

Structured reporting: if, why, when, how—and at what expense? Results of a focus group meeting of radiology professionals from eight countries

J. M. L. Bosmans · L. Peremans · M. Menni ·
A. M. De Schepper · P. O. Duyck · P. M. Parizel

Received: 28 June 2011 / Revised: 16 December 2011 / Accepted: 20 January 2012 / Published online: 14 March 2012
© European Society of Radiology 2012

Abstract

Purpose To determine why, despite growing evidence that radiologists and referring physicians prefer structured reporting (SR) to free text (FT) reporting, SR has not been widely adopted in most radiology departments.

Methods A focus group was formed consisting of 11 radiology professionals from eight countries. Eight topics were submitted for discussion. The meeting was videotaped, transcribed, and analyzed according to the principles of qualitative healthcare research.

Results Perceived advantages of SR were facilitation of research, easy comparison, discouragement of ambiguous reports, embedded links to images, highlighting important findings, not having to dictate text nobody will read, and automatic translation of teleradiology reports. Being compelled to report within a rigid frame was judged unacceptable. Personal convictions appeared to have high emotional value. It was felt that other healthcare stakeholders would impose SR without regard to what radiologists thought of it. If the industry were to provide ready-made templates for selected examinations, most radiologists would use them.

Conclusion If radiologists can be convinced of the advantages of SR and the risks associated with failing to participate actively in its implementation, they will take a positive stand. The industry should propose technology allowing SR without compromising accuracy, completeness, workflows, and cost-benefit balance.

Main Messages

- *Structured reporting offers radiologists opportunities to improve their service to other stakeholders.*
- *If radiologists can be convinced of the advantages of structured reporting, they may become early adopters.*
- *The healthcare industry should propose technology allowing structured reporting.*
- *Structured reporting will fail if it compromises accuracy, completeness, workflows or cost-benefit balance.*

Keywords Structured reporting · Radiology · Advantages · Qualitative healthcare research · Obstacles

J. M. L. Bosmans · A. M. De Schepper · P. M. Parizel
Antwerp University Hospital,
Edegem, Belgium

P. O. Duyck
Ghent University Hospital,
Ghent, Belgium

L. Peremans
Department of Primary and Interdisciplinary Care,
University of Antwerp,
Antwerp, Belgium

L. Peremans
Department of Public Health, Vrije Universiteit Brussel,
Brussels, Belgium

M. Menni
General Electric IT,
Dornstadt, Germany

P. O. Duyck
AZ Nikolaas,
Sint-Niklaas, Belgium

J. M. L. Bosmans (✉)
Dept. of Radiology, Ghent University Hospital,
De Pintelaan 185,
9000 Ghent, Belgium
e-mail: janbosmans@telenet.be

Introduction

While information technology has made rapid progress in all fields of medicine, including imaging modalities,

radiology reports seem to have been immune to change for many years, both in form and content [1]. In the last decade, a potential shift from text-based to structured reporting systems has been the subject of intensive research. Structured reporting systems may lead to rapid report turnaround time, reduced reporting costs, improved communication, more satisfied referring providers, and simplified quality and compliance reporting [2].

Since 2001, studies by Naik et al. [3], Johnson et al. [4], Plumb et al. [5], and Bosmans et al. [6] have shown that both radiologists and referring clinicians have a clear preference for structured reporting (SR) systems in radiology. Despite this overall preference, we have no knowledge of any imaging department, including those of the aforementioned authors, where SR is the standard rather than the exception for all imaging studies. The reasons for this apparent contradiction between preferences and implementation are complex and diverse and therefore difficult to explore by quantitative methods. Qualitative healthcare research, however, allows researchers to perform in-depth examination, use subjective information, examine complex or value-laden questions, and build new theories without the rigidity of a predefined format [7].

For these reasons, we decided to perform an in-depth analysis of the views, experiences, feelings, motives, and expectations of radiology professionals concerning the advent of SR.

Methods

During the 2009 European Congress of Radiology (ECR) in Vienna, Austria, we organized a focus group meeting to discuss two topics of present interest, SR and teleradiology. All radiologists and information technology (IT) professionals who were members of the Advisory Board of a major healthcare informatics provider and who attended ECR 2009 were invited to participate. Those who agreed, did so voluntarily. There was no preliminary selection on the basis of experience with SR. Participants were “experts of daily practice,” not of structured reporting.

The initiative for this meeting came exclusively from the authors of this paper who were working at the University of Antwerp, and the meeting was mainly prepared by the first and the second authors.

The healthcare informatics company was asked to give logistical support to the meeting and provide an independent moderator, but they were not allowed to interfere with the subject or the topics for discussion. Although employees of the company were present as observers, none of them were allowed to interfere. The company neither organized nor paid for the congress attendance of the participants. Participants did not receive

any fee for their participation in this meeting nor for their Membership on the Advisory Board.

