

AMSTAR: Assessing methodological quality of systematic reviews

A summary of

Shea, B.J., Grimshaw, J.M., Wells, G.A., Boers, M., Andersson, N., Hamel, C., & Bouter, L.M. (2007). Development of AMSTAR: A measurement tool to assess the methodological quality of systematic reviews. *BMC Medical Research Methodology*, 7(10). doi: 10.1186/1471-2288-7-10



National Collaborating Centre
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Categories:
Tool, Appraise
Tool

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Relevance For Public Health

This tool was developed for general use and may be applied to assess the methodological quality of systematic reviews of public health interventions. It should be noted, however, that its use has only been tested on systematic reviews of randomized controlled trial designs. AMSTAR is being used by a number of groups, including the Canadian Agency for Drugs and Technologies in Health and The Cochrane Effective Practice and Organization of Care Group (EPOC).

Description

The [tool](#) is an 11-item questionnaire that can be used to assess the methodological quality of systematic reviews by assessing the presence of:

- an a priori design;
- duplicate study selection and data extraction;
- a comprehensive literature search;
- the use of status of publication as an inclusion criteria;
- a list of included/excluded studies;
- characteristics of included studies;
- documented assessment of the scientific quality of included studies;
- appropriate use of the scientific quality in forming conclusions;
- the appropriate use of methods to combine findings of studies;
- assessment of the likelihood of publication bias; and
- documentation of conflict of interest.

The AMSTAR tool was created by building on previous tools, empirical evidence and expert consensus. Over a decade has passed since the initial development of these types of tools, and more research has been conducted about potential sources of bias in systematic reviews. AMSTAR has incorporated these other sources of bias and will remain a "living document" subject to improvement as further advances in methodological research occur.

The instrument was developed using the following:

1. the enhanced Overview Quality Assessment Questionnaire (OQAQ) by Oxman and Guyatt (1991)
2. a checklist created by Sacks et. al (1987)
3. three additional items recently judged to be of methodological importance:
 - language restriction
 - publication bias
 - publication status (inclusion of grey literature)

The tool was applied to 99 paper-based and 52 electronic systematic reviews. Exploratory factor analysis was used to identify underlying components. Methodological experts considered the results using a nominal group technique aimed at item reduction and design of an assessment tool with face and content validity.

These summaries are written by the [NCCMT](#) to condense and to provide an overview of the resources listed in the [Registry of Methods and Tools](#) and to give suggestions for their use in a public health context. For more information on individual methods and tools included in the review, please consult the authors/developers of the original resources.

Implementing the Tool

Who is Involved?

Anyone who is critically appraising a systematic review could use this tool.

Steps for Using Tool

Users may print off a copy of the 11-item tool and use it to critically appraise a systematic review. This tool enables the user to qualitatively assess the quality of a systematic review.

AMSTAR determines the methodological quality of systematic reviews by assessing the presence of:

- an a priori design;
- duplicate study selection and data extraction;
- a comprehensive literature search;
- the use of status of publication as an inclusion criteria;
- a list of included/excluded studies;
- characteristics of included studies;
- documented assessment of the scientific quality of included studies;
- appropriate use of the scientific quality in forming conclusions;
- the appropriate use of methods to combine findings of studies;
- assessment of the likelihood of publication bias; and
- documentation of conflict of interest.

Note: One study by another group of authors (Kung et al., 2010) has developed a revised tool called "R-AMSTAR" that uses a quantitative scoring method to assess the quality of systematic reviews.

Evaluation and Measurement Characteristics

Evaluation



Has been evaluated.

