication adherence as a control.

Results: GASAC consists of four adherence subscales: drug prescriptions; blood test/ radiography prescriptions; lifestyle advice and follow-up instructions. An analysis of the 154 sets of answers from patients showed that the GASAC drug subscale had satisfactory internal coherence (Cronbach’s alpha = 0.78) and was correlated with the Girerd score, as was GASAC as a whole ($p<0.01$). The median score was 0.93 IQR [0.78-1] for a maximum value of 1 ($n = 154$). In multivariate analysis, infection was more conducive of good adherence (cut off at ≥ 0.8 ; $n=115/154$; 74.7% [67.0-81.3]) than trauma (OR 3.69; CI [1.60-8.52]). The Doctor-Patient Communication score (OR 1.06 by score point, CI [1.02-1.10]) also influenced adherence.

Conclusions: GASAC is a generic score to measure all dimensions of adherence in emergency departments for clinical research and the evaluation of clinical practice. The level of adherence was high for acute conditions and could be further improved by good Doctor-Patient Communication.

1 Introduction

2 Adherence is an important component in the assessment of the quality of healthcare. A review of the
3 literature on the evaluation of adherence found 90 articles published in the last 10 years [1]. For the
4 World Health Organization (WHO) "Optimizing medication adherence would have more impact in
5 terms of global health than the development of new drugs [2]." Non- adherence leads to a considerable
6 waste of health resources (e.g. unnecessary hospitalizations, unused drugs) and is a cause of avoidable
7 morbidity and mortality [3,4].

8 While chronic diseases (hypertension, asthma, HIV etc.) have received much attention [2,5,6],
9 adherence following an acute condition (AC) has been relatively little studied. Most of the studies in
10 this field have been performed for a particular chronic disease and many authors mainly studied
11 adherence to drug prescriptions [7-13]. In only a few cases did they look at adherence in a broader
12 sense [4,14-16]. The most widely used scale, considered a reference in the field [17,18], the Morisky
13 score, measures drug adherence for chronic conditions [19,20]. It is sometimes criticized for its lack of
14 discrimination [21]. The Girerd adherence scale, although initially created for chronic disease, has
15 several advantages: the items that constitute it are compatible with its use in acute conditions and there
16 is a validated French version [10,11].

17 AC are the most frequent reason for consultations in both general practice [22] and Emergency
18 Departments (ED). Primary care services are overcrowded and the management of AC is becoming a
19 major public health issue [23]. The period after a consultation for an AC is one of high vulnerability for
20 patients [24]. They run the risk of further health deterioration, may suffer from a misdiagnosis [23] or
21 even experience side effects from a newly prescribed drug [24]. Immediate vital (e.g. some infections)
22 and/or long-term outcomes (eg. sequels of an ankles sprain) might possibly arise and could potentially
23 affect the prognosis [23]. In such a context, adherence to the doctor's advice and to all types of
24 prescriptions given is key to the success of any treatment [25]. Any aspects of the patient's behaviour
25 (acting upon prescriptions for X-rays and laboratory tests, respecting appointments with specialists
26 etc.) could be as important as adherence to medications, which is already spontaneously high [3,26,
27 27].

1 The notion of adherence uniquely to prescriptions for medication is insufficient [27,28]. Although
 2 some authors defined adherence “as the extent to which a patient's behaviour (in terms of taking
 3 medication, following a diet, modifying habits, or attending clinics) coincides with medical or health
 4 advice” [4], there is still no method to measure adherence that includes all aspects of a patient’s
 5 behaviour after a consultation. There lacks a standardized tool that is well adapted to clinical research
 6 [29] and assessment of health-care quality [1,17], and none suitable for the context of AC [30,31]. The
 7 question of how best to measure adherence is still open [2].

8 A generic scale would be useful to analyse the relationship of between adherence to and other
 9 outcomes such as Doctor-Patient Communication (DPC) or satisfaction, and to quantify and compare
 10 the impact of measures introduced to improve adherence, such as Patient information leaflets [30,31].

11
 12 Our objective was to create a Global Adherence Scale usable in the context of an Acute Condition
 13 (GASAC) based on a theoretical model describing the various dimensions of patient behaviour
 14 following a consultation [15] and the results of a literature search. Then, to validate it in two hospital
 15 emergency departments and analyse its determinants.

16

17 **Materials and methods**

18 **Literature search**

19 We searched the Medline database using the following Mesh terms: patient compliance, adherence
 20 AND scale, tool, assessment, measures or questionnaires, in various combinations. We also consulted
 21 the Embase and PsycInfo databases, and the Cochrane library in English.