The focus group consisted of 10 radiologists and 1 IT professional, all working in the radiology department of an academic or community medical center. One participant was female. The eight countries represented were Turkey (1), Israel (1), Germany (3), Italy (1), France (1), Belgium (1), Poland (1), and the United Kingdom (2).

The leading investigator of the study gave a short introduction to clarify the subject and present the eight topics to be discussed (Table 1). During the group discussion, the investigator acted as an observer of verbal and nonverbal behavior but did not actively take part. The moderator allowed participants to elaborate on themes directly related to the topics but brought the discussion back to the topic when there was a risk of losing the lead. The session was videotaped. The comments of the participants on the videotapes were transcribed. This transcribed content was coded by the first author of this study by means of QSR NVivo 8 (QSR International, Doncaster, Australia). Coding was open, and the resulting codes were subjected to a thematic analysis. In a second stage, the coded content was linked to the research questions and an attempt was made to prepare a working document that summarized this content. Transcription and summary were compared by an independent collaborator. As potentially valuable information had shown up that could not easily be linked to any of the topic questions, this working document was rearranged according to 11 main themes that were identified. This document was presented to the participants for validation and approval or amendment. The final paper was reviewed by all authors.

The working document with the results was mailed twice to all participants in October 2010, with the explicit request to respond if they felt they had been quoted incorrectly or their opinions had been misinterpreted. Four participants stated their explicit agreement with the document (two by mail, two in person). None suggested any changes. As had been explained to the participants, those who did not respond after a reminder were considered to agree with the text.

Results

The discussion was lively and very open. None of the participants seemed to feel inhibited from interjecting, and nobody tried to impose his/her views or monopolize the debate. Only two of the participants were native English speakers, and the fluency level of the other participants differed. Although all interactions received the same level of interest and respect from the group and the moderator, subjects brought up by those who were fluent in English seemed to give more rise to further discussion. Comments

Table 1 Topics for discussion

Questions for participants

Are you familiar with the concept of structured reporting?
What do you consider the advantages of structured reporting?
Do you consider structured reporting a useful or necessary way to go?
Have you attempted to implement structured reporting in the past?
If so, what problems were you faced with?
Do you feel PACS and speech recognition systems could facilitate the implementation of structured reporting?
What modifications of existing systems would be required to achieve implementation of structured reporting?
What other influences could PACS and related technology have on the structure and content of the report, now and in the future?

by nonnative speakers were more difficult to transcribe and interpret. Transcription, coding, analysis, and synthesis took a full year. This is not exceptional, as systematic and rigorous preparation and analysis of qualitative health-care research data are time consuming and labor intensive [8].

In the following paragraphs, we review the answers to the questions that were addressed during the meeting. We only present a summary of the ideas that came forward during the meeting and cautiously refrain from any form of interpretation in this section.

Advantages of structured reporting

Perceived advantages of SR centered around 11 major themes: *accuracy/quality*, *retrievability* (e.g., in the interest of research), *accessibility*, *automatization*, facilitation of *workflows*, keeping the *electronic patient record (EPR)* up-to-date, *teleradiology*, *information exchange* between medical centers, *ergonomics* of the radiologist and the referring physician, *financial benefits*, and *education*.

Accuracy and quality assurance of the report were important issues. SR would compel radiologists to use specific terms and therefore keep them from hiding behind vague and verbose reports. Its systemized approach would prevent practitioners from recognizing one lesion and not looking at the rest. The clinician would be able to make the distinction between essential and accessory information more easily (quote 1; Table 2). The group felt that SR would facilitate communication between radiologists and clinicians and should be considered a tool for the whole medical community. SR would improve the overall quality of patient care.

One participant's main objective for introducing SR was to create a research base. Free text (FT) reports do not easily allow research queries. Although there was consensus on this perceived advantage, it did not seem to raise much interest.

Closely related to retrievability is accessibility of the data. The role of the radiologist in the diagnostic work-up

was considered essential by all. Several participants were convinced that nobody reads the descriptive part of a circumstantial report, although it may contain important information. SR would facilitate absorbing and integrating the essential information in a report, the group thought. The problem of information overload extends well beyond the scope of radiology reporting: the final report of one hospital admission can contain much more information than, for example, primary care physicians can handle.

The group agreed that in structured reports, it would become easy to further automate the reporting process. The radiologist would be freed of repetitive, most often loathsome tasks. SR can facilitate separation of essential information that needs to be integrated into the electronic patient record (EPR) from redundant or accessory information.

It was mentioned that, due to the introduction of workflows, the written report is no longer the end product of the radiology process. Today, radiologists still need clinicians to transform the findings into a medical workflow. In the disease-related groups (DRG) system, emphasis is put on delivering the best possible care, while the patient is in the hospital for as short a time as possible. According to the focus group, this can only be achieved if both the diagnostic and the therapeutic management is adequately planned and structured.

