Journal of Biomedical Informatics 60 (2016) 365–375

Contents lists available at ScienceDirect

Journal of Biomedical Informatics

journal homepage: www.elsevier.com/locate/yjbin

Special Communication

Health IT vendors and the academic community: The 2014 ACMI debate

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ARTICLE INFO

Article history:
Received 11 December 2015
Revised 29 January 2016
Accepted 1 March 2016
Available online 8 March 2016

Keywords:
Electronic health records
Health information technology
Technological innovation
Industry
Universities

ABSTRACT

The American College of Medical Informatics (ACMI) periodically hosts a debate at the American Medical Informatics Association (AMIA) fall symposium on a timely topic in biomedical informatics. In 2014 a panel of ACMI fellows debated the following proposition: "The lack of interaction and collaboration between health IT vendors and academic clinical informatics units is stifling innovation and will continue to have a detrimental effect on the evolution of commercial products." Debaters disagreed on the level of interaction and collaboration between the health IT sector and academia and disagreed on whether and by whom innovation was actually taking place. While collaboration between industry and academia was seen as desirable by all of the debaters, there was an acknowledgment that these groups have notably different roles and responsibilities. There was consensus that a path forward should be found, and that AMIA itself has an important role to play in effecting this.

1. Introduction

The American College of Medical Informatics (ACMI) periodically hosts a debate at the American Medical Informatics Association (AMIA) fall symposium on a timely topic in biomedical informatics. The topic for the 2014 debate concerned the relationship between the commercial health information technology (HIT) sector and the academic clinical informatics community – with a view to the impact that the nature of this relationship has on innovation and evolution of commercial HIT systems. This year's debaters were ACMI fellows Ross Koppel, PhD, University of Pennsylvania, Curtis Langlotz, MD, PhD, Stanford University, John Glaser, PhD, Siemens Healthcare and Jonathan Silverstein, MD, MS, NorthShore University HealthSystem. Alexa McCray, PhD, Harvard Medical School, the current ACMI President, served as moderator for the debate.

Several themes arose during the debate and in the ensuing discussion. Recognizing the transformational power of information technology in our modern society and seeing its potential in the health care field, the Federal government enacted the Health Information Technology for Economic and Clinical Health (HITECH) Act in 2009 [1–3]. The debaters discussed both the positive and negative impact that this legislation, and, in particular, its 'meaningful use' provisions and what impact these provisions have had on innovation in the development of HIT systems [4,5].

Industry, likewise, has recognized the potential of information technology, with the debaters noting the sharp rise in the amount of venture capital funds expended on health IT innovation, and the large number of patents that have been granted to health IT firms. There was, however, concern that although there are numerous health IT startups, with some evidence of successful collaboration between these innovative companies and academia (see, e.g., [6]), that the successful integration of the technologies developed by these small emerging companies with the large electronic health record (EHR) vendors was uncertain.

A significant part of the debate involved the technical aspects of large-scale EHR systems, and, in particular, issues related to usability, standards, and interoperability – topics that have been discussed widely in the literature, but with no clear resolution as of yet. See, for example, [7–11].

Debaters disagreed on the level of interaction and collaboration between the health IT sector and academia and provided examples of suboptimal interaction, and the consequences thereof, as well as examples where there was interaction with benefit to both groups. While collaboration and interaction between industry and academia was seen as desirable by all of the debaters, there was an

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http://dx.doi.org/10.1016/j.jbi.2016.03.003
1532-0464/

acknowledgment that these groups have notably different responsibilities, incentives, and roles.

These different roles have an impact on whether and what types of collaboration are possible. Vendors are working in a rapidly evolving industry and are subject to governmental regulations that require modifications to their systems according to a specified timeline. The debaters noted that this has led to some short-term thinking, with little attention paid to the longer-term vision for well-functioning, interoperable systems that are designed according to recognized and community developed standards. Academics are researchers with the attendant pressures of publishing, teaching, and seeking grants. In addition, while informatics researchers have built EHRs for entire hospital systems, many are now faced with using commercially designed systems that leave little room for the innovation that has characterized the field.

Given these different roles and incentives, there are, nonetheless, approaches that can be taken for bridging these communities. Related fields where collaborations between academia and industry have been successful may provide valuable insights and new models for moving forward. For example, vendors might, as they have done in other fields, provide fellowships and grants to academics to develop new ideas that will lead to the improvement of health care IT systems. Vendors should now also be in a better position to open up their software architectures for innovative development by others, and they should do so. Academics, for their part, can ensure that the students who graduate from their programs have the training and background to engage across the vendor and academic communities. Academics should leverage their leadership roles in professional societies to influence the development of transparent and standards-based systems, and they should take advantage of their society meetings and other forums to foster open dialog among all segments of the Health IT community. Concrete steps in this direction have already been taken by AMIA, which regularly brings members of each of the communities together at conferences and in other venues. AMIA task forces, comprising members of both sectors, as well as members of the Federal government, have recently published white papers on the status and future of electronic health record systems [12,13].

There was consensus that we need a path forward, in spite of the challenges in doing so, and that the tensions between the academic informatics community and the commercial sector must be put behind us. There is great opportunity for the two communities to learn from each other and to find new and effective ways of working together.

In the following, while we have edited the debate transcript for clarity and added references where appropriate, we have attempted to maintain the informal, conversational, and lively style of the discussion.

2. Introductory remarks

Dr. McCray: I will be your host this morning for our ACMI debate. As is customary for all ACMI debates, this year's debate treats a timely topic in informatics, namely, the interaction or lack thereof between health IT vendors and the academic community. The proposition for the debate is:

> Resolved: The lack of interaction and collaboration between health IT vendors and academic clinical informatics units is stifling innovation and will continue to have a detrimental effect on the evolution of commercial products.

Our debaters will be Ross Koppel of the Department of Sociology and Perelman School of Medicine at the University of Pennsylvania and Curtis Langlotz of the Department of Radiology at the Stanford University Medical Center. They will be speaking for the resolution. John Glaser of the Health Services Division of Siemens Healthcare and Jonathan Silverstein of the Center for Biomedical Research Informatics at NorthShore University HealthSystem will be speaking against the resolution.

In the tradition of debating practices, the debaters will take strong opposing positions in order to stimulate discussion. There will be ample time for audience questions and comments, and at the conclusion of the session, I will ask you to vote for or against the resolution with a show of hands.

3. Statement in support of the proposition

Dr. Koppel (RK): In terms of history it's very clear that academics were intimately involved in the development of HIT and EHRs [14]. So, we're not going to debate that part. However, in terms of the current focus on innovation, it is pretty clear that if vendors have been benefitting from academics, then as a lifelong academic I am profoundly disappointed with my own profession because there's very little innovation that I see out there. If our contribution has been seminal, then I should pick another job. If the vendors have not been listening to us, then shame on them and shame on us because we academics should have done a better job of explaining what it is we think could be better, and they should have perhaps been listening to us.