22 Our search filter covered the period from 1985 to 2014. Only meta-analyses, randomized controlled
 23 trials, and reviews of the literature were retained. In addition we searched English (NHS) and US
 24 (Agency for Healthcare Research and Quality, AHRQ) institutional databases on quality of care
 25 assessment and books on the field. Two doctors independently screened titles and if necessary abstracts
 26 for all types of articles pertinent to adherence in the context of acute conditions. A manual search was

also conducted from the bibliographies of promising articles. Since our literature search did not find specific articles for AC, we based the elaboration of our scale on: 1/ a previously constructed theoretical model, itself based on the literature, 2/ commonly used definitions of adherence [2,4] and 3/ on an analysis of the literature so as not to overlook any dimension in our scale [32, 36].

Questionnaire development

Theoretical model used

Analysis of adherence behaviour from a strictly medical point of view is insufficient [32]. For this reason, we based the construction of our scale on an existing model recently developed by a multidisciplinary team [15] using a multifactorial approach, as recommended by studies in psychology and sociology [5,32]. It also helped us to avoid the pitfalls of vague terminology [31], poor construction of the scoring system and redundancy between outcomes [15]. This model describes the four aspects of a patient's behaviour following a consultation: taking medications as instructed, following prescriptions for evaluations and tests (radiography, blood tests, appointments with specialists), making appropriate lifestyle changes (i.e. diet, stopping smoking, physical activity, alcohol consumption) and when to engage the healthcare system for worsening or reoccurring symptoms and follow-up. Respecting the model's categories, we constructed a rigorous scale with pertinent items. Moreover the model assisted us in studying the determinants of adherence such as DPC and satisfaction, also defined in the model, with a solid theoretical foundation.

Requirements of the new scale

The scale needed to respect the following criteria: usable in routine practice, independent of any particular clinical situation, self-reported by the patient, easy to understand, easily evaluable, brief, respectful of the patient's privacy, possible to be completed by or together with carers where necessary, validated and reliable [20]. Self-assessment by the patient was considered the method of choice as it is fast, inexpensive, non-invasive and can potentially help detect the underlying reasons for non-adherence [21,37]. In practice certain authors consider it to be the most suitable method for assessing

health improvement [20] although it might sometimes suffer from self-deception or dishonest answers. An objective measure such as pill counts, sometimes used in assessing drug adherence, was not feasible in the broad context of assessing other types of behaviour.

Validation of the questionnaire

The pilot study

The first version was tested in a pilot study on 30 patients whatever the pathology diagnosed. Immediately after the consultation the patient was given the questionnaire to complete, followed by an additional page about their understanding of the questionnaire and open remarks.

Sample size calculation

We based our calculation on the general adherence literature according to a systematic Cochrane Library review [27]. To measure the impact of any intervention on adherence we needed to obtain a minimum of 75 completed questionnaires for each group. As we intended to include patients with either a non-severe trauma i.e. ankle sprain, or a medical indication i.e. an infection, this meant the minimum sample size for our study was 150.

Assuming good adherence (estimated at 85%) [3] a sample size of 150 patients would provide an accuracy of measurement, with a 95% confidence interval (CI) of $\pm 6\%$. The inclusion of 150 patients would also allow a calculation of the Cronbach coefficient with a satisfactory level of precision (Cronbach alpha with one-sided 95%; CI = 0.75 for three items of the pharmacological subscale and a coefficient estimated at 0.8).

Allowing for 20% patients potentially being lost to follow-up we required 180 patients in total. We stopped inclusions when this number was reached.

Design

1 A two-centre prospective observational study was conducted from November 2013 to May 2014 in the
2 emergency departments of two hospitals. The study was approved by the regional ethics committee
3 (IRB n° 5891 on 31-Oct-2013).

4
5 Physicians who regularly worked in the ED of the two establishments were contacted and voluntarily
6 participated. The physician briefly presented the study (orally and in a patient information letter) and
7 proposed participation to all consecutive adults and children (>15 and accompanied by an adult)
8 diagnosed with a common traumatic or infectious acute condition (ankle sprain or infectious colitis,
9 pyelonephritis, diverticulitis, prostatitis or pneumonia). These acute conditions were chosen from those
10 most commonly seen in primary care [22] and which usually require medication, prescriptions for
11 specialist evaluation or tests, and/or advice and follow-up instructions. We excluded patients whose
12 care led to a hospital stay of more than 48 hours.

13
14 The patient information letter explained the broad aims of the study: to help develop tools to measure
15 the quality of care. Details were not given so as to reduce any self-selection bias. If the patient agreed
16 to participate, they signed a written informed consent. If they declined to participate, this was recorded.
17 Physicians included patients in the study by completing a short inclusion-case report form, describing
18 the patient's baseline and socio-demographic characteristics.

