Improving Bridging from Informatics Practice to Theory

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Summary
Background: In 1962, Methods of Information in Medicine (MIM) began to publish papers on the methodology and scientific fundamentals of organizing, representing, and analyzing data, information, and knowledge in biomedicine and health care. Considered a companion journal, Applied Clinical Informatics (ACI) was launched in 2009 with a mission to establish a platform that allows sharing of knowledge between clinical medicine and health IT specialists as well as to bridge gaps between visionary design and successful and pragmatic deployment of clinical information systems. Both journals are official journals of the International Medical Informatics Association.

Objectives: As a follow-up to prior work, we set out to explore congruencies and interdependencies in publications of ACI and MIM. The objectives were to describe the major topics discussed in articles published in ACI in 2014 and to determine if there was evidence that theory in 2014 MIM publications was informed by practice described in ACI publications in any year. We also set out to describe lessons learned in the context of bridging informatics practice and theory and offer opinions on how ACI editorial policies could evolve to foster and improve such bridging.

Methods: We conducted a retrospective observational study and reviewed all articles published in ACI during the calendar year 2014 (Volume 5) for their main theme, conclusions, and key words. We then reviewed the citations of all MIM papers from 2014 to determine if there were references to ACI articles from any year. Lessons learned in the context of bridging informatics practice and theory and opinions on ACI editorial policies were developed by consensus among the two authors.

Results: A total of 70 articles were published in ACI in 2014. Clinical decision support, clinical documentation, usability, Meaningful Use, health information exchange, patient portals, and clinical research informatics emerged as major themes. Only one MIM article from 2014 cited an ACI article. There are several lessons learned including the possibility that there may not be direct links between MIM theory and ACI practice articles. ACI editorial policies will continue to evolve to reflect the breadth and depth of the practice of clinical informatics and articles received for publication. Efforts to encourage bridging of informatics practice and theory may be considered by the ACI editors.

Conclusions: The lack of direct links from informatics theory-based papers published in MIM in 2014 to papers published in ACI continues as was described for papers published during 2012 to 2013 in the two companion journals. Thus, there is little evidence that theory in MIM has been informed by practice in ACI.

1. Introduction

In 1962, Methods of Information in Medicine (MIM) began to publish papers on the methodology and scientific fundamentals of organizing, representing, and analyzing data, information, and knowledge in biomedicine and health care [1, 2]. Due to increased demand for research and information focusing on the implementation, improvement, and maintenance of bedside health information systems, 47 years later the journal Applied Clinical Informatics (ACI) was launched in 2009 [3–5]. Both journals are official journals of IMIA, the International Medical Informatics Association [6]. Published by the same publishing house [7], they can be viewed to some extent as companion journals intended to maintain and strengthen bridging from informatics theory to practice and vice versa on an international level [8, 9].

The American Recovery and Reinvestment Act incentive payments for the implementation of electronic health records (EHR) increased the relevance of applications in informatics and the successful launch of the U.S. clinical informatics board certification for physicians accelerated the recognition of ACI as an official journal of the American Medical Informatics Association, a little over five years after its launch.

In 2014, we explored congruencies and interdependencies in publications of ACI and MIM in the years 2012 and 2013 [10, 11]. We recognized that congruencies could be found in themes, but with different emphasis in its contents. Interdependencies from practice to theory as well as from theory to practice were only limited. We acknowledged that the bridging goals remained far from achieved. In this manuscript as well as in a companion paper [12], we set out to explore if the lack of associ-
ation of publications in both journals con-
tinued in 2014 and to find ways to improve 
bridging through various means including 
potential changes to the journals’ editorial 
policies.

2. Questions

This paper attempts to address the follow-
ing questions:
1) Which major topics were being dis-
cussed in recent ACI publications?
2) Is there evidence that theory in MIM 
has been informed by practice in ACI?
3) Are there lessons learned in the context 
of bridging informatics practice and 
theory?
4) How could ACI editorial policies evolve 
to foster and improve bridging?

Our results for and/or answers to questions 
1 to 4 can be found in sections 4 to 7.