Let's take a look at some specific examples. I was one of the only academics who briefed the JASON task force. (JASON is a think tank commissioned by the ONC to address problems with EHRs and lack of interoperability.) This is not the joint task force with ONC, but the actual JASON folk out in California, and I know the report that they wrote [15]. Look at what happened when the task force, which was composed of mainly vendors and some ONC regulators and academics met. They gutted the JASON report, which called for data standards and interoperability, and they accepted the part that said we need workarounds, which are APIs. APIs, as most of you know, are "application programming interfaces," sets of requirements that govern how one application can talk with another. In our case of EHR data, APIs might reconfigure how data are listed in one EHR so that they can be transferred correctly into another EHR. Alas, APIs are not all created equal, and many EHRs have remarkably arbitrary ways of recording and displaying data. Thus, relying on APIs – instead of just requiring clear data standards – is often an act of faith. In fact, ONCs solution was to use APIs and a limited number of variables to be placed in a C-CDA (Consolidated-Clinical Document Architecture) that would allow transfer of EHR information. However, a recent study by John D'Amore and colleagues on C-CDA's [16] examined some ninety-one different types of C-CDAs from scores of EHRs. And what did the authors find? They found that there were six hundred and fifteen transfer errors in the C-CDAs. C-CDAs are a workaround required by the lack of interoperability and the lack of accepted data standards. So even that workaround failed repeatedly. And by the way, look at the number of vendors who came to John D'Amore and his colleagues at Harvard. Some vendors were involved in the work with him at first, but the number of vendors who came and said help us improve our C-CDAs was zero. Zero vendors came to John to seek help with their C-CCDAs.

The key point here is that, once again, the industry was offered academics' insights but they ignored the hard parts and went for the easy parts that kept their IP intact.

Speaking of vendors and openness, as you know, there's the nondisclosure clause in vendor contracts. I have in my bag the report to the FDA, funded by the FDA, written by my colleagues at Harvard and me and some others at other universities. The study involved four or five different EHR vendors, involving six world-class institutions – Penn, Harvard, Montefiore, New York and the

like – in which we looked at the role of EHRs and CPOE screens in reducing medication prescribing errors. We came up with fifty-nine or so powerful innovations that should be adopted by industry. Guess who will see this report? No one. That's because it has screenshots, and the vendors do not want to allow anyone to see screenshots. What kind of joint innovation is going to happen when the results of research paid for by the FDA are not allowed to be seen by anyone?

Then there are features that people have been calling for forever. For example, what do neonatologists want from the vendors? They want a couple of decimal places when rounding up for dosages. Because what is a trivial difference for a two-hundred pound man, for a .6 kg baby is the difference between life and death. Have they gotten them? With struggle, and sometimes they still don't have them. We kill babies because of this. Also, there's a study out now that shows that when you have a photograph of the patient it can reduce patient errors up to 24% in children's hospitals and up to 40% in adult hospitals [17]. We have been asking for photos on every page of the EHR. We still don't have it.

I have a lot more to say, but let me just end with a few comments. The vendors and the enthusiasts out of true belief in the power and value of HIT sought to create meaningful use (MU). It was something that was on the books for twenty or thirty years. MU is not a new idea to the vendors and to people who wanted EHRs. Remember that the vendors created MU, and they cannot now claim that MU is the barrier to innovation. It is sort of like Henry Ford saying he can't get around town because there's so much car traffic. This is a creation of the vendors because they genuinely thought it would help safety, and we all believe in that, but also because it, of course, had tremendous sales value.

4. Rebuttal to Dr. Koppel's statement

Dr. Silverstein (JS): Let me first say a few words about this notion of APIs as workarounds. This is a notion very near and dear to my heart. I have been spending a lot of time working on scalability and interaction amongst large and different types of systems and organizations and the way that we're enabling interoperability as a community and worldwide in modern times. And so to say that we need to take an interoperability approach that is specifically designed like building a bridge rather than one that is highly flexible and allows innovation in multiple places I think is just wrongheaded. This notion that the JASON task force didn't listen seems to me to have two problems in your argument, Ross. One is that you mentioned you were there. It seems to me that shows evidence of interaction and collaboration and the opportunity to innovate together. And, second, it seems right to me that there is a lot of listening and heading towards service oriented architectures as the platforms for innovation in this field.

Regarding these questions: are the vendors listening or not, and are we interacting or not? The academic world and the commercial world have different roles. I do not think it is shame on us for doing academic work, and I don't think it is shame on the vendors for doing commercial work. If the commercial activities are adopting things from robust work in this field done by many of all of you for the last thirty years, that is terrific. If academics want to get involved in that and profit from it, they ought to do that, but at some point they may have to switch back and forth from academics to industry as some here have done. So, in the robust debating tradition, I will call you elitist for saying that vendors should come to us to ask us how to improve things. You described many vendors and academics working together to reduce prescribing errors. I think that is terrific. That's a time when the vendors can come to us academics.

In response to the statement that you made about the FDA report and how can there be joint innovation when you can't share the results of a report that has screen shots, I would say, in terms of moving things forward, all we can do is hope that the vendors will use that information to improve their product. This is a problem that cannot be entirely solved as long as there is IP. The IP has to be protected. If the vendors see IP as screenshots, one can't avoid that. It is great that they've been willing to engage despite that.

5. Statement in opposition to the proposition

Dr. Glaser (JG): I want to take two pieces of the resolution and zero in on them. The first is the term 'stifling innovation'. Is that happening in this industry? Jon and I actually believe innovation is accelerating, and let me give you some examples and some data that would, I presume, support that argument. If you look at venture capital money that went into HIT, you will see that venture capital money is funding innovation, small startup companies, etc. Data provided by Brian Edwards, StartUp Health Fellow [18], showed that in the year 2006, $200 million was invested by venture capital companies broadly. Just running down the years, in 2010, it was $1.1 billion in 142 deals, and these are infusions of money and/or second infusions of money. In 2011, it was $1.6 billion in 242 deals. In 2012, it was $2.2 billion in 447 deals, and in 2013 it was $2.8 billion in 580 deals, and so far in the first half of calendar year 2014 about $3.3 billion is going in, and there were 248 deals as of that moment. So there is this rapid and dramatic uptake of money going to fund smart startup ideas that will challenge the incumbents, advance the cause, and advance innovation. Venture capital money tends to go to companies that are far enough along. They've got product. They may actually have some customers. They've got a good start, but these companies still need money.

