

Supplementary material

Table 2S.

We herein present the 87 PROs used for measurement of adherence to asthma inhaled maintenance medication. Each of these PROs were used in ≥ 1 of the 186 included studies. Even though these instruments were reported to measure adherence, we present them according to the adherence stage(s) that they were found to assess, based on the *ABC Taxonomy for Medication Adherence* [1, 2]. For each instrument, we show the number of items, the types of question, the types of response options, and the number of studies that used the instrument. We also summarize the level of evidence in regards to the measurement properties of the few PROs (n=13/87) that have been validated in patients with asthma (additional information about the measurement properties of these PROS is available elsewhere [3]).

Due to copyright, we could not reprint the items, as well as detailed response options. Nonetheless, this information can be found in the article cited in reference.

Please note that the number of items may not equal the number of questions (e.g. an instrument that comprises questions 1a, 1b, and 2 has two questions, but three items).

PRO [reference]	Items, n	Type of questions: response options	Study that used the PRO, n (%) ^a	Measurement properties evaluated in patients with asthma ^b
PROs that could be used for measurement of initiation of inhaled maintenance medication (n=1/87)				
1. Ad hoc questionnaire #1 [4]	2	Closed-ended: checklist	1 (0.5%)	—
PROs that could be used for measurement of initiation and implementation of inhaled maintenance medication (n=2/87)				
2. Ad hoc questionnaire #2 [5]	2 ^c	Closed-ended: checklist	1 (0.5%)	—
3. Ad hoc questionnaire #3 [6]	1	Closed-ended: checklist	1 (0.5%)	—
PROs that could be used for measurement of implementation of inhaled maintenance medication (n=74/87)				

PRO [reference]	Items, n	Type of questions: response options	Study that used the PRO, n (%) ^a	Measurement properties evaluated in patients with asthma ^b
4. <i>Adult Asthma Adherence Questionnaire</i> (AAAQ) [7]	5 ^d	Closed-ended: Likert Scale	1 (0.5%)	Unknown evidence of construct validity, due to study poor methodological quality [3]
5. <i>Asthma Adherence Instrument</i> (AAI) [8]	4	Closed-ended: Likert Scale	1 (0.5%)	—
6. <i>Asthma Diary</i> [9, 10]	2	Open-ended (event log)	1 (0.5%)	Limited negative evidence of criterion validity [3]
7. <i>Brief Medication Questionnaire</i> (BMQ) [11]	13 ^e	Open- and closed-ended: checklist and Likert scale	3 (1.6%)	—
8. <i>Medical Outcome Study (MOS) General Adherence Items</i> [12]	5	Closed-ended: rating scale	4 (2.0%)	—
9. <i>Medication Adherence Reasons Scale</i> (MAR-Scale) [13, 14]	20 ^f	Closed-ended: checklist	2 (1.0%)	Limited positive evidence of internal consistency Unknown evidence of structural validity, due to study poor methodological quality [3]
10. <i>Medication Adherence Report Scale</i> , 9 items (MARS-9) [15]	9	Closed-ended: Likert Scale	7 (3.8%)	—
11. Adapted from the MARS [15]: 5-item MARS (MARS-5) [16] ^g	5	Closed-ended: Likert Scale	2 (1.0%)	—
12. Adapted from the MARS [15]: 4-item MARS (MARS-4) ^g	4	Closed-ended: Likert Scale	4 (2.0%)	—
13. Adapted from the MARS [15]: 10-item MARS for Asthma (MARS-A-10) [17, 18]	10	Closed-ended: Likert Scale	21 (11.2%)	Limited positive evidence of internal consistency and structural validity Limited negative evidence of reliability and criterion validity [3]
14. <i>Self-Reported Medication-Taking Scale</i> (SRMTS) [19]	4	Closed-ended: checklist	41 (22.0%)	—
15. Adapted from the SRMTS [19]: Inhaler Adherence Scale (IAS) [20, 21]	4	Closed-ended: checklist [21] or rating scale [20]	8 (4.3%)	Unknown evidence of hypotheses testing [3]
16. Adapted from the SRMTS [19]: Medication Adherence Rating Scale [22]	10	Closed-ended: checklist	3 (1.6%)	—
17. Adapted from the SRMTS [19]: Medication Adherence Scale (MAS) [21]	4	Closed-ended: checklist	6 (3.2%)	Unknown evidence of hypotheses testing [3]