19 Patients were contacted by telephone between 7 and 10 days after the consultation by a study
20 investigator who did not participate in patient recruitment. They were asked the series of questions
21 from the Girerd scale (yes/no) and then the GASAC questions (scored on a Likert scale of 1 to 4). Next
22 they were asked a series of questions about DPC, about patient satisfaction and some additional
23 questions about the intentional or non-intentional nature of their behaviour (not counted in the score).

24 **Statistical analysis**

25 Statistical analysis was performed using Stata Version 13.0 (Stata Corp, College Station, Texas).
26 Statistical tests were performed with a significance level of 0.05. Qualitative variables are described by
27 frequency and percentages, and quantitative variables using medians and IQR [25th and 75th
28 percentiles]. The internal consistency of the GASAC score items was assessed by Cronbach's alpha

[34]. For quantitative variables, we used the Mann-Whitney test to compare two groups, or the Kruskal-Wallis test to compare more than two groups (non-parametric tests). For qualitative variables, we used the Chi-squared test. Finally, we conducted a multivariate logistic regression to identify factors associated with a "high" adherence according to the distribution of the histogram. To study the determinants of adherence we had to dichotomise the variables, so patients with a GASAC score ≥ 0.8 were classed as "highly-adherent", whereas those with a score < 0.8 were classed as "poorly-adherent". All patient characteristics, the level of information, satisfaction and DPC score with $p < 0.2$ in univariate analysis were included into the full model. The final model was obtained by a manual step-wise logistic regression. The correlation between GASAC and the DPC, and correlation between subscales of GASAC scores was explored by calculating Spearman's rho.

Results

Literature search

Our search extracted 845 records, including 80 reviews. Among these, neither of the two doctors found any reviews or original articles that dealt with an acute condition, nor with global adherence. Concordance was 100%. Among the reviews, four dealt with adherence to exercises (e.g. for musculoskeletal disease); one with showing up at a mammography appointment and one with keeping to a diet. The rest concerned drug adherence in chronic diseases (HIV, psychiatric disease, diabetes). Due to the lack of specific articles we consulted those dealing with adherence from a general point of view, non-specific to any given disease, and searched their bibliographies manually. We used scales measuring the quality of care from articles, the institutional websites and books [32-36]. Thus while the literature did not provide us with any suitable scales it helped us to be more precise and to better formulate our questions. We profited from the accumulated knowledge of the multidisciplinary research team that included experts in "adherence" (AG, BA).

Description of the new scale

1 GASAC incorporates four adherence subscales: drug prescriptions (3 items); laboratory tests and/or
 2 radiography prescriptions (one item); lifestyle advice (one item) and instructions on when, or if, to
 3 consult a medical professional again (one item). These 6 items were each rated from 1 to 4 (1 = no, 2 =
 4 rather not, 3 = rather yes, 4 = yes). As not all questions were relevant to all patients (not all patients
 5 received prescriptions and /or instructions) the final score was expressed as the ratio, between 0 and 1,
 6 of the patient's answers to the questions actually posed by the study investigator and the maximum
 7 possible score from this number of questions (Table 1). The mean time to complete the questionnaire
 8 was 3 minutes.

10 **Table 1.** Global Adherence Scale for Acute Conditions (GASAC).
 11

DOCTOR’S BEHAVIOR		
Did the doctor give you any of the following:		
A- Prescriptions for medications	Yes/No	(Not scored)
B- Prescription orders for evaluations, tests or specialized consultation (imagery, laboratory analyses, an appointment with a specialist)	Yes/No	
C- Advice on hygiene, diet, lifestyle, physical activity, regular activities, occupational activity, tobacco or alcohol consumption, hydration, environment	Yes/No	
D- Instructions on when to engage the healthcare system for worsening symptoms	Yes/No	
PATIENT’S BEHAVIOR: THE GASAC QUESTIONNAIRE		SCORE
Possible answers (Likert scale): No; not at all=1; Partly =2; Mainly=3; Yes, that’s right= 4 To each of the following questions:		
A- Adherence to prescription(s) for medication/drugs (asked if “yes” to A above):		Sub-total:
I- Have you taken the whole course of prescribed medication?		I + II + III = W
II- Did you take the prescribed doses?		
III- Did you comply with the regimen and conditions (time at which you took the medication, if you were fasted or not, before meals, during meals etc.)?		
B- Adherence to prescription orders for evaluations, tests or specialized consultation (asked if “yes” to B above)		Sub-total:
IV- Did you have the additional examinations (imagery, laboratory analyses) or a specialized consultation (an appointment with a specialist) prescribed by the doctor?		X
C- Adherence to recommendations and advice (asked if “yes” to C above):		Sub-total:
V- Did you follow the advice and recommendations and/or have you changed some habits as a result of the consultation:		
• Diet and weight control		
• Lifestyle		
• Physical activity		

<ul style="list-style-type: none"> • Reduction or cessation of smoking • Alcohol consumption • Hydration • Avoidance of things causing worsening, recurrence, or transmission of infection • Personal hygiene 	Y
D- Adherence to use of the health care system <i>(Asked if “yes” to D above):</i> VI- Did you follow the doctor’s instructions and advice on if and when to reconsult a healthcare professional, did you follow his advice?	Sub-total: Z
TOTAL SCORE = [(W + X + Y+ Z) - number of counted questions] / (3*number of counted questions)	Total Score (Between 0 and 1).