Then there is a segment called, "I've got an idea, and I need help just to get out the door here," and there you look at the incubators. That's one of the roles of the incubators. For example, Rock Health has got 50 companies, or startup companies. Blueprint Health has 100; Dream IT 127; Startup Health 76; and there are many other incubators, such as Health Box and Health Wildcatters [18]. There's been an extraordinary increase in the last five, let alone ten years of incubators and hundreds of people with great ideas. In fact, it looks like about 20% of all the VCs and startups actually come out of the academic community. They either have academic ties to an institution or are in the informatics community.

If you also say, what about the incumbents, the big guys, the Epics, the Cerners and the Siemens, etc.? We will look at patents as a bellwether of innovation. You combine the patents of Siemens, Microsoft, Cerner, McKesson, Optum, Epic, and Allscripts. You take those organizations, you bundle them together. In the last five years, they've been granted 526 patents across all of those organizations. So what about all the time leading up to those five years ago? If you go back to 2009 and the decades that preceded this, there was a grand total of 150. So, we've gone from 150 over a couple of decades to 526 over the last couple of years and 707 that are in process, or being applied for [19]. If you take as signs of innovation, venture capital money, incubators, and patent activity, you could say there is a lot of innovation going on here.

Now, how much of it involves the academic community? That is a separate question. The key part of the resolution is stifling innovation. That isn't happening. It's going the other way. It's a separate question whether academics have a role here. In addition to that it's still early and nascent, but nonetheless reflective in organizations like Athena, Epic, Cerner, and Siemens that are coming together to open up their systems through a series of APIs and services and trying to foster ecosystems. They're early and learning how to do this, but they're making really good progress. And all of them are saying we want to encourage innovation. A lot of people don't want to write the ideal CPOE system, but they do

want to write applications that surround and support that and leverage that. We see a lot of activity along these lines, and a number of vendors and providers have come together, for example, under the Healthcare Services Platform Consortium [20] to get standards in this realm, and so you look at who's participating in this. It is Cerner. It's HP. It's Harris. It's Siemens. It's Epic. It's Relay Health. It's Allscripts; along with Intermountain Healthcare, the Mayo Clinic, the NLM and the VA. This is an example of industry coming together with the academic and the government communities to say let's further the cause of the interoperability using services, taking the next step beyond the standards that we've adopted through HL7 and things along those lines. So there is a fair amount of activity.

The second part of the resolution makes the statement that there is a lack of interaction and collaboration between the health IT vendors and the academic clinical informatics community. I don't doubt that there are examples where collaboration isn't happening, and we ought to get to this during the discussion – how to increase the interaction because I do think we will collectively benefit, but to say there is a lack of interaction is incorrect. Just some basic examples – if you look at the corporate sponsors of AMIA: Cerner, Oracle, GE, IBM, HP, Meditech, Siemens, and Philips all sponsor this organization. Why do the vendors sponsor this organization? Because they want to encourage the organization. They want it to thrive. They want the academic community to thrive. They want the innovation to occur. They want the funds to be available so that you can hold events like this, to publish in *JAMIA* or a variety of other things like that.

If you look at the AMIA membership, 13%, or 650 people, work for a vendor, and I'll bet a number of them are here. I'm not going to ask for a show of hands, but I can see some faces in the audience. The vendors also read *JAMIA*. They're going to the talks. They're giving the talks. They're having the hallway conversations that are occurring. They are interacting. That's what interacting means. They are part of this community. They are engaged in this community and want to learn from this community. They want to take those ideas back to their customer base, back to their products. So there's real interaction that is occurring across the board here. In addition, I know that in the International Ballroom East the health learning community principles [21] are being discussed, and you see a range of vendors who are engaging in those discussions.

If you take these two pieces: stifling innovation and interaction, you will see that stifling of innovation is not happening. In fact, it is going the other way, and a fair amount of interaction is occurring.

I have one last comment about the statement that meaningful use is sponsored by the vendor community. Now, I was part of the early Markle efforts and the early eHealth initiative efforts that led to and helped guide the staffers in Congress when they wrote the HITECH legislation [1]. Those were multi stakeholder forums. Those forums had vendors. Yes, they did. They had academics. They had providers. They had people from health plans. They had people from the life sciences. They had people from advocacy groups. Those were multi-stakeholder initiatives that fundamentally said if we're going to improve the care in this country, including improving safety, quality, and efficiency of health care, we'll need vendors, but we also need providers; we need health plans; we need the whole community coming together to make that happen. That was the origin of the HITECH legislation together with the pioneering efforts of Carol Diamond at Markle and Janet Marchibroda at the eHealth Initiative, that led to the legislation [22,23].

Remember, any resolution can collapse if you take a piece of it out. You don't have to defeat all the clauses in the resolution. If you take out the clauses 'stifling innovation' and 'interaction' – the resolution collapses. Did the vendors benefit? Sure. Do patients benefit? Sure. Do providers benefit? Sure. Do health plans benefit? Sure. Does policy benefit? Everybody. We have a lot of work to do to make this all happen. But I want to make sure that we understand that the HITECH Act was a result of a field coming together collectively to make it happen.

6. Rebuttal to Dr. Glaser's statement

RK: If all of this money is going into innovation and HIT, then you are worse spenders of money than are academics. Because look at what everybody says about HIT. They call it clunky. They call it unusable. They call it state-of-the art interfaces circa 1997. We asked the implementation list to tell us of their experiences on vendors accepting innovation from academics [24]. This is what the vendors said. They listen politely. Then they say we can do it better than you. You don't understand what it takes to make a product. We're not interested in improving our product. It's wonderful. They refer us to the engineering department, and then nothing happens, and they keep talking until we say let's get the IP people here from the university, and then they disappear.

And look at usability. When I faced the vendor committee and Carl Dvorak (of Epic), the questions asked of me and of other usability academics were:

- Is it not the case that usability is entirely theoretic?
- Is it not the case that usability is entirely subjective?
- Is it not the case that usability is not measurable? – and there's no point in measuring it.
- Is it not the case that usability is entirely dependent on the implementation, and it's screwed up by the users who don't understand it?

And then they answered their own questions. They said "We get feedback from customers. We know our system is great. We measure it carefully." (Note the irony.) We have our own human factors experts. (Again, note the irony.)

On the key issue of usability and learning from academics, the vendors resisted it. You mentioned the idea of learning from the screenshots, but nobody will see those screenshots because the vendors won't let us display them. We are dealing with an information void under the name of IP protection. But if these are screenshots that lead to errors then what are they protecting? I mean, if they were Machiavellian, they'd want the other vendors to accept their terrible screenshots.