Most participants felt that teleradiology will have tremendous effects on radiology reporting. Automatic translation of structured reports in foreign languages may help to provide reports that make sense. A necessary requirement for such an approach is a uniform coding system and a comprehensive radiological lexicon. Since outsourcing implies a client-provider relationship, the client would be in a position to impose this approach.

Does SR make reporting easier or less time consuming? One participant was convinced that radiologists would use the system if those conditions were fulfilled. In the case of complex measurements for instance, only the numbers would have to be filled in and the rest would be calculated instantly. Hyperlinks to relevant images, integrated into the report, could improve the quality of the report as well as of the EPR. Some however wondered if SR was to make life

Table 2 Relevant quotations from participants in the structured-reporting focus group

Quote number	Quote
1.	“Radiologists often write nice sentences, but the key information is hidden somewhere in the middle of the report.” (Rx-D1)
2.	“We have experience with the structured report of MR spectroscopy. We put a standard structure out of the ratio of metabolites and so forth, and at the end of the report you give an impression with those ratios.” (Rx-TK)
3.	“People who work in obstetrics [...] use a standard report. People who work in cardiology, [...] cardiological ultrasound and angio make structured reports.” (Rx-IL)
4.	“We have very detailed structures, like cardiac CT and such stuff.” (Rx-D2)
5.	“When I went to see this [structured reporting system], as I remember, I said ‘How do you get people to work with that?’ She said: ‘Well, here I’m the boss, and it’s either my way or the highway’.” (Rx-IL)
6.	“... when I read the report I want to know, I want to read it, I have to see the images in front of me... and I think structured reporting is not so easy as when you describe it.” (Rx-B)
7.	“It has to be automatic.” (Rx-D1)
8.	“Structured reporting for teleradiological purposes requires absolute consistency in the terminology. This concept is clearly conflicting with the need of radiologists to feel free of constraints.” (Rx-UK1)
9.	“The difficulty is to reach consensus... One radiologist is difficult, two radiologists are very difficult, and with three it’s impossible to have one structured report in the same pathology.” (IT-Fr)
10.	“In a structured report, one should be more precise than in a prose report, and sometimes we cannot be more precise. In a narrative report one can ‘dance’: a lesion may be metastatic, it should be followed and so forth... which is different from stating it is either metastatic or not. (Rx-TK)”
11.	“There’s always something on the paper that doesn’t fit in the structure. Even if you have a space for remarks, it’s difficult to make a structured report in which everything is included.” (Rx-B)
12.	“To whom are we writing reports? [...] To other physician(s) and two groups, [...] the physicians [...] are related with (our department) [...] (and in) general with some other physician with whom our cooperation is vague...” (Rx-PL)
13.	“I agree that you need to have some description of the procedure, [...] a description of the findings, [...] and you need a summarized conclusion of some sort or impression or interpretation of those findings. Yes, that kind of structure, yes, but not the fine detail of how to describe something using actual vocabulary.” (Rx-UK1)
14.	“Today, one CT scan provides more data than can be described in two pages of close text. Therefore, the really important information is in the conclusion.” (Rx-D3)
15.	“I think the ‘prose’ is the part that nobody reads. I think that part is there for the radiologist, not the clinician. If I read that part, I will understand it but the clinician won’t.” (Rx-B)
16.	“I have my template, you have your template—that’s not a structured report! A structured report is: here we’re going to have a standardized nomenclature, it’s going to look like BI-RADS.” (Rx-IL)
17.	“If it is coming with the system, then people would use it and then you have already a structured report.” (Rx-D1)
18.	“Moreover, there may be a huge difference between the input by the radiologist and the output, the way the information contained in the report is presented to the clinician. Despite some negative experience, the concept of data mining remains a trail to be further explored.” (Rx-UK1)
19.	“I think that’s where the pressure will come from—they will pay the more for radiology, the better the input from radiology is, and the more structure there is in the input, the better it will be for them, not for radiology, of course, it will put more workload to radiology.” (Rx-D3)
20.	“Structured reporting is coming our way, whether we like it or not. And when it comes, radiologists better be in the driver’s seat.” (Rx-IL)
21.	“I think there is one circumstance under which radiologists will reach a consensus, and that is if money comes into the equation.” (Rx-UK1)

Abbreviations following the quotes can be understood as follows. The first part of the abbreviation identifies the type of practitioner: *Rx* radiologist, *IT* IT professional; the second part of the abbreviation identifies the participant’s country: *B* Belgium, *D* Germany, *Fr* France, *I* Italy, *IL* Israel, *P* Poland, *TK* Turkey, *UK* United Kingdom; the third part of the abbreviations is a number to distinguish different representatives of the same country

better for radiologists or for other people. One does not preclude the other, it was felt: SR could prevent many requests for additional information from referring physicians.