PRO [reference]		Items, n	Type of questions: response options	Study that used the PRO, n (%) ^a	Measurement properties evaluated in patients with asthma ^b
18.	Adapted from the MAS [21]: Ad hoc questionnaire #4 [23]	6	Open- and closed-ended: checklist	1 (0.5%)	—
19.	Adapted from the SRMTS [19]: Reported Adherence to Medication (RAM) Scale [24]	4	Closed-ended: Likert scale	2 (1.0%)	—
20.	Adapted from the SRMTS [19]: Ad hoc questionnaire #5 [25]	1	Closed-ended: checklist	1 (0.5%)	—
21.	Adapted from the SRMTS [19]: Ad hoc questionnaire #6 [25]	1	Closed-ended: checklist	1 (0.5%)	—
22.	Adapted from the SRMTS [19]: Ad hoc questionnaire #7 [25]	1	Closed-ended: checklist	1 (0.5%)	—
23.	Adapted from the SRMTS [19]: Ad hoc questionnaire #8 [26]	1	Closed-ended: checklist	1 (0.5%)	—
24.	Adapted from the SRMTS [19]: Ad hoc questionnaire #9 [27]	6	Closed-ended: rating scale	1 (0.5%)	—
25.	Adapted from the SRMTS [19]: Ad hoc questionnaire #10 [28]	4	Closed-ended: checklist	1 (0.5%)	—
26.	Adapted from the SRMTS [19]: Ad hoc questionnaire #11 [29]	4	Closed-ended: Likert scale	1 (0.5%)	—
27.	<i>Morisky Medication Adherence Scale</i> , 8 items (MMAS-8) [30]	8	Closed-ended: checklist and Likert scale	24 (12.9%)	The Slovenian version of the MMAS-8 has recently been validated in asthma patients ≥ 12 years by Janežič <i>et al.</i> (2017) [31]
28.	Adapted from the MMAS-8 [30]: Ad hoc questionnaire #12 [32]	4	Closed-ended: checklist	1 (0.5%)	—
29.	Medication Intake Survey-Asthma (MIS-A) [33]	9	Open- and closed-ended: checklist	1 (0.5%)	Limited negative evidence of hypotheses testing
30.	<i>Newly Developed Adherence Questionnaire</i> [34]	8	Closed-ended: Likert scale	1 (0.5%)	—
31.	<i>Patterns of Asthma Medication Use Questionnaire</i> [35]	5	Closed-ended: checklist	1 (0.5%)	Evidence not rated owing to insufficient data on the quality of the measurement properties assessed [3]
32.	<i>Patient Medication Adherence Questionnaire</i> (PMAQ) [36]	5	Open- and closed-ended: checklist	1 (0.5%)	—