NIST is a part of HITECH. All vendors were asked to submit their EHRs to NIST for evaluation of their usability. But this is what the vendors wrote into the regulations: You don't need to submit your software. If you do submit, you don't have to tell anybody if you've submitted or not. You don't have to report the results, and NIST is not allowed to tell anyone whether or not a vendor has submitted and what the report was. So where is the innovation to be learned from that? Where is that cross fertilization? Where is that openness?

There is a small vendor who had a problem, which was that they didn't want to write software that would allow the users, doctors and the like, to search the entire EHR record for something. The users could only search that one screen that you were looking at. So they said, "Dear customers, please write to the ONC and tell them that it would be distracting to allow us to search the entire record. Just tell them it's enough to search that one screen." The vendor wrote that note to their customers, and the note said "Remove our name here and insert your hospital name." Many hospitals submitted the statement to the ONC with the staged directions included about removing the vendor statement and inserting the hospital name before submitting it. That's how I got it.

7. Statement in support of the resolution

Dr. Langlotz (CL): My perspective on this issue is that of a practicing radiologist. I grew up in the academic ivory tower of Stanford University in the 1980s and then ran a startup for several years in the 1990s and early 2000s, and since then I have had academic and hospital positions both at Penn and at Stanford where I've been a customer of these vendors. So, I've been a vendor. I've been a customer. I've been an ivory tower researcher. Ross has talked about the evidence that innovation is not happening and the barriers to innovation. I would like to talk about some of the factors that are environmental, contextual, indirect, and some of the motivations of the vendors and the attributes of the marketplace in which the vendors live that lead to this lack of innovation.

One reason that there are barriers to collaboration between vendors and academics is the lack of market forces. You look at the current EMR market, which is really the big gorilla. There was some mention of venture capital dollars as the measure of innovation. Well, really what we're talking about here are the electronic medical records that we use every day, and that involves primarily a small group of vendors; particularly when we're talking about who sells to the academic market. We're talking about a very small two or three and shrinking set of vendors who sell to the academic marketplace. The government just dropped tens of billions of dollars into that marketplace so that these vendors, in many cases, don't even need to market their products. They don't spend money on marketing. They simply wait for the customers to come in the door and ask them to install their services.

That's not an environment where the vendors need to be very responsive to the academic customers in terms of providing innovation. The academic customers themselves are often locked in long-term contracts – often nine-figure contracts or billion dollar contracts. The customers are locked into those contracts and are not able to change vendors. So they don't have the leverage with the vendors that would facilitate that collaboration. If the customer wanted to transition to a new product, the standards are really not there that would allow their electronic medical record data to move easily into that new product. So there's this possibility of a kind of a divorce where the jilted vendor would be required to extract the data and provide it to the new electronic medical record system. So, the marketplace is not conducive to facilitating innovation in these arrangements between academic customers and industry.

Let's talk about what product is really being sold and who it's being sold to. The true customer is the person who spends the money for the product. That is really the C-Suite of the hospital. It's not the academic innovator. It's not the practicing physician. Generally the vendors are selling not so much the software or the user experience, which, by the way, is extremely difficult for a customer to evaluate because of the panoply of different user experiences, from radiologists, anesthesia, gastroenterology clinic, to internal medicine clinic, etc. All of these are different user experiences. To evaluate each of those at multiple points is extremely difficult to do in advance of installation of that system. Instead, what the vendors are doing is they're selling an installation process that will be successful so that no one will get fired; that makes it difficult for the users of that system to then later object to the way that system is installed and configured at their institution. They're also selling the ability to interface to every legacy system under the sun, and, as I said, nobody gets fired.

What are the obstacles to innovation, and what are the reasons that the vendors don't do it? The vendors have an extremely complex software system that they're trying to sell. I can tell you as a startup vendor. Our system wasn't even that big, and we had these same very complex problems. You touch anything and the other pieces start to get into trouble. So the vendors don't want to perturb that installed base that interfaces to all those other systems. They don't want to make changes. They're working with outdated platforms. Some of the languages that are being used that underpin our modern systems have been in existence since the 1960s.

Given the size and scope of these companies, it's extremely difficult for the small fry to compete. Normally in these marketplaces you would have academic innovation, creating startups, and the startups would compete with these electronic medical record vendors. If you look at the venture capital dollars that were mentioned that are being invested now, those are primarily being invested in consumer health companies. Those are not likely to displace these very large vendors, which are selling the electronic systems that we're using at our hospitals and our clinics today. It's really unlikely to be a kind of Netflix/Blockbuster scenario where you have a small furry mammal that makes these giant dinosaurs extinct. The dinosaurs are going to be here for a long, long time, and so that's really the calcified state of the electronic medical record market that makes innovation and collaboration between academics and industry difficult.

What happens when you have a marketplace where you've got two of the largest vendors merging? One of them probably could have paid cash to buy the other. Clearly it has a large war chest of money. The other vendor, when I looked at the most recent market research reports, has about 90% going-forward market share in the hospital electronic medical record market. These are vendors who are doing very well, who just had tens of billions of dollars dropped on their market, and yet there's very little support for academic research.

In my world, in radiology, we have something called GERRAF grants [25,26]. The first two letters, "GE", are not a coincidence. The money comes from vendors, and those are career development awards that help academics who are interested in health services research and innovative informatics techniques. These are the kinds of things that don't generally exist today that could exist, that could really foster the innovations in the big gorilla market, which is the electronic medical record system that we all use every day.

8. Rebuttal in response to Dr. Langlotz' statement

JG: First, the focus of Curt's remarks was on the electronic health record, which is obviously a big part of the market. However, the resolution is about healthcare IT, which includes consumer facing activities, including wellness. It includes population health. It includes clinical knowledge based incentives. So it is a fairly broad market and getting increasingly broad. Second, the focus was also on academic health centers, but again healthcare providers are a lot more diverse than that. There are community hospitals, critical access hospitals with clinics, freestanding physician practices, etc. Just remember that we are dealing with healthcare IT across this broad market and some venture money is going into EHRs, but a lot is going into a series of innovations surrounding that.

You have to be careful, and I sit as a vendor, to conclude that there's not fierce competition within the vendor community for business. In a normal year, about 6–10% of health systems or hospitals change their vendor, and we're likely to see an uptick in that in the years ahead. People got to meaningful use in their systems. They say "I've got it, but I'm not exactly happy with the vendor I'm with, and I'm expecting to move". So there is a fair amount of market still out there that they will compete for. When you look at the meaningful use adoption statistics, we're about halfway with the doctors. There are still a lot of docs who are not using these

systems. We're probably 70% on the hospitals, but even there are some basic EHRs, etc. So, one should not conclude the market is locked up in any way.