1

2 Table 2 shows the optional supplementary behavioural questions we asked. Supporting information S1
 3 file gives an example of a patient’s replies and how it was scored. Supporting information S2 file
 4 contains both the GASAC questionnaire and the supplementary optional questions in French.

5

6 **Table 2.** Additional questions about the intentional or non-intentional nature of the patient’s behavior.

7

8 Why did you not take all your medication or follow the advice? 9 - Because you forgot it..... yes/ no 10 - Because the treatment is too complex yes/ no 11 - Because of its side-effectsyes/ no 12 - Because the medicines do you more harm than good:yes / no 13 - Because you thought it was not useful or suitable:yes / no 14 - Because you already felt better:yes / no 15 - Because you no longer had any pain:.....yes / no 16 - Because you did not go to the pharmacy to collect the medication:yes / no 17 If yes, why?..... 18 - Did you take any medications other than those prescribed by your doctor? yes / no 19 If yes, which? 20 - Have these medications been prescribed by another doctor?.....yes / no 21 - Has your doctor prescribed any laboratory tests?yes / no 22 - Has your doctor prescribed any imaging examinations? yes / no 23 - Has your doctor prescribed any consultations with a specialist? yes / no 24 - Has your doctor given you another appointment with himself? yes / no 25 -Would certain information or advice interest your entourage?yes / no 26 If yes, have you informed them? yes / no, 27 - Have you needed to seek medical advice about the same problem? yes / no 28 - If yes, did you consult your general practitioner?yes / no 29 - Or another doctor?yes / no 30 - Or emergency services?yes / no

- Have you called an emergency number?yes / no
- Was your attitude consistent with the advice?yes / no

Clinical study

Population

The median GASAC score was 0.93 IQR [0.78; 1] (n = 154). Figure 1 shows the patient flow chart.

Figure 1. Flow-diagram for the validation of the GASAC scale. Patients lost to follow-up were those who could not be contacted by telephone after 3 attempts.

Table 3 shows the baseline and socio-demographic characteristics of the patients.

Table 3. The baseline and socio-demographic characteristics of patients

	All patients (n=154)	Ankle sprain (n=82)	Infection (n=72)
Female	93 (60.5%)	40 (43%)	53 (57%)
Male	61 (39.6%)	42 (68.9%)	19 (31.1%)
Age	36 [23-57]	27.5 [20-39]	53.5 [29.5-68.5]
Age bands:			
<40 yrs	83 (53.9%)	62 (74.7%)	21 (25.3%)
≥40 yrs	71 (46.1%)	20 (28.2%)	51 (71.8%)
Highest educational level attended:			
Junior High	62 (40.3%)	25 (40.3%)	37 (59.7%)
High school	38 (24.7%)	25 (65.8%)	13 (34.2%)
University studies	54 (35.1%)	32 (59.3%)	22 (40.7%)

Employed in the health care sector	22 (14.3%)	11 (50.0%)	11 (50.0%)
Socio-professional category:			
1. Farmers/artisans/tradesmen/ Intellectuals/managers	36 (23.4%)	22 (61.1%)	14 (38.9%)
2. Employees/workers	43 (27.9%)	26 (60.5%)	17 (39.5%)
3. Retired	31 (20.1%)	5 (16.1%)	26 (83.9%)
4. Unemployed person	44 (28.6%)	29 (65.9%)	15 (34.1%)
Single	77 (50.0%)	46 (59.7%)	31 (40.3%)
Living as a couple	77 (50.0%)	36 (46.8%)	41 (53.2%)

Internal validity of the GASAC questionnaire

Cronbach's alpha coefficient, calculated for the drug subscale was 0.78 (n=149; one-sided Cronbach's alpha 95% confidence interval 0.72). The other subscales were composed of a single question. It was not relevant to calculate a Cronbach coefficient for global adherence because not all patients were concerned by all the questions.

We calculated the Spearman's coefficient between the different subscales of the GASAC. There was a correlation between the drug subscale and the use of the health care system (Spearman coefficient = 0.29 with $p = 0.01$). In contrast, there was no correlation between the drug subscale and the subscale of recommendations and advice, or between the drug subscale and the test and examination subscale.

