On Using References as Evidence

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Summary
Background: One has to start to consider references as a kind of evidence similar to measured data and observations. Moreover, proper referencing adds to the credibility of a paper and gives appropriate credits to work of others. Experience of reviewers and editors indicate that there is room for improvement in the way that our scientific evidence base is referred to.

Objective: To provide guidelines for referencing in medical informatics publications.

Method: The authors have collected examples of poor as well as good referencing as encountered in manuscripts submitted for review as well as in published literature.

Results and Conclusion: A set of 12 rules for proper referencing was derived. The rationale for each rule is provided and examples of rule violations and proper use of the rule are presented.

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1. Introduction

In the past, the codex of good behavior for authors of scientific papers was to survey the literature fairly exhaustively, providing a synthesis of available evidence while discussing the different views on the topic addressed in the article with the pros and cons to one’s own hypothesis and results. This is still the rule in many scientific domains. However, this is no longer always feasible because of the immense growth of the scientific literature across all domains.

In the scientific literature several publications have appeared on the quality of referencing. Most studies address the accuracy of the references in the reference list and/or the retrievability of the references. A small number of papers address the quality of referencing, for instance: recommendations on quotations and paraphrasing [1], and empirical data on citation and quotation accuracy/appropriateness [2–4].

We as reviewers for health informatics journals and conferences and as editor of a health informatics journal have come across a number of problems related to how the literature is referenced in the body of the manuscripts, a topic less often addressed in the literature.

References in publications are necessary to convince the audience of the value of addressing the research topic. When used properly, they contribute to the trustworthiness of the approach taken and to the validity of the conclusion of the paper. One has to start to consider references as a kind of evidence similar to measured data and observations.

With this editorial we aim to provide guidance on how to reference the scientific literature. We propose 12 rules that will help authors to improve their referencing so that readers are better able to appreciate the line of reasoning and to place the current paper in the perspective of what is known in the literature, while avoiding overly lengthy reference lists. We will provide examples of good and bad referencing as seen in various manu-
scripts and even in accepted papers. We provide these examples without making a reference to the source as to protect the authors. In some cases we have paraphrased what we have found or provided more generalized examples as to make our points stand out more clearly.

### Table 1

<table>
<thead>
<tr>
<th>Subjective statements</th>
<th>Objective statements</th>
</tr>
</thead>
<tbody>
<tr>
<td>High level of evidence</td>
<td>&quot;strongly supports&quot;</td>
</tr>
<tr>
<td>&quot;know&quot; or &quot;argue&quot;</td>
<td>&quot;show&quot; or &quot;in agreement with&quot;</td>
</tr>
<tr>
<td>&quot;assume&quot; or &quot;discuss&quot;</td>
<td>&quot;indicate&quot; or &quot;suggest&quot;</td>
</tr>
<tr>
<td>Low level of evidence</td>
<td>&quot;believe&quot; or &quot;hypothesized&quot;</td>
</tr>
<tr>
<td>&quot;suspect&quot; or &quot;might&quot;</td>
<td>&quot;possibly&quot;</td>
</tr>
</tbody>
</table>

### 2. Principles of Referencing

#### 2.1 Rule #1: The Authors Should Include Only References that Are Really Needed for their Arguments

**Rationale:** Not every statement requires a reference. General statements can be taken for granted or serve as an assumption.

**Examples:**
1. “It is commonly accepted that information systems will contribute to the quality of health care delivery [a–z]”
2. “For high quality health care delivery, doctors need to maintain expertise through formal and informal Continuing Medical Education (CME) [r1–r5, r14–r21]. Internationally, doctors’ use of the Internet has been studied widely, by both independent researchers and medical associations, in the USA [r22], Canada [r23], and Europe [r24; r25]. A systematic literature review of these and other studies conducted by the author [r26] revealed that, …”

**Explanation:** Premises and facts upon which an argument is built up – for example for the reason of a study – require supporting evidence. In *example 1*, the word ‘commonly’ allows the reader to have his own opinion. Without the references, the statement serves appropriately as an assumption for the study. When references are provided, however, they in themselves need to synthesize such conclusion, such as reviews on the topic.