It is hard to switch these systems when you get in, but, nonetheless, churn occurs, and if you look at other industries like the ERP business management software companies, you see Salesforce.com taking on the SAPs and the Oracle's, etc. So it does happen, and if you look in the IT industry, you know, you would have said Microsoft had a lock on healthcare IT or the IT infrastructure several years ago and all of a sudden, there are the Google's of the world. You have to be careful with the assumption that the big vendors have a lock and hence don't care. They care because they have to compete. They are expected to grow. That's why shareholders invest in them, and so they fight like crazy because of this.

I appreciate the comment that it's a complex sale. Yes, it is. You have to engage those who deliver care in the trenches. You have to engage those who are responsible for the overall quality and the ability of the organization to thrive. You are selling to boards; you are selling to C-Suites; you're selling to people in the trenches; and they look at very different things and have very different obligations and commitments to the organization. So it's a complex sale. All need to weigh in on this thing, and that's part of the dynamic. At the end of the day, the customers don't buy software as much as they buy improvements in organizational performance. How do I make my care better? How do I make it safer? How do I make the lives of my clinicians more convenient, etc.? It is a combination of the software, but to the point raised it's also a combination of the implementation approaches, etc. No wonder they're cautious in some ways. They don't want to screw it up.

You all know the failure rates on large IT projects where, if there's not a mushroom cloud, there's vast overrunning of budgets and timeframes If you're not careful, you can damage the organization. So, the system selection process tends to be conservative in lots of ways. It is appropriate to be conservative and to avoid unnecessary implementation risk, but at the same time there is a great deal of interest in thriving on the innovation that is brought by the vendors and on the innovation that is brought by the venture capital community because all of the vendors realize they have to innovate if they're going to thrive and stay alive in the years ahead.

9. Statement in opposition to the resolution

JS: Let me just state it first of all positively this way, at this point. Interaction and collaboration between health IT vendors and academic clinical informatics units is substantial and having a positive effect on the evolution of commercial products. Believe that. That is the positive that is directly contrary to the resolution.

Let me give you some evidence to get you along to that side. First, John talked a bit about the recent acceleration of HIT innovation. John mentioned some of these numbers but let me just summarize them. Since 2010, according to Startup Health – courtesy of Brian Edwards who manages the data there – there has been more than a tripling of the dollars invested in digital health deals. Startups in digital health, for a sense of scale, are running faster than a billion dollars of investment per quarter. The incubators are roaring and based on Brian's review of those deals in the last twelve months, 20% of those included a cofounder who was an academic or involved systems licensed from an academic institution. This to me is clear evidence of substantial interaction and collaboration between IT vendors and academic units. This acceleration is resulting now in even larger deals, which I see as a natural evolution as the market matures from many, many small startups to fewer successful ones gaining additional rounds of funding.

Let's look at technology evolution in general for a moment. Collaboration and innovation that involves interoperability, platforms and APIs. This comes late in technology evolution lifecycles. Systems have to first work effectively for a focused need and then develop add-on functionality via interfaces and APIs. Then finally the core elements may become swappable. If you look at software keyboards for smartphones, this is a core element that comes later in this kind of lifecycle. We're about midstream in the natural evolution of EMRs where wide deployment of vended systems is happening and they are maturing to enable interoperability. With that, at this current time, there is an extremely strong push for innovation and collaboration, particularly driven by changing healthcare financing models where the incentives for innovation and efficient care have become very real. If academic clinical informatics units wish to interact and collaborate with a rapidly evolving industry, they'll need to engage and find their own models and incentives to match with the models and incentives of the industry. Academics, too, are seeing the funding models driving toward corporate engagement particularly in this domain. So, it's natural. The argument I'm making is that it is natural, having built much of the market, that the vendors now would be opening up their software architectures, web-based application integration and patient contact sharing with third party applications.

Let me focus specifically on Epic for a few minutes. This is a market leader. One that has taken some heat from the other side. Before opening its service oriented architecture to its clients, Epic had hundreds of thousands of shared order sets, documentation tools, protocols and displays shareable in the community of Epic clients. There is a challenge in putting those things out completely openly in the broader marketplace. You can't really ask the vendor to do that, but they have done it openly with everyone who buys their product.

I want to highlight some projects in collaboration with our Center for Biomedical Research Informatics and the MyChart tethered portal of Epic, which we call NorthShoreConnect. We have about 250,000 users of this portal, and we do a lot of treatment payment and operations through NorthShoreConnect, but this is a tremendous infrastructure, and so we've taken on some innovative approaches to take advantage of that scale. One of the leading academics in this field is someone named Bill Knaus. As you may know, he built the APACHE score [27], commercialized it, and sold it to Cerner. He then was at the University of Virginia building something called Health Heritage using hundreds of rules to allow patients to collect their own health history, integrate that with features from the electronic medical record and run prediction rules on population risk for cancers [28]. This was a project funded by the Federal government over ten years with participation from Epic. He moved to our team at NorthShore University HealthSystem a few years ago in order to deploy this. We've made this work. The system is a stand-alone application that's now undergoing a commercial spinoff.

Health Heritage at NorthShore uses the security and context of the portal to bring patients over to it. It uses Epic's service oriented architecture (open.epic.com) to collect information from the electronic health record while interacting with the patient directly to collect other information that isn't in the record in order to run the rules, provide risk reports, give those to the patients with the option for the patients to send them, much like a test result, back to their doctors if they choose. In the very spirit of the newest technical approaches, the newest thoughts about patient control of their record, this works tremendously well as an innovation on top of this commercial platform that we could never do at this scale if the platform didn't exist. In five months, there are over 5000 people who have used it with about a 10% result of high risk in cancer – with those results being used to justify insurance payment for genetic testing and genetic counseling.

In another application using NorthShoreConnect, 3800 patients have consented in real time for genomic studies using Epic's portal. So, we've enabled a completely scalable genomic health initiative on top of the portal. Epic is now participating and figuring out with us how to do electronic consent on top of that. The point is that there are problems that require innovation and that have been solved at some scale. The vendors have a substantial challenge of filling a large customer base, with varying expectations and demands, IP protection, and physician demands. They've made a clear commitment to open architecture, to cross-vendor activities, and service oriented architecture. Innovations such as those I mentioned at NorthShore are happening at other leading organizations, including Children's Hospital of Philadelphia, Partners Health Care, Cincinnati Children's Hospital, and others.

10. Rebuttal in response to Dr. Silverstein's statement

CL: First of all, "clear commitment to open architecture" – I just leave that open to the group. Do we all think that the major EMR vendors have made a clear commitment to open architecture? Just answer that for yourself.