PRO [reference]	Items, n	Type of questions: response options	Study that used the PRO, n (%) ^a	Measurement properties evaluated in patients with asthma ^b
33. Adapted from the <i>Revised Asthma Problem Behavior Checklist</i> (RAPBC) [37]	6	Closed-ended: Likert scale	1 (0.5%)	—
34. Adapted from the <i>Simplified Medication Adherence Questionnaire</i> (SMAQ): Ad hoc questionnaire #13	6	Closed-ended: checklist	1 (0.5%)	—
35. <i>Test d'évaluation de l'observance</i> [38]	6	Closed-ended: checklist	2 (1.0%)	—
36. <i>Test of Adherence to Inhalers</i> (TAI), patient domain [39]	10	Closed-ended: Likert scale	3 (1.6%)	Limited positive evidence of internal consistency, reliability, and structural validity Limited negative evidence of criterion validity [3]
37. <i>Tool for Adherence Behaviour Screening</i> (TABS) [40]	8	Closed-ended: Likert scale	1 (0.5%)	—
38. Unnamed questionnaire [41]	1	Closed-ended: checklist	1 (0.5%)	Evidence not rated owing to insufficient data on the quality of the measurement properties assessed [3]
39. Ad hoc questionnaire #14 [42]	1	Closed-ended: Likert scale	2 (1.0%)	—
40. Ad hoc questionnaire #15 [43]	4	Open-ended	1 (0.5%)	—
41. Ad hoc questionnaire #16 [44]	2	Closed-ended: checklist	1 (0.5%)	—
42. Ad hoc questionnaire #17 [45]	1	Closed-ended: VAS	1 (0.5%)	—
43. Ad hoc questionnaire #18 [46]	1	Closed-ended: checklist	1 (0.5%)	—
44. Ad hoc questionnaire #19 [47]	3 ^h	Closed-ended: checklist and rating scale	1 (0.5%)	—
45. Ad hoc questionnaire #20 [48]	2	Open-ended	1 (0.5%)	—
46. Ad hoc questionnaire #21 [49]	1	Closed-ended: checklist	1 (0.5%)	—
47. Ad hoc questionnaire #22 [50]	1	Closed-ended: Likert scale	1 (0.5%)	—
48. Ad hoc questionnaire #23 [51]	2	Open-ended	1 (0.5%)	—
49. Ad hoc questionnaire #24 [52]	2	Closed-ended: checklist	1 (0.5%)	—
50. Ad hoc questionnaire #25 [53]	1	Closed-ended: Likert scale	1 (0.5%)	—
51. Ad hoc questionnaire #26 [54]	1	Open-ended	1 (0.5%)	—
52. Ad hoc questionnaire #27 [55]	2	Closed-ended: checklist	1 (0.5%)	—
53. Ad hoc questionnaire #28 [56]	1	Open-ended	1 (0.5%)	—
54. Ad hoc questionnaire #29 [57]	1	Closed-ended: checklist	1 (0.5%)	—
55. Ad hoc questionnaire #30 [58]	2	Open- and closed-ended: checklist	1 (0.5%)	—

PRO [reference]	Items, n	Type of questions: response options	Study that used the PRO, n (%) ^a	Measurement properties evaluated in patients with asthma ^b
56. Ad hoc questionnaire #31 [59]	5 ¹	Open- and closed-ended: checklist	1 (0.5%)	—
57. Ad hoc questionnaire #32 [60]	1	Closed-ended: checklist	1 (0.5%)	—
58. Ad hoc questionnaire #33 [61]	2	Closed-ended: checklist and Likert scale	1 (0.5%)	—
59. Ad hoc questionnaire #34 [62]	1	Closed-ended: checklist	1 (0.5%)	—
60. Ad hoc questionnaire #35 [63]	1	Closed-ended: checklist	1 (0.5%)	—
61. Ad hoc questionnaire #36 [64]	10	Open- and closed-ended: checklist	1 (0.5%)	—
62. Ad hoc questionnaire #37 [65]	1	Closed-ended: checklist	1 (0.5%)	—
63. Ad hoc questionnaire #38 [32]	1	Closed-ended: VAS	1 (0.5%)	—
64. Ad hoc questionnaire #39 [66]	1	Open- and closed-ended: checklist	1 (0.5%)	—
65. Ad hoc questionnaire #40 [67]	1	Closed-ended: checklist	1 (0.5%)	—
66. Ad hoc questionnaire #41 [68]	1	Closed-ended: checklist	1 (0.5%)	—
67. Ad hoc questionnaire #42 [68, 69]	1	Closed-ended: Likert scale	1 (0.5%)	—
68. Ad hoc questionnaire #43 [70]	1	Open-ended	1 (0.5%)	—
69. Ad hoc questionnaire #44 [66, 71]	1	Open- and closed-ended: checklist	1 (0.5%)	—
70. Ad hoc questionnaire #45 [72]	1	Closed-ended: checklist	1 (0.5%)	—
71. Modified Ad hoc questionnaire #46 [73]	1	Closed-ended: checklist	1 (0.5%)	—
72. Ad hoc questionnaire #47: <i>Cost-Related Non-Adherence</i> [74]	3	Closed-ended: checklist	1 (0.5%)	—
73. Ad hoc questionnaire #48: <i>European Community Respiratory Health Survey</i> (ECRHS) [75]	2	Closed-ended: checklist	3 (1.6%)	—
74. Ad hoc questionnaire #49: <i>Global Asthma Physician and Patient</i> (GAPP) Survey [76]	1	Closed-ended: checklist	1 (0.5%)	—
75. Ad hoc questionnaire #50: <i>Questionnaire Low Adherence</i> [7]	2	Open-ended	1 (0.5%)	—
76. Ad hoc health diary #51 [77]	4	Open-ended (event log)	1 (0.5%)	—
77. Ad hoc health diary #52 [78]	5	Open-ended (event log)	1 (0.5%)	—