Introductory statements seldom require more than 2–3 references, provided they carry sufficient supporting evidence. It is an overkill to give a total of 21 references for the first sentence of a manuscript as seen in *example 2*. They probably can all be left out given the fact that this was a manuscript about the use of the Internet by physicians. Also [r22–r25] are superfluous, since they are covered by [r26].

#### 2.2 Rule #2: The Authors Should Make Clear whether a Referenced Statement or Argument is a Conclusion of a Study, an Observation or Just an Argument in a Discussion

**Rationale:** Normally it is of less value to cite an author for a statement that is hypothetical, an opinion, or merely a link in a chain of arguments.

**Examples:**
1. “These studies have shown that … [u, v].” Hence, physicians would be more willing to accept the CPOE … behaves consistently and meets the requirements of the physicians [x, y].”
2. “Our study strongly supports the vision that women with breast cancer benefit from a secured web environment where they can discuss their disease with others who suffer(ed) from this disease [xx].”
3. “Since the functionality of the CPOE is made available through its user interface, its design has a huge influence on its usability [w1–w5].”

**Explanation:** In *example 1* the first full sentence refers to a conclusion made by [u] and [v]. However, in the second sentence the authors themselves draw a conclusion (the “hence”) and add references. It is unclear whether the references draw the same conclusion or had the assertion as a hypothesis for which the current study provides evidence. The difference in level of supporting evidence is huge. The problem is that authors regularly present their opinion or a conclusion and then make a reference to a paper of someone else without making clear how that reference evidence-wise relates to the statement made.

In *example 2* it is unclear whether [xx] initially suggested that vision, or that it had similar results.

The references in *example 3* are only used in this sentence. It is unclear what those five references contribute to the evidence level of the statement, and hence further qualification is needed. We encourage the use of phrases like “as discussed in [xxx],” as concluded by the review and analysis of [***] or “which is in accordance with the findings in [xxx]” as to specify the support of the references for the statement made.

Therefore, use language to indicate the qualifications and strengths of claims.

**Table 1** gives some suggestions of phrases that can be used to qualify the evidence of references.

#### 2.3 Rule #3: Only Make References to Papers that you Have (recently) Read from Beginning to End

**Rationale:** Using references as evidence implies that authors seriously have to make certain that the way they use a reference is absolutely correct (i.e. both accurate and precise).

**Example:**
1. “A study of 8000 ICT projects among more than 300 US companies shows that more than 50% of ICT projects fail one way or the other [n].”

**Explanation:** It seems that the author of the paper in which *example 1* occurs has not read [n]. When reading [n], one notices that the
statement is nearly verbally taken from [n], but the problem is that [n] – an editorial – is referring to another study that has provided these results. Since such linked references are weakened as evidence and may even be misleading when the paper that references the original work has not properly described the evidence of the original paper, a reference should be made to the original work. If you cannot access the original reference, then at least make the indirect reference explicit for example by using "… as referenced by [nn]".

2.4 Rule #4: Lists Should Be Restricted to References for which the Statement Referenced Constitutes a Kernel Topic

*Rationale:* It is improper to provide a long list of references in a non-committal fashion. Only those that carry most support for the statement should be included, pros as well as cons.

*Examples:*
1. "The model has been applied in medical and healthcare areas [xx–yy]" (comment: without any further information provided).
2. "The model has been tested in medical and healthcare areas such as laboratory medicine [x1–y1], radiology [x2–y2] and diabetes management [x3–y3] with the following conclusions …"

*Explanation:* Although example 1 does provide the reader with opportunities for finding more papers using the same model there is no indication upfront on the domains, or of variation in the applications, or whether the applications were successful. Hence, the reader has to check the references to see whether and to what extent they each are of interest to him/her.

A better approach therefore would be example 2. Only references should be included that really demonstrate the use of the model in the listed areas and in which the model was the main focus of the study.