Two reliability and validity evaluations of the AMSTAR tool have been conducted. Both evaluation studies include authors from the AMSTAR tool development study (Shea, Grimshaw, et al., 2007):

1) Shea, B.J., Bouter, L.M., Peterson, J., Boers, M., Andersson, N., et al. (2007). External Validation of a Measurement Tool to Assess Systematic Reviews (AMSTAR). PLoS ONE, 2(12): e1350. doi:10.1371/journal.pone.0001350

- AMSTAR was used to appraise 42 reviews focused on therapies for gastro-esophageal reflux, peptic ulcer disease and other acid-related diseases.
- Two assessors applied the AMSTAR to each review.
- Two other assessors, plus a clinician and/or a methodologist, independently applied a global assessment to each review.
- Reported outcomes included reliability (inter-observer kappas) and construct validity.

2) Shea, G.J., Hamel, C., Wells, G.A., Bouter, L.M., Kristjansson, E., Grimshaw, J., Henry, D.A., Boers, M. (2009). AMSTAR is a reliable and valid measurement tool to assess the methodological quality of systematic reviews. Journal of Clinical Epidemiology. Oct; 62(10):1013-20. Epub 2009 Feb 20.

- Thirty systematic reviews were randomly selected from a database of 151 reviews that were used in the development of AMSTAR.
- Each review was assessed by two reviewers using the following:
 1. the Overview of Quality Assessment Questionnaire (OQAQ)
 2. Sack's instrument
 3. AMSTAR
- Reported outcomes included reliability (inter-observer kappas), intra-class correlation coefficients of the sum scores, construct validity and completion times.

Validity



Validity properties meet accepted standards.

The following validity properties have been assessed:

- 1) **Face validity**—expert review for appropriateness; see method/tool development below
- 2) **Content validity**—extent to which a measure represents all facets of a given social concept; see method/tool development below
- 3) **Construct (convergent) validity**—ability of an instrument to measure an abstract concept or construct; assesses the overlap between two or more tests that presumably measure the same construct

In the 2009 Shea et al. study, construct validity was assessed by converting the mean total score of each of the 30 reviews to a percentage of the maximum score for each of the three instruments (AMSTAR, OQAQ and Sacks et al.). Intra-class correlation assessed convergence of the total scores between each pair of instruments (AMSTAR-OQAQ, AMSTAR-Sacks and OQAQ-Sacks). Similarly, in the 2007 Shea et al. study, construct validity was assessed by comparing AMSTAR with a global assessment tool.

Reliability



Reliability properties meet accepted standards.

The AMSTAR tool was found to have high inter-rater reliability by measuring the kappa statistic in both evaluation studies (Shea, Bouter, et al., 2007; Shea, Hamel, et al., 2009). The kappa statistic measures the level of agreement between two observers that could be expected by chance. Kappa scores > 0.8 are considered to be almost perfect agreement.

In both evaluation studies, kappa scores ranged from moderate to almost perfect agreement for AMSTAR. In the 2007 Shea et al. study, nine out of 11 items scored a kappa > 0.75 and the overall scores had a kappa of 0.84. The 2009 Shea et al. study had an average kappa score of 0.70 for inter-rater agreement for individual items.

Methodological Rating



Strong

Tool Development

Developers

Beverley J Shea
Jeremy M Grimshaw
George A. Wells
Maarten Boers
Neil Andersson
Candyce Hamel
Ashley C. Porter
Peter Tugwell
David Moher
Lex M. Bouter

Method of Development

The AMSTAR tool was created by building on previous tools, empirical evidence and expert consensus. Initially, the tool created using the following:

The tool was applied to assess the quality of 99 paper-based and 52 electronic systematic reviews. Exploratory factor analysis was conducted to discover the main dimensions of the tool by conducting a preliminary investigation of the correlations between all the identified variables. Items with low factor loadings tended to be weakly correlated with other items and were removed. The factor analysis made it possible to reduce the 37-item instrument to 29 items that measured 11 components.

Nominal Group Technique

Building on the results of the explanatory factor analysis, 11 international experts in the fields of methodological quality assessment and systematic reviews were convened to reduce the item pool and assess face and content validity using nominal group technique.