I did want to address a couple of points. One relates to measuring innovation with patents and venture capital dollars. I want fewer clicks in my core application that helps me care for my patient. I don't want patents. And I think that's the place where innovation needs to happen, and it hasn't been happening.

I want to particularly drill down on one of the areas that Jonathan raised, which is this service oriented architecture. We hear a lot about the JASON report. We hear about SMART on FHIR [29,30]. These are really interesting innovative technologies. There is an analogy to the app store, and I just want to talk about where that analogy really breaks down. We've seen an application, for example, demonstrated at this meeting, of a really neat growth chart – a different way to display the pediatric growth data using one of these SMART on FHIR applications. This is very cool. The question is, as these apps get closer and closer to the core business of the electronic record, where you're talking about entering orders, you're talking about documentation; if the companies were to commit to have this SMART on FHIR platform, where you could build an app on top of their EMR, and you start building an app that threatens their core business, do we have the trust that the company is going to continue to provide that platform? Or, is it going to become like the Apple iPhone that suddenly decides to just develop that app themselves and install it natively on every iPhone that's built and essentially put this small company out of business?

That's why when you look at the venture dollars, they're not yet investing in these apps to be built on top of the supposed open architectures of these electronic medical record systems. So, the areas of innovation are really being stifled. There are not small companies coming up who can compete with these large companies for the core business of interacting with electronic records, which physicians have to do and other caregivers have to do every day to care for their patients.

I'm going to give the last minute to my partner, Ross.

RK: If there's so much innovation, then why do we have proprietary systems that have created these towers of Babel? These isolated systems that don't talk with each other, and why is it that the ONC has to come up with these sort of Gilbert and Sullivan like amendments, delays, and things like that? There are 5800 certified EP products and about 2000 certified EH products [31,32]. About 1% have been attested to in actual use. Where is the innovation? Compare that to people's use of Androids and that sort of thing, and the SMART on FHIR, something I was involved with. Yesterday at this meeting, Cerner talked about how proud they were of accepting SMART on FHIR. But then the other vendors all said wait a second, SMART on FHIR is just the beginning metric. It would be wrong to insist on it. Don't make it mandatory. Don't include it. Don't require it. And the vendors did the same thing on usability issues. They said usability is very hard to measure. This was yesterday.

11. Question and answer period

The last half hour of the debate was devoted to questions and comments from the audience. These are shown below together with the responses from the debate participants.

Attendee (Robert Greenes): What we're seeing at Mayo Clinic and Intermountain Health, the VA, and other places is wrestling with things that go beyond improving the EHR. There are lots of situations where we need to integrate across systems; where we need to do patient centered things; where we need to do care coordination across venues; where we need to harness big data and analytics. That's where I think the innovation is occurring, and what we're trying to focus on is exactly those things that we can't do within the existing EHRs.

JS: This plays right into the things that I was cut off from earlier, so I'm going to finish right where I was. In regard to Epic in particular, they have committed to research collaboration very directly, and I will just cite two or three quick examples. One is the research advisory days that they have. There are over a hundred organizations presenting, including clinic analytics panels: three hundred top academics have participated in that over the last five years. Epic has put forth a research data network, which I co-chair with Peter Embi. They have active meetings to enable the possibility of doing research across 200 some instances at the same time. And then finally, OHSU has deployed a separate instance of Epic specifically to support research and education so that students in Bill Hersh's informatics training program can build their projects directly in a commercial EMR as part of that training. So I think along those avenues we see real and direct effort.

RK: Bill Hersh spoke about the program that he has, and he said that the way it works is that he can use it for teaching and for hands-on experience for his students, but the amount of research coming from it will be zero because of the concerns with IP and the like.

Attendee (Richard Singerman): I'm co-founder of TrustNetMD. We use social media as a clinician learning tool focusing on community healthcare workers and social workers. My question is about the innovation marketplace and especially consumerism. We've heard a lot about the entrenched giant HIT vendors in the hospitals. But recently there was the IOM report on having mental health and community health as part of the EHR. But how do you see really bringing in the rest of that continuum? For example, you have the VA Blue Button for consumer data. You had Health Vault five years ago, and you've got all these really cool innovators out there for social services for the homeless and for community healthcare workers. What is the view of the panelists on these innovations that are outside the walls of the hospital?

JG: There is no question that the incumbent EHR vendors could do a better job of having systems be more usable, be safer, etc. Everyone who is a vendor gets that, and is working on that. We ought to acknowledge that, and as you know, no one would say that the status quo is perfect. With that said, there is a lot of uncertainty about how you deal with the patient, the consumer, to engage them in their health, whether it's getting your hip done or whether you've got a series of chronic diseases where we have to manage you over time and locations. How does that happen? It's a combination of interoperability. It's a combination of extant EHRs, although there are usually dozens of them in a metropolitan area. It's a combination of devices on yourself and a lot of complex

factors such as how do you motivate people, and what do you do about people who are really poor and can't pay the copay? That's where a lot of the innovation is occurring and as a vendor person, but also working with customers who are health systems, we're trying to feel our way through here. It's murky. It's chaotic. One of the upsides of innovation is lots of neat ideas; one of the downsides is that there are hundreds of companies. Who in the world is going to carry the day? We have a lot to learn as an industry about how to move forward in this and how to bring it together. One of the values of forums like this is that you can actually learn from each other and talk about what's working and what's not. So I think it is the big frontier in lots of ways. It's critical that we do it right.

CL: One example of an innovation that I've seen is a very nice visual interface for medication reconciliation developed in Ben Shneiderman's lab [33]. That's been out there for many years, and, yet, as far as I can tell, there isn't anything like that in any vendor product. So, again in these core applications, even though the vendors say they're trying, there isn't a lot of flow in that direction. We've had Health Vault. We've had Google Health. We've had a history of companies who look at this market and say "Wow. The user interface that's being used is really bad. We can do a lot better than that." These are large IT companies outside the healthcare space who try to break in and the history of that is frankly not very good at all. It's partly because of the forces that we described earlier about the marketplace that make it very difficult for others to enter into that space.

Attendee (Michael Becich): Is it a vendor problem? Is it an academic problem? Is it a lack of exchange? Where are the best practices? How can we move away from the finger pointing of the past and find the best way to catalyze academic and industry collaboration today? I thought that our training programs might be one way, but it is nearly impossible to have a large vendor enter into a dynamic training relationship.