If available, one on-spot review reference usually carries more weight than numerous singular references and is preferred over a list of individual references since reviews usually take a broad view, describing the pros and cons on the topic and providing a synthesis of the findings. However, for detailed issues like in the discussion section references to the original research publications may be more appropriate.

2.5 Rule #5: Self-referencing Must Be Done, yet in Justifiable Doses

*Rationale:* Prior work by the authors should be referenced to provide a frame of reference for the interpretation of the current work, just like any relevant work published by others.

*Examples:*
1. "We have implemented a guideline-based CPOE system in our secondary care facility. The impact of guideline-based CPOE on appropriateness of lab-orders have to our knowledge not been studied."
2. "Information systems are more than the technical construct and the flow of information. It includes the soft human aspects [xx–yy], (comment: [xx–yy] are all self-references).

*Explanation:* When previous work constitutes the stepping stone of the present study one must reference one’s relevant preceding conclusions on the same research topic, method, or system, as well as relevant feedback within the literature, both of a confirmatory and a contradictory nature. The reason is that one must enable the reader to form an opinion on the logical steps that lead to the present study, and to judge the conclusion of the present article in view of previous approaches and findings.

Omitting a reference to, for instance, an evaluation study or development project that the authors now repeat for another type of system, in another domain, or for another case may be highly inappropriate, since there may in reality be no additional scientific value, and hence the publication serves but the purpose of extending a CV and publication list. If example 1 appears in a paper submitted by a team that previously has studied the impact of CPOE for medication errors or has addressed the appropriateness of lab-testing in a primary care setting, omitting such references will prevent the reader’s judgement of whether the current study is original or a replication (for different purposes) or in different settings.

A highly inappropriate kind of self-referencing is to use self-referencing for a statement that is common knowledge (i.e. more or less agreed by the literature) or debated intensely in the literature (see example 2). By solely referencing the author’s own articles or articles from his/her research team he/she gives the reader the impression that the author really believes that s/he (or the team) invented this viewpoint. For example 2 there are various groups, also from other disciplines, that have argued in favor of this conclusion from various theoretical perspectives. Such rich background should be reflected in the references.

2.6 Rule #6: Referencing Parts of Books Requires Additional Bibliographic Detail

*Rationale:* Books often comprise hundreds of pages and cover a variety of aspects. Hence just referencing a book gives the reader the burden of searching for the referenced material.

*Examples:*
1. "We used the formulas for the ICC as given in [book]."
2. "For an overview of potential biases in evaluation studies see for instance pages xx–yy in [z]."

*Explanation:* With [book] referring to a textbook on evaluation methods, it is obvious in example 1 that the reference is insufficient for the reader. Additional detail should be provided at least indicating the relevant chapter, but preferably pointing to a particular formula ID or section or page number(s) as is done in example 2.

2.7 Rule #7: Citations Must Be Followed by a Reference with a Specific Pointer to a Page Number

*Rationale:* The rationale for this rule is the same as for Rule #6.

*Example:*
1. "Most technologies considered in the field of "classical" Medical Technology Assessment, work in a way which makes them exterior to the user. The user defines and prescribes the use of the technique, and specifies its modalities. In a second step,
the technical device works on its own (as a black box) according to the prescription” ([xx]; page 10, slightly rephrased).

**Explanation:** Picking an argument out of its context may unintentionally twist its meaning, and hence the author(s) of the reference are assigned a given statement with a readers’ interpretation that they may actually not agree with. An explicit pointer to a page number will enable the reader to quickly find the relevant place and thereby its context. Thus, if possible, one should include the context of the citation.

Example 1 was used in an argumentation of why classical MTA is not applicable for MI applications, but this context for the message is not visible in the citation and hence an explicit reference is needed to enable the reader to identify the context of the citation himself.

**2.9 Rule #9: Spicing with References Is Strongly Discouraged**

**Rationale:** By ‘spicing’ we refer to the extensive use of references, in particular in the Introduction and the Discussion sections.

**Examples:**
1. Statement 1 [x]. Statement 2 [y]. Statement 3 [z]. …
2. “Lee [1] demonstrated the effectiveness of this approach [2].”