Nominal group technique is generally used to aid decision making. The nominal technique involves experts, discussion and a consensus that is qualitative in nature. In this study, the expert panel reviewed the results of the factor analysis. Each participant recorded his or her ideas independently. Then, ideas were listed in a round-robin format with a facilitator until all ideas had been listed, and then a group discussion took place. Individuals again independently recorded their private judgments. These were aggregated to produce group judgments. The formulated tool was electronically circulated to the group for a final round of fine tuning after the meeting.

The nominal group identified the items that most appropriately captured the 11 components identified through factor analysis and confirmed face and content validity of the tool. The resulting instrument is an 11-item questionnaire.

1. the enhanced Overview Quality Assessment Questionnaire (OQAQ) by Oxman and Guyatt (1991)
2. a checklist created by Sacks et al. (1987)
3. three additional items recently judged to be of methodological importance:
 - o language restriction
 - o publication bias
 - o publication status (inclusion of grey literature)

Exploratory factor analysis

Release Date

2007

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Resources

Title of Primary Resource	Development of AMSTAR: A measurement tool to assess the methodological quality of systematic reviews
File Attachment	None
Web-link	http://www.biomedcentral.com/1471-2288/7/10
Reference	Shea, B.J., Grimshaw, J.M., Wells, G.A., Boers, M., Andersson, N., Hamel, C., & Bouter, L.M. (2007). Development of AMSTAR: A measurement tool to assess the methodological quality of systematic reviews. <i>BMC Medical Research Methodology</i> , 7(10). doi: 10.1186/1471-2288-7-10
Type of Material	Journal article
Format	Periodical
Cost to Access	None.
Language	English
Conditions for Use	Copyright © 2007 Shea et al; licensee BioMed Central Ltd.

Title of Supplementary Resource	External validation of a measurement tool to assess systematic reviews (AMSTAR)
File Attachment	None
Web-link	http://www.plosone.org/article/info:doi/10.1371/journal.pone.0001350
Reference	Shea, B.J., Bouter, L.M., Peterson J., Boers, M., Andersson, N., Ortiz, Z., & Grimshaw, J.M. (2007). External validation of a measurement tool to assess systematic reviews (AMSTAR). <i>PLoS ONE</i> 2(12), e1350. doi:10.1371/journal.pone.0001350
Type of Material	Journal article
Format	Periodical
Cost to Access	
Language	English
Conditions for Use	Copyright © 2007 Shea et al.

Title of Supplementary Resource	AMSTAR is a reliable and valid measurement tool to assess the methodological quality of systematic reviews.
File Attachment	None
Web-link	http://www.sciencedirect.com/science/article/pii/S0895435608003259
Reference	Shea, B.J., Hamel, C., Wells, G.A., Bouter, L.M., Kristjansson, E., Grimshaw, J., & Boers, M. (2009). AMSTAR is a reliable and valid measurement tool to assess the methodological quality of systematic reviews. <i>Journal of Clinical Epidemiology</i> , 62(10), 1013-20.
Type of Material	Journal article
Format	Periodical
Cost to Access	Journal article purchase
Language	English
Conditions for Use	Copyright © 2009 Elsevier Inc.

Title of Supplementary Resource	From systematic reviews to clinical recommendations for evidence-based health care: Validation of revised assessment of multiple systematic reviews (R-AMSTAR) for grading of clinical relevance
File Attachment	None
Web-link	http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2948145/?tool=pubmed
Reference	Kung, J., Chiappelli, F., Cajulis, O.O., Avezova, R., Kossan, G., Chew, L., Maida, C.A. (2010). From systematic reviews to clinical recommendations for evidence-based health care: Validation of revised assessment of multiple systematic reviews (R-AMSTAR) for grading of clinical relevance. <i>The Open Dentistry Journal</i> , 4, 84-91.
Type of Material	Journal article
Format	Periodical
Cost to Access	
Language	English
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