External validity of the GASAC questionnaire

We compared the GASAC and Girerd scores (Figure 2). The Girerd analysis included 149 patients with scores distributed as follows: no patient had a score of less than 3/6; 5 (3.3%) had a score of 3/6; 19 (12.8%) had a score of 4/6; 35 (23.5%) had a score of 5/6 and 90 (60.4%) had a score of 6/6. Using a non-parametric test there was a statistically significant link between the GASAC score and the Girerd score ($p < 0.01$) and between the drug sub-section of the GASAC score and the Girerd score ($p < 0.01$). We also found a statistically significant correlation between the GASAC and satisfaction scores (n=

154; Spearman coefficient=0.22; $p<0.01$), as well as with the DPC score ($n=154$; Spearman coefficient = 0.18, $p=0.03$).

Figure 2. Comparison between GASAC and Girerd adherence scores ($n=149$). Box plot representing the results by continuous variables using median and IQR [25th and 75 percentile].

The determinants of adherence

Using an univariate analysis, we determined that the variables associated ($p<0.05$) with high adherence were the age-band over 40 years, an infectious pathology (as compared to trauma), high patient satisfaction and a high DPC score.

In the multivariate logistic regression model the explanatory variables for high adherence were the type of acute condition, trauma versus infectious (odds ratio, OR 3.69; IC [1.60-8.52] with $p<0.01$) and the DPC score (OR 1.06; IC [1.02-1.10] by score point with $p<0.01$) (Table 4). There was no interaction between these two variables. No individual characteristic, the satisfaction score nor the level of information given, were selected by the manual step-wise selection in the final model. For the multivariate analysis the area under the ROC curve was 0.73. The rate of correctly classified patients was 75.32%, with a Hosmer-Lemeshow $\chi^2(8) = 7.7$ and Prob > $\chi^2 = 0.46$.

Table 4. Determinants of a good adherence ($n=154$) after emergency department consultations

Characteristics of the population studied	High adherence (GASAC Score ≥ 0.8 ; $n=115/154$, 74.7%)	OR [95%CI]	p
UNIVARIATE ANALYSIS			
Age bands <40 yrs ≥ 40 yrs	54/83 (65.1%) 61/71 (85.9%)	13.28 [1.46-7.34]	< 0.01
Sex Male Female	41/61 (67.2%) 74/93 (79.6%)	1 1.90 [0.91-3.96]	0.09
Employed in the health care sector No Yes	99/132 (75.0%) 16/22 (72.7%)	1 0.89 [0.32-2.46]	0.82

Highest educational level attended			
Junior High	51/62 (82.3%)	1	
High school	25/38 (65.8%)	0.41 [0.16-1.06]	
University studies	39/54 (72.2%)	0.56 [0.23-1.36]	0.16
Family context			
Single	55/77 (71.4%)	1	
Living as a couple	60/77 (77.9%)	1.41 [0.68-2.93]	0.35
Socio-professional category:			
Farmers/artisans/tradesmen	26/36 (72.2%)	1	
Intellectuals/managers	31/43 (72.1%)	0.99 [0.37-2.67]	
Employees/Workers/Retirees	28/31 (90.3%)	3.59 [0.89-14.5]	
Unemployed person	30/44 (68.2%)	0.82 [0.31-2.17]	0.15
Type of conditions:			
Ankle sprain	53/82 (64.6%)	1	
Infection	62/72 (86.1%)	3.39 [1.51-7.60]	< 0.01
Level of information*			
0: No information received	24/38 (63.2%)	1	
1: One information received	49/64 (76.6%)	1.91 [0.79-4.58]	
2: The two information received	42/52 (80.8%)	2.45 [0.94-6.36]	0.15
Satisfaction score (continuous)	GASAC ≥ 0,8: 19 [17-20] GASAC < 0,8: 18 [14-20]	1.15 by satisfaction score point [1.03-1.28]	0.01
DPC score (continuous)	GASAC ≥ 0,8: 53,1 [48-56.8] GASAC < 0,8: 50 [37-53]	1.06 by DPC score point [1.02-1.10]	< 0.01
MULTIVARIATE ANALYSIS **			
DPC score		Adjusted OR 1.06 [1.02-1.10] by score point	< 0.01
Infection vs trauma		Adjusted OR 3.69 [1.60-8.52]	< 0.01

1

2 * 2 questions were asked about information received: "Has your doctor given you any advice to follow?" And

3 "Has the doctor given you information on when to reconsult?"