See also the examples under Rule #2.

**Explanation:** The worst cases are those, like example 1, in which each statement has one or more references. It is hardly conceivable that there is a logical flow in the reasoning when each sentence requires a reference. The motivation for spicing may be as simple as to increase the number of references used in order to avoid a bad referee score on ‘references to the literature’, or to try to impress the reader with how much literature has been read (assuming that Rule #3 is adhered to).

Example 2 is from the background section of a manuscript in which about half of the sentences have this construct and several of them referring to [2]. This example of spicing also violated Rule #2.

A mere counting of the occurrences of each reference in a manuscript may be useful for the authors. One should be critical about references that occur only once: One should assess whether they are really needed.

**2.10 Rule #10: Do not Selectively Refer to Papers that Are Supportive for a Specific View**

**Rationale:** In a paper, one should sketch as fair a picture of the state of the art as possible. It is inappropriate to cite only papers that are supportive of the view of the authors.

**Example:**
1. “The effectiveness of CPOE has been demonstrated in many studies (e.g. [1–6]).”

**Explanation:** Apart from the violation of Rule #1, the example ignores other papers and is adopted by the authors. The Bayesian approach has been developed by others and is adopted by the authors. This gives a strong suggestion that the article presents something new and innovative, while only existing methods are being applied. This is a misrepresentation of the state of art.

**2.11 Rule #11: Do not Omit References to Papers that Address Precisely the Same Topic**

**Rationale:** It is inappropriate to exclude references addressing the exact same topic as one’s own study, as expressed by the editorial [6].

**Example:**
1. “We present an innovative way to identification and analysis of subgroups using Individual Patient Data Meta-analyses based on a Bayesian approach.”

**Explanation:** When reading further in the manuscript, it turns out that the IPD meta-analysis has been used in several studies and the Bayesian approach has been developed by others and is adopted by the authors. The example gives a strong suggestion that the article presents something new and innovative, while only existing methods are being applied. This is a misrepresentation of the state of art.

**2.12 Rule #12: Always Give Credit to the Intellectual Contributions upon which your Article Builds**

**Rationale:** Be fair to your sources of inspiration, state them as sources, and make appropriate references. When relevant, include also papers from meetings, proceedings and technical reports.

**Examples:**
1. “Inspired by among other things the discussions at the COMAC-BME working conference (see [www, xxx, zzz] for details and participants) and the reports presented by yyy et al. [yyy] and zzz et al. [zzz] we developed the present framework for …”
2. “…… [R.E. Asearcher 1996, personal communication]”
3. “A perspective does not determine the answers to design questions but guides design by generating the questions to be considered (ww and ff, cited by [book], page 46).”
3. Discussion and Conclusion

This contribution aims to guide authors in addressing the existing evidence base and the way to give appropriate credit to the work of others and oneself. We propose a set of rules that can easily be applied as a checklist while writing a manuscript as well as in the review process.

The basic principle behind the rules is that one needs to handle references as a kind of evidence in much the same way as measured data and observations.

When one presents one's data one has to secure representativeness (coverage), accuracy and precision, otherwise there is bias: Omission of data – except when there is a good reason and when this is explicitly stated – is fraud, and so is other kinds of conscious, sloppy ways of dealing with data and their analysis. The same holds for the way references are used in a manuscript. Our rules cover representativeness (Rules #4, 5, 10, and 12), accuracy (Rules #1, 3, and 4), precision (Rules #2 and 6), omission (Rule #11), some of them fall also under the category of sloppiness.

It is the responsibility solely of the authors that the referencing and reference list are correct and complete. Although reviewers and editors may save authors from some embarrassments by identifying gross errors in referencing, poor referencing that is not identified in the peer review process will in the end negatively impact the authors’ reputations.

The rules presented here are based on our experience as reviewers and journal editor. We are aware that other rules may apply which we have taken for granted or which may not yet have surfaced. We expect that with time the proposed rules will be sharpened and new rules will be developed that will guide authors in proper referencing previous work.

References