JG: There are probably analogs of good industry academic collaboration that occur in the life sciences between those who fund and are in the business of pharmaceuticals and medical devices and those engaged in the labs. Something a little closer to my upbringing is management. If you look, for example, at the interaction between the Harvard Business School and the MIT Sloan School and the practitioner community, it's really quite strong. It might be something that collectively we take on. Let's learn from the other models and whether it's the business community, whether it's the life sciences community or the computer science community who appear to have stronger ties. Why is it that they have stronger ties? What is it about them that enables it? There are probably some factors that you can't replicate here. If you look at IBM, it's the size. It's just bigger. HP is bigger. They have resources for R & D that the Siemens healthcare information technology business, for example, doesn't necessarily have. In a lot of a ways, it's the right question coming out of this conversation. We ought to look at a couple of areas to see what the good models are.

RK: First, I'd like to thank John for making a point that Curt and I were going to make, which is that the other industries have actual markets where the clients are not forced to buy the software. Those vendors actually work with academics, as compared to the current EHR industry where there is a captured market.

JG: This is a mischaracterization. It's not a captive market. People do change vendors. We get tossed out. We take advantage of people who get tossed out. Vendors are no purer than any other human beings, but they do care about the market. They do care about customers. They do care about advancing health.

JS: I wanted to add one notion to that. If you consider the private Epic Users Group Meeting (ugm.epic.com) that was held in Verona in September with about 11,000 people, there was a specific commitment to FHIR. There are no multiple third party vendors being invited to engage with Epic in developing what the needs are around FHIR, but Epic, and I think it's probably true of some of the other vendors, is much more open in its communication with its clients, many of whom are academics, than it is with the rest of the community. That's a natural thing for a vendor to do. They need to have the time to engage with their community and figure out what the best path forward is using something. It is true that you get a lot more information when you are engaged as a client of one of these major products.

CL: I think of the analogy of the radiology world where there's a recognition of the old saying, "The thing about standards is that there are so many to choose from." But the standards that really work are the standards that have users. And the way that you create users for standards is by getting the request for standards into the RFPs and an organization like AMIA and its brother organizations in the radiology world have spent a lot of time trying to educate their members, who are customers after all, to include the request for these standards in the RFPs. In the radiology world we have DICOM [34,35], and we have a number of other standards for vendor neutral architecture and other IHE standards for communication between reporting systems and work lists and the PACS, and the like. We then get vendors who pick off modular parts of this marketplace. For example, we have a very healthy startup marketplace for cloud based image exchange. These companies are competing like crazy against each other. These companies are beating the big boys every day, and they're also coming to academic institutions all the time and saying would you please work with us and help us innovate on our products. That to me is a great model. If AMIA could take some steps to encourage these standards and break apart these monolithic systems, that could really help generate this collaboration.

Attendee: Why have other industries and products, for example, Windows applications, Word, iPads, etc. made screen shots freely available and that seems not to have been a disadvantage in the marketplace?

JS: I think there is timing involved in that, and we have had permission to use Epic screenshots in very public presentations and even in some cases in publications. We haven't done it much. When we've asked them permission to do it, they've allowed us to do it. I agree that the notion that you have to ask for permission is not ideal. Most of these products are so widely deployed that you can go see them anywhere you want. When I have had conversations with the leadership of Epic in particular about this issue of screenshots, it seems that there is a significant concern about misrepresentation rather than protection, and that showing screens will lead people to believe the system works differently from the way it actually works. I think that that's a much more substantial driver when you talk directly to them. I don't think it's entirely this capitalist notion, although it's certainly part of it, and I think it will go away as the market gets a little bit more mature.

JG: What I wouldn't do as a community is to grab hold of a narrow issue called screenshots and indict an entire industry based on that. I'm not going to say whether a vendor's approach is right or incorrect. I do think that when you get an industry that is not used to FDA oversight and now is being exposed to FDA oversight, they become quite cautious. They don't know what they're in for, and so they want to be very careful until they understand it. So, you'll get a conservative reaction. It's not surprising at all, given the stakes or the potency of that organization.

CL: I don't remember who said it, but the solution to objectionable speech is more speech.[1] The solution to misleading screenshots is more screen shots.

[1] "If there be time to expose through discussion the falsehood and fallacies, to avert the evil by the processes of education, the remedy to be applied is more speech, not enforced silence."—U.S. Supreme Court Justice Louis D. Brandeis (1856–1941), Whitney v. California, 274 U.S. 357 (1927).

Attendee (Edward Shortliffe): In contrast with informatics, there is a sense of camaraderie and shared purpose between the vendors and the faculty in academic computer science. Those of us who have grown up in both communities, both as computer scientists and in the informatics world have become aware of this difference. In a way it was excusable in the days when the health IT industry was struggling. It didn't have any money to start R&D labs or to make major investments in academia or collaborative research. The few joint projects that they did with academic groups were mini-versions of what you've been describing, Jonathan. In other words, "Let's work with one of our more informed academic clients to really fix this system in innovative ways during this new implementation and, subsequently, maybe we can generalize it to enhance our product beyond that one institution. I don't consider that approach to be a supportive research collaboration. What the academic synergy with industry has been in many other fields is more than simply improving a specific given product that a company is trying to sell. Most of the investments in academia that the major computer science, software, and hardware vendors have made are in fellowships and in grants for innovative research activities. And today you can see the industry dollars flowing into academic research groups. It's an alternate source of funding for innovative research in universities. The funded projects are often very collaborative with cross fertilization involving visitors from industry working in the academic setting and summer internships for students and that kind of thing. We in informatics are far from having achieved that even with the incredible growth of the HIT industry in the last decade. There are tremendous opportunities here (with all the money that's been going into that industry) for much more collaborative research at the basic end of the spectrum. I'd like us to be thinking more about the relationship, the attitudes, and the shared respect between the two communities, which I don't feel is always present.

I'm going to tell you an anecdote. There was an open workshop at the National Academy of Sciences. The CEO of one of the major HIT companies – one of the clinical systems vendors – was at that meeting. There was a discussion of medical informatics training and efforts underway in the academic community to create people who are knowledgeable and could fill the roles of CMIOs bringing substantive knowledge both of the academic informatics side – what was happening in research – and what was happening for clinicians in practice. This CEO said openly that "the worst thing that can happen when I have a new contract to implement a system in an academic medical center is to discover that the CMIO has medical informatics training". This comment speaks volumes about the respect for the academic informatics community by at least one vendor in the HIT community. It would appear that people who know too much tend to "get in the way".

JG: We're evolving from transaction oriented systems to systems that have to be intelligent, and that have to reach across boundaries and engage patients. Decades ago, systems didn't have much informatics. They just had to post data, read and write and present the data in a reasonable way. Now, with the pressures on performance, quality and safety, that just won't be enough. The demand and the need for informatics is growing, and people on the vendor side are beginning to appreciate that. Although, a number have appreciated it for quite some time. We can look at other examples of collaboration and ask what is it that they do that we could adopt. I would ask us to say collectively – and I don't care whether you're a vendor or an academic – whatever sins you've committed in the past are forgiven. Come back home, and let's start the way we ought to be doing this thing.