4 **Final model with manual stepwise logistic regression

5

6 Additional Results

7 Ninety-eight patients (65.8%) reported having followed the entire treatment; 134 patients (89.9%)

8 reported having taken the prescribed daily doses and 110 (73.8%) said they complied with instructions

9 for the treatment (when and how to take the treatment). Eighty of the 98 patients who had blood tests or

10 radiography prescriptions (81.6%) said they had fully complied with them. Sixty-five patients out of 89

1 who had been given lifestyle and dietary instructions (73%) said they had followed the advice closely.
2 Sixty-eight (84%) of the 81 patients said they had respected the advice concerning potential
3 consultations.

4

5 **Discussion**

6 **Characteristics of the GASAC and strengths**

7 The GASAC is a short, patient self-reported questionnaire evaluating four types of patient behaviour
8 following a consultation for an acute condition. The absence of correlations between adherence to
9 drug-prescriptions and adherence to prescription orders for evaluations, tests or specialized
10 consultations, and also with adherence to advice given by the physician, shows that each of the
11 different subscales provides complementary information and are not redundant.

12 The validity of the intrinsic properties of the drug sub-section of the GASAC score was confirmed by a
13 satisfactory Cronbach's alpha coefficient³⁴ and a high rate of correctly classified patients. For external
14 validity, the study also showed convergence with the Girerd score as well as with well-known
15 determinants of adherence for chronic conditions such as DPC and satisfaction [17,30].

16

17 **Clinical results for adherence and comparison with literature**

18 Our median overall score reflects high short-term adherence. This adherence rate is consistent with
19 those reported in the literature for drug adherence for an AC [3,27]. This high rate can be explained by
20 the generally strong motivation of patients seeking ED consultations to follow their treatment, even
21 though the conditions of patient management do not always allow physicians to give detailed
22 explanations. In the literature, the average adherence rates are highly dependent on the context of the
23 study. Nevertheless, adherence rates are higher for acute diseases than for chronic diseases, for which
24 the median adherence is around 40 to 50% [26,39]. In a study using microelectronic monitors to record
25 pill taking Cramer et al. showed that 88% of patients adhere to the treatment prescribed during the first
26 5 days following the consultation, 86% during the next 5 days, dropping to 67% one month after the
27 consultation [40].

1 According to a review of reviews on adherence to medical treatment, the median rate of adherence to
2 lifestyle and dietary recommendations is generally lower than for drugs [26]. However, this was not the
3 case in our study: the adherence rate was good for all 4 dimensions of GASAC. This might be
4 explained by the nature of the acute conditions we chose to study.

5

6 In univariate analysis, the factors associated with good adherence were age >40 years, an infectious
7 pathology, good satisfaction and quality of DPC. Women tended to be more adherent than men, even if
8 our result wasn't significant. Patients who lived with a partner also tended to be more adherent. In the
9 literature older and female patients are associated with better adherence [33].

10 In multivariate analysis, the only determinants of high adherence were infection (versus trauma) and
11 quality of DPC. Whereas the individual characteristics of the patients (age, sex, level of education and
12 professional activity) were not retained in the final model, the DPC score was. This is a major
13 determinant for which measures can be taken to improve, for example through the training of
14 caregivers. The better adherence of patients with an infection might be explained by the risk of
15 deterioration without treatment and the well-known efficacy of antibiotics. Older age and female sex
16 did not appear in the final model because these were also characteristics of patients with infections, as
17 opposed to younger patients presenting with trauma.

18

19 **Limitations**

20 It is possible that patients lost to follow-up (who could not be contacted by telephone after 3 attempts)
21 were the least adherent. Our study included patients consulting a hospital emergency department; they
22 may well have had more severe conditions requiring more urgent attention with better adherence rates
23 than others who waited to consult their GP. For minors (n=13, 8%), adherence may well have been
24 improved by parental supervision.

25

26 While the emergency physician who included the patient, and the patient were told that the study was
27 aimed to evaluate tools used to assess the quality of care, they weren't told in detail what was being

1 measured to avoid biases. Moreover, the investigators who made the telephone interviews were
2 completely independent of the emergency departments.

3

4 To reduce any social desirability bias (e.g. the patient wanting to be a "good patient"), the interviewers
5 tried to create an atmosphere in which patients did not feel judged, reminding the patient that their
6 answers were anonymous and that the interviewer was not part of the medical team. We considered a
7 telephone questionnaire as being more anonymous and less intimidating for the patient than a face-to-
8 face interview.

9

10 It is thought that patients overestimate their level of adhesion when self-reporting by 10 to 20%
11 compared with other methods [21]. Despite this drawback, self-evaluation is frequently used in clinical
12 practice and gives more reproducible results, is more reliable, less expensive and less invasive than
13 direct measurements [28].