3. Material and Methods

Consistent with the methodology used ear-
ier, we conducted a retrospective observa-
tional study to answer the first question. 
Congruent with the analyses of 2012 and 
2013, we searched for all ACI publications 
in the calendar year 2014 (volume 5). Pub-
llications were defined as journal articles 
excluding editorials and letters to the edi-
tor. To identify these publications we used 
a Medline/PubMed [13] query, specifying 
ACI as the journal and limiting the publica-
tion dates to include January to 
December, 2014. The Medline/PubMed search 
was performed on September 30, 
2015. We retrieved a total of 73 publi-
cations through the search and excluded 
one editorial [14] and two special articles 
[10, 15] resulting in 70 publications in-
cluded in the analysis. Papers were re-
viewed and indexed. Complying with rules 
for good scientific practice (e.g. [16]), all 
indexing data have been stored and may be 
requested from the authors. All analyzed 
publications can be accessed through the 
respective publishing company’s web site 
mentioned above and/or through PubMed 
Central [17].

For question 2 we analyzed the refer-
ence lists of all MIM articles printed in 
2014 (excluding electronic papers to be 
printed after 2014 [29], editorials [8], 
letters to the editor [3] and [11] and 
searched the remaining 61 publications for 
references to articles published in ACI in 
any year. This was done using the find 
function across the reference lists of each 
MIM article on the MIM journal website 
[1] with the search term “Appl Clin Inform” 
and manually checking the reference lists 
in the printed journal issues.

Answers for questions 3 and 4 are based 
on the authors’ opinion and as such are 
subjective in nature.

4. Major Topics Discussed 
in ACI

Clinical Decision Support (CDS) was a 
major topic for 2014 ACI publications. A 
frequent theme was the poor performance 
of CDS tools for a variety of indications 
and settings including immunosuppressive 
therapy in transplant centers [18], medi-
cation administration and laboratory alerts 
in retirement/nursing homes [19, 20], as 
well as the continued high override rate of 
drug-drug alerts [21] requiring a tailoring 
of drug-drug alerts to specific user groups 
[22]. Very interesting work from Korea 
demonstrated that CDS cannot be just 
translated into other languages, but that 
there is a need to modify the CDS to ac-
count for cultural differences [23]. At 
the same time, ample evidence was provided 
on the success of CDS for a variety of tasks 
such as reducing and improving use of 
antimicrobials [24, 25], increasing the util-
ization of HIV testing [26], improving insu-
lin-dosing in diabetics [27], preventing 
drug overdoses [28], improving scheduling 
[29], predicting readmission rates based on 
the patient’s medication regimen [30], pre-
dicting acute kidney injury [31], predicting 
patients with acute respiratory distress syn-
drome early [32], identifying adverse drug 
reactions from claims data [33], potentially 
reducing the risk for malpractice claims 
[34], and identifying foreign-born individ-
uals [35]. The challenge of developing CDS 
from existing guidelines was highlighted 
with an analysis of the Bright Futures 
Guidelines, which were found to have only 
52 actionable items [36].

Clinical documentation was another 
major topic of discussion. Topics ranged 
from purposes of documentation [37], 
required/desired data elements in EHRs 
[38, 39], representation of relatives in 
structure data format [40], data standard-
ization [41], reasons for free text use [42] 
and the benefits of text prediction [43], and 
documentation quality [44] and timeliness 
[45] in relation to documentation method. 
Papers on ontology content as bridge for 
tobacco use information collected in het-
erogeneous systems [46] and SNOMED 
CT concept set visualization rounded out 
this topic [47].

One recurring topic focused on the age 
of the users or the patients when interac-
ting with health information technology 
(HIT). There was overarching consensus 
that acceptance by younger users is higher 
in CDS [48], portal [49], and computerized 
provider order entry (CPOE) use [50]. User 
acceptance was a frequently discussed 
theme in e-prescribing systems [51] and 
two papers found that user interface design 
has a major impact on e-prescribing [52, 
53]. Related to these findings were papers 
on usability of drug alerts [54], work flow 
analysis in diabetes [55], and user centered 
design of tools to document falls [56] or 
quality of life [57].

The impact of regulatory changes in the 
U.S. in the form of Meaningful Use (MU) 
legislation was a frequently discussed topic 
[21, 58]. Skepticism in the provider com-
munity that Meaningful Use will improve 
care [59] was joined with evidence of lack 
of usability of drug-drug alerts [21] and 
challenges to extract quality measures [60]. 
One paper explored length of stay (LOS) in 
conjunction with CPOE implementation 
mandated by MU and found a 20% reduc-
tion in LOS associated with CPOE adopt-
ion [61]. Funding for HIT was further found 
to improve quality measures and im-
proved quality of care [62]. At the same 
time, EHR implementation [63] – a major 
feature of MU – was not associated with a 
reduction in readmissions [64]. One of the 
consequences of MU – the change to a new 
EHR vendor [65] – was addressed in a paper 
discussing data migration from one 
EHR to another [66].
5. Links from Practice to Theory

In 2014 Haux and Lehmann stated that bridging between both journals (ACI and MIM) was very limited although congruencies in themes could be found but with different emphasis [10, 11]. These statements were the results of analyzing ACI and MIM articles published during 2012–2013 by comparing articles during the same time period. Although ACI being a rather new journal had a cited half-life of 2.7 years in 2014 [89], it would be rather unusual to find links when comparing articles of the same year.