JS: I should have made this point more clearly, but what I was trying to argue was that industry really benefits from a pipeline of innovation that feeds into the future products that they're going to want to make and they, frankly, have benefitted. Why do you think there are EHRs to be sold today? It's because of thirty years of research, mostly in academic medical centers that created the first EHRs. So, investing in basic science informatics back in the universities is in the interest of industry, and needs to be viewed that way regardless of whether it has to do with a current product. It's a little bit hard for the vendors to support academic research early on. Certain of the vendors have reached the capability that they can do those things and have begun to do them in various different ways. I think there will be lots of others coming. It's an industry learning how to do that. Having said that, it also does vary. It also is going to be vendor specific, and I do believe that we are in that evolution and that those will emerge. That's a very positive vision, and it may not come from every one of them, but I really believe it is coming and we need to ensure that.

CL: Thank you for reinforcing this need for direct support from vendors to academics. One of the unintended consequences of the meaningful use program that brought all this money into the market is that it created a lot of short term thinking among the vendors. The vendors needed to get their current systems into as many places as possible in their current state. Now that they have these war chests from the amount of money that's been brought in, they might transition to some longer term thinking and some of the programs that you described.

Attendee (Peter Embi): There is an angle here that I would like to hear you all speak to, and it's a bit different. We've heard a lot about the market forces and you have covered that pretty well, but there's an aspect of this that I haven't heard mentioned much, but that a lot of us experience, which are the issues that are internal to our institutions. That is, there are innovation opportunities that are either being enabled or stifled at least in part because of the relationships in our universities and hospitals between our IT departments and our academic informatics units. The IT department takes care of the EHR implementation and if there's a good relationship with our academic units, innovation can be enabled. But sometimes the feeling is that academics should stay out of IT operations, and that can be stifling. There are also contractual issues that either enable or don't enable collaboration. What I'd like you to comment on is what role our community can play in addressing these issues.

CL: The leadership of the hospital sometimes looks at the academics coming across the road with the same skepticism that our EHR CEOs do. The other factor is that academics often think that when they've built a really cool program that they're eighty percent of the way to a product, but really it's the other way around: twenty/eighty, maybe ten/ninety to actually bring something to market as a product. Also, academic technology transfer offices are often not as comfortable with IT and specifically health IT, as let's say they are with pharmaceutical products. When somebody walks in to their office with software, at least in my experience, that's a little bit more of an awkward conversation and a difficult transition to the commercial marketplace than someone who walks in with a new pharmaceutical.

Attendee (Lawrence McKnight): What is the solution and what from the academic side can be done to facilitate better collaboration with the vendors?

RK: I appreciate Curt being so ecumenical in pointing out the failures of academics. Underlying so much of this is the lack of data standards and the lack of interoperability that's such a barrier to innovation across all the systems. It is not the academics who fought data standards and interoperability. It's the industries that have invested perhaps billions in their various proprietary systems, but we all have an obligation to try to come up with some sort of

solution to that. If Harvard or Penn is spending $400 million on their software programs, and then spending three to five times that on the implementation, we are as invested as the vendors. AMIA is the perfect place for us to try to overcome these barriers to interoperability, so that we can continue to build our systems. Android and Apple both benefitted from having, as it were, open platforms that people could build on. We need to reach that level of agreement.

CL: I wasn't being as ecumenical as you might have thought. I just wanted to point this out as a debating point. We're not talking about whether it's the vendor's responsibility or the academic's responsibility. We're talking about whether the interaction occurs. So the fact that academics are also not pulling their weight in some areas I think also supports our side.

JG: Hey, I should have made that point.

JS: Let me make a quick rebuttal of that which is to say that the term is "stifling innovation" which to me is an active effort to prevent it, and I am not sure that that supports what I see. For example, Cerner presented their efforts with SMART on FHIR yesterday. The vendors, I think, have in general been very aware and engaged in the standards community, and they use them as early as they can. However, it's still a challenge in our field to really make these things work together. And the academics are right there doing that. That's an area where there is collaboration, interaction. It is not stifling, so I'm not sure why you said those things, Ross, because they support our argument.

JG: There are a number of things that we do, and I think most vendors perhaps do them too, to try to bridge the communities and to learn and to leverage them. One of them is hiring people who have training and background in informatics – people who are able to bridge both worlds. The second is by sponsoring organizations like this to make sure they're alive and thrive, and that they grow over time, and there's a fertile place where the community can come together and do a variety of things. The third is to participate in industry-wide forums and discussions, whether that is by putting people on standards committees or policy committees, or participating in the eHealth initiative, and a wide variety of other ways for bringing the community together. We've got issues with interoperability. Let's move the ball in a way that advances this. The fourth is that we have certain academic collaborations that are deep and are in targeted areas where we know we need to grab that knowledge base to be part of it. The fifth is that we pay a lot of attention to the venture market. Some of them will die but some of them are really quite extraordinary, whether they were founded by an academic or not. It doesn't really matter. There is a range of things that are done to try to bridge the communities and to leverage multiple channels and multiple opportunities to bring innovative thinking into the products and the services that we have.

12. Vote on the resolution

The debate ended with a show of hands of those who support the resolution:

> Resolved: The lack of interaction and collaboration between health IT vendors and academic clinical informatics units is stifling innovation, and will continue to have a detrimental effect on the evolution of commercial products.

The resolution was supported.

Acknowledgments

The authors wish to thank the audience members, especially those who participated in the question and answer period. Their questions and comments enriched the discussion.

Appendix A. Table of acronym

AMIA	American Medical Informatics Association
API	Application Programming Interface
C-CDA	Consolidated-Clinical Document Architecture
CPOE	Computerized Physician Order Entry
DICOM	Digital Imaging and Communications in Medicine
EH	Eligible Hospital
EHR	Electronic Health Record
EMR	Electronic Medical Record
EP	Eligible Professional
ERP	Enterprise Resource Planning
FDA	Food and Drug Administration
FHIR	Fast Health Interoperability Resources
HIT	Health Information Technology
HITECH	Health Information Technology for Economic and Clinical Health
IHE	Integrating the Healthcare Enterprise
IP	Intellectual Property
IT	Information Technology
MU	Meaningful Use
NIST	National Institute of Standards and Technology
NLM	National Library of Medicine
ONC	Office of the National Coordinator for Health Information Technology
PACS	Picture Archiving and Communications System
R & D	Research and Development
RFP	Request for Proposals
VA	Department of Veterans Affairs
VC	Venture Capitalist

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