14

15 To reduce recall bias [20], the telephone interview was made relatively early (7 to 10 days after the
16 consultation) to obtain more reliable answers, however some patients had not completed their treatment
17 or had not been able have all the additional tests required. Although telephone questionnaires have
18 limitations (difficulty understanding questions, call hours and availability vary according to the
19 patient), they allow data to be obtained rapidly, the number of patients lost to follow-up is minimized
20 and they are inexpensive, To optimize accuracy, when measuring adherence it is recommended to
21 combine different types of measures [28,41], direct and indirect [3]. However, this is rarely possible in
22 practice [37,42]. Objective methods would have been further complicated in our study due to the wide
23 range of behaviours we considered (e.g. following a diet, increasing physical activity etc).

24

25 For statistical analysis purposes we needed to dichotomize patients into "highly-adherent" or "poorly-
26 adherent" groups, however this led to some simplification and loss of information [21]. For reasons of
27 feasibility, we limited our study to 6 AC corresponding to 2 subgroups of pathology (trauma versus
28 infection). Patients who consulted for an infection outnumbered those seen for a sprained ankle, and

posed very different therapeutic issues. However, we cannot generalize our findings to all the pathologies encountered in an ED.

Conclusion

The Global Adherence Scale for acute conditions is short, patient self-reported, well adapted to the context of an acute condition, independent of the type of condition and takes into account the different aspects of a patient's behaviour. Such a tool can be useful to assess the quality of healthcare both in clinical research and routine practice. Despite overcrowding in emergency departments, the quality of doctor-patient communication is a major aspect, which can improve adherence. Strategies for improving doctor patient communication should be tested in an interventional study with adherence as the major outcome [23,43].

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1 **Supporting information**

2

3

4 **S1 file. An example of a patient's replies and how it was scored.**

5 **S2 file. The GASAC questionnaire and the supplementary optional questions in French.**