In addition to analyzing the topic descriptions of ACI, we therefore looked for evidence that ACI practice informed MIM theory by analyzing the reference lists in MIM publications. Analysis of the references of all MIM publications from 2014 except [11] revealed that only one MIM article [90] cited a paper from ACI [91] from any year. The ACI article that was cited described requirements of IT infrastructure components for bio-banking. In the MIM article, a new method for integrating collection protocols in bio-banking information systems was presented and some of the requirements detailed in the ACI article were taken into account. This example shows a possible direct link where practice is used to inform new theory. However, in general the practice to theory links between both journals were extremely low.

6. Discussion

There are several lessons from this seemingly aspirational exercise of trying to find references to ACI publications in MIM papers as practical underpinnings for theory and/or methodological development. The first is that the relatively short life of ACI (< 6 years) may not be sufficient to realize the hope of the founding editors to see a direct link from papers on the practice of clinical informatics to theory-based papers published in MIM. This leads to the second lesson that it may not be possible to find such a link in all papers published in ACI due to the nature of the topic being discussed. It is also possible that the current ACI editorial policy that asks for ‘clinical relevance’ statements to be included in each paper directs the authors to consider only the significance of their work to the clinical realm.

Current editorial policies of ACI are to peer-review and accept manuscripts on any topic of relevance to clinical informaticians in operational roles, academics, government, and industry. ACI’s mission is to establish a platform that allows sharing of knowledge between clinical medicine and health IT specialists as well as to bridge gaps between visionary design and successful and pragmatic deployment. Topics of interest as stated on our website include clinical information systems, personal health records, physician/provider order entry, electronic prescribing, clinical decision support, nursing information systems, patient scheduling and tracking tools, lab information systems, radiology information systems, administrative and management systems, eHealth systems, information technology development, deployment, and evaluation, socio-technical aspects of information technology and health IT training.

As with any academic journal, we consider articles that are submitted to us (unsolicited) for regular or theme issues while keeping solicited manuscripts on specific topics of interest or editorials to a minimum. In this setting, there are several possible directions in which ACI editorial policy could evolve. Based on consensus from the editorial board, there is a possibility of encouraging and even fostering theme issues on topics of interests including a yearly or bi-annual issue on the specific topic of bridging informatics practice and theory. To supplement the ‘clinical relevance’ statement, it is conceivable that authors may be asked to consider adding a statement on “underlying informatics theory, if any” to their submissions and cite relevant journal articles to support this statement (MIM and other journals). The composition of the editorial board (of Editor-in-Chief and senior and associate editors) may also subtly influence submissions, peer review, and acceptance. The legacy policy of maintaining a diverse and international editorial board of clinical informaticians in various operations and research roles ensures a broad interest in clinical informatics and likely encourages high-quality submissions.

We acknowledge several limitations of this exercise. We did not perform a thorough systematic analysis of the reference lists in all MIM articles but we could observe that MIM authors very often cite medical/clinical journals when referring to a problem or clinical application area. An example of this was in 2014 when one of the focus themes dealt with bio-signal interpretation and there were numerous references to a clinical journal (Circulation).
7. Conclusions

The lack of direct links from informatics theory-based papers published in MIM in 2014 to papers published in ACI continues as was described for papers published during 2012 to 2013 in the two companion journals. Thus, there is little evidence that theory in MIM has been informed by practice in ACI. From its position as an official journal of IMIA, ACI has now matured and achieved recognition as an official journal of AMIA. This is expected to increase the number of submissions and may lead to links to articles in the Journal of the American Medical Informatics Association (JAMIA). These changes will likely lead to subtle shifts in editorial policies and acceptance of articles of broad interest to members of two large and influential international informatics organizations. For the successful practice of clinical informatics, the aspiration continues that there be direct links and bridging to informatics theories, established and evolving.

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