PRO [reference]	Items, n	Type of questions: response options	Study that used the PRO, n (%) ^a	Measurement properties evaluated in patients with asthma ^b
PROs that could be used for measurement of implementation and persistence with inhaled maintenance medication (n=7/87)				
78. <i>Asthma Starts with Knowledge</i> , 12 items (ASK-12) [79]	12	Closed-ended: Likert scale	2 (1.0%)	ASK-20 (longer version): unknown evidence of hypotheses testing [3]
79. <i>Questions of interest</i> (QIs) [80]	4	Open-ended	1 (0.5%)	Evidence not rated owing to insufficient data on the quality of the measurement properties assessed [3]
80. Adapted from the SRMTS [19]: Ad hoc questionnaire #53 [81]	4	Unclear	2 (1.0%)	—
81. Ad hoc questionnaire #54 [82]	1	Closed-ended: checklist	1 (0.5%)	—
82. Ad hoc questionnaire #55 [83]	4	Open- and closed-ended: checklist	1 (0.5%)	—
83. Ad hoc questionnaire #56 [84]	2	Closed-ended: checklist	1 (0.5%)	—
84. Ad hoc questionnaire #57 [85]	3	Closed-ended: checklist	1 (0.5%)	—
PROs that could not be used for measurement of any adherence stage (n=3/87)				
85. <i>Adherence Estimator®</i> [86]	3 ^j	Closed-ended: Likert scale	1 (0.5%)	N/A: was not found to measure any adherence stages
86. <i>Beliefs about Medicines Questionnaire</i> [24]	18 ^k	Closed-ended: Likert scale	1 (0.5%)	N/A: was not found to measure any adherence stages
87. Ad hoc questionnaire #58 [87]	3 ^l	Open-ended	1 (0.5%)	N/A: was not found to measure any adherence stages
ICS: Inhaled corticosteroids; MARS: Medication Adherence Report Scale, 9 items; MAS=Medication Adherence Scale; PRO=Patient-reported outcome instrument; SRMTS=Self-				

Reported Medication-Taking Scale; VAS: Visual analog scale.

^a Percentages exceed 100%, because there was sometimes more than one PRO used within a single study.

^b We herein report measurement properties for which evidence was judged as positive, negative, or unknown. More details presented elsewhere [3].

^c The second and last item measures barriers to adherence.

^d The last four items measure barriers to adherence.

^e The last nine items measure barriers to adherence.

^f The last nineteen items measure barriers to adherence.

^g Chapman *et al.* (2017) the five items in their online supplementary material.

^h The third and last item measures satisfaction with medications.

ⁱ The last three items were not used to measure adherence.

^j The PRO measures barriers to adherence.

^k The PRO measures beliefs about medicines.

^l The PRO measures medication use.

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