6 **S3 file. Protocol in English.**

7 **S4 file. STROBE Checklist.**

8

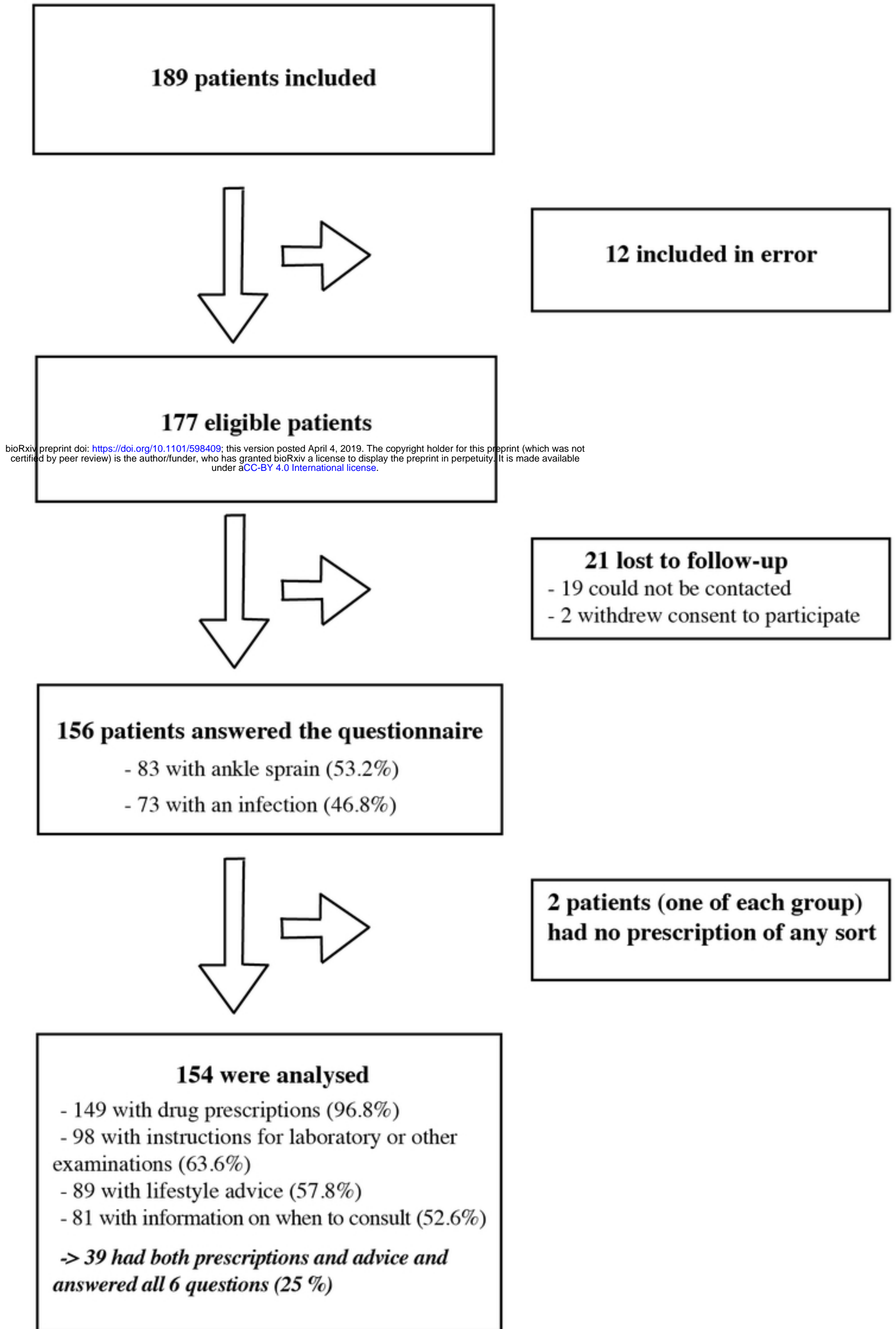


Figure 1

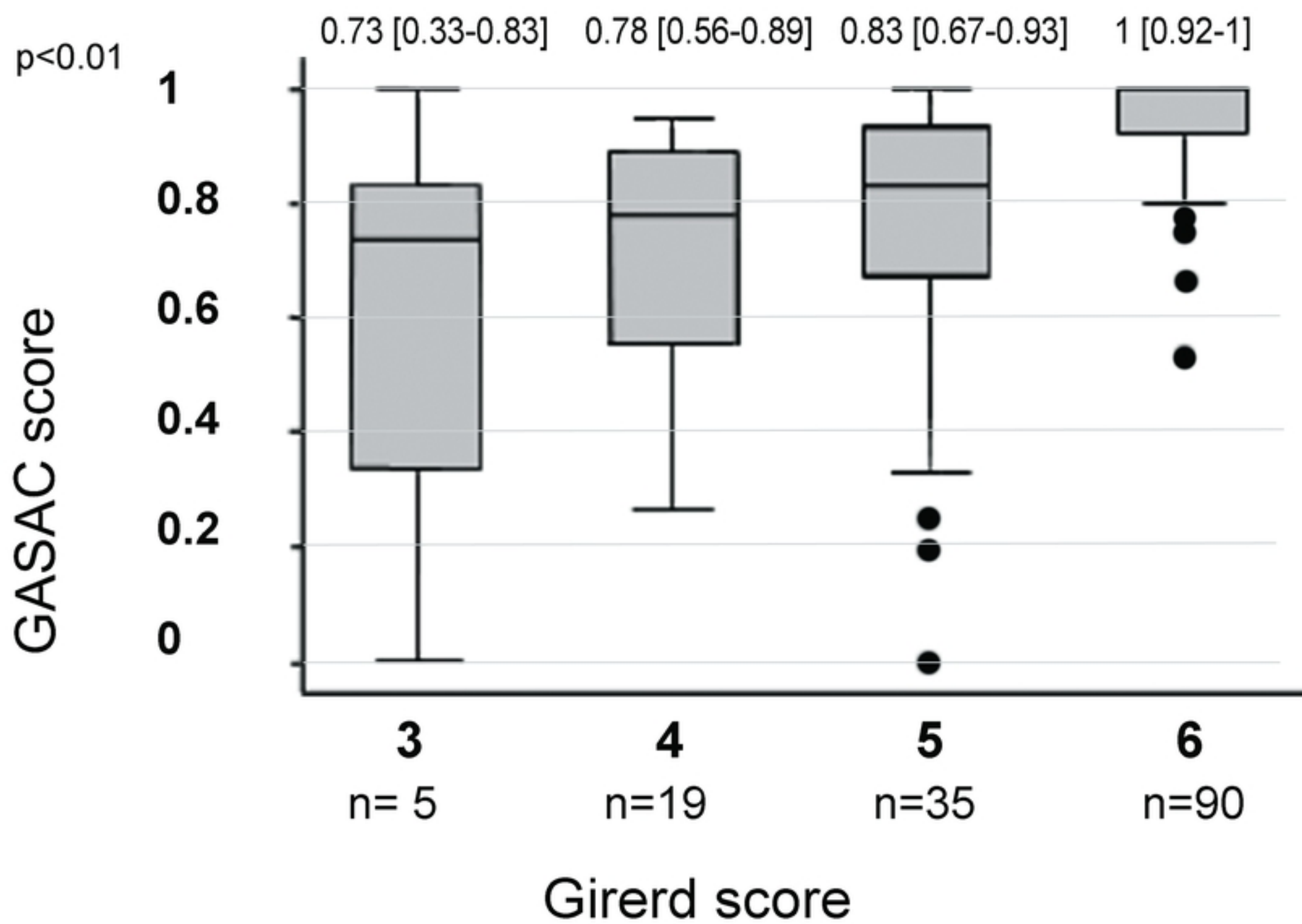


Figure 2