Thanks to SR, workflows and DRGs may provide financial benefits for the radiology department. If radiology can add significant value to patient management, administrators will invest in it, one participant thought.

And how about education? Today, standard reports of normal examinations are available in many centers. At least one participant thought the use of these all-in-one shortcuts might have a negative effect on residents-in-training, as they allow superficial viewing of an examination. SR in which residents would have to click every single detail as ‘normal’ might prevent this. One participant expressed the opinion

that in a well-designed SR system with a detailed standard lexicon, residents would be forced to specify abnormal findings, such as a lesion in the liver or a pulmonary nodule. That would encourage their study of the subject.

Structured reporting at present: only niche applications?

Participants agreed that some structuring is already present in predominantly narrative reports: separate headings for the reason for clinical referral, the topical report, the technique, the findings, the interpretation, and the signature can be considered a rudimentary form of structuring. A more advanced form of SR was mentioned as standard in a limited number of applications in some of the centers, such as in cardiology (coronary CT, cardiac ultrasonography), oncology (follow-up of multiple myeloma, follow-up of lung lesions), obstetrics, and MR spectroscopy (quotes 2, 3, 4; Table 2).

In one center, a number of standard templates were available for different examinations, e.g., a right vs. a left heart study. Within these templates, there was room for FT. One participant had a particularly disappointing experience with a well-structured report for MR spectroscopy, to which the radiologist just had to add an impression to the measurements. However well-made it looked, for a variety of reasons his colleagues did not use it.

Only one participant knew of a center where SR had been the standard for all imaging studies for a few years at the end of the 1980s. In that center, radiologists used a hierarchically ordered, tree-like reporting system. Its implementation had been imposed by the head of the department (quote 5; Table 2). The practice was discontinued in later years, when this person unsuccessfully tried to export it to other centers.

Obstacles to more general use of SR

Defining obstacles for the introduction of SR turned out to be the most important theme of the meeting. A first obstacle mentioned was the time and energy the daily use of SR would require. The consensus was that anything more complicated than what we are used to would pose a problem. Several were convinced that the mechanics of SR would detract the radiologist's attention from the image (quotes 6, 7; Table 2).

The need to allow for the freedom and individual expression of the radiologist was another frequently mentioned theme. There was broad consensus on the principle that SR should allow the addition of FT if necessary. Some went even further: it should be possible not only to add content but also to adapt the templates themselves (quote 8; Table 2). Despite this, SR would require a fair amount of standardization, and standardization requires a consensus. Reaching a consensus among specialists on anything, even a simple template, was perceived by all as very difficult (quote 9;

Table 2). Someone mentioned that even in cardiology, where SR is used abundantly, most everyone uses templates of their own making. In contrast, one participant mentioned that radiologists were able to reach a consensus on other matters, such as examination protocols.

With the introduction of the EPR, automatic integration of the radiology report has become mandatory. In many centers people are trying to find solutions for their problems independently. It was felt that SR would be pointless without widely accepted standards for information interchange. The DICOM (Digital Imaging and Communications in Medicine) standard exists, and so does the DICOM structured report. But whether or not the latter provides the solution remains to be seen, participants thought. And for all participants it remained unclear who would have the authority to impose standards—within one medical center, in one country, in Europe, the U.S., worldwide...

While other specialists do use structured reports, the complexity of the task of the radiologist may be a major impediment. In coronary CT for instance, cardiologists look at three vessels and decide if there is a stenosis or not; radiologists have to describe and interpret much more, a participant put forward. Many findings cannot be reduced to figures and standard descriptions. The fine detail that can be described using common vocabulary cannot and should not be suppressed, most participants thought (quote 10; Table 2). Moreover, perfect templates do not exist (quote 11; Table 2). Also the kind of report we make depends on the profile of the referring physician (quote 12; Table 2).

Facilitating SR implies finding better ways to input data: do we dictate, type, click through menus...? No one in the group suggested an ideal input device. One participant had tried data mining, but he was not satisfied with the results.

Is it really necessary to structure the complete content of a report? A substantial number of the participants did not consider that option ideal or even desirable (quote 13; Table 2). Moreover, is it worthwhile? Several participants were convinced that clinicians only read the conclusion of the report and that the descriptive part is only of interest to other radiologists (quotes 14, 15; Table 2).

Still, it would be wrong to believe that bringing some structure into narrative reports would be sufficient, according to one. A structured report requires a fixed framework and standardized nomenclature. BI-RADS, the Breast Imaging Reporting and Data System of the American College of Radiology, was cited as a good example (quote 16; Table 2).

The time and energy required for implementing an SR system and preparing the necessary templates were considered a major problem by most participants. But even if it were properly implemented, SR was perceived as affecting productivity, which was considered a major impediment, especially in private practice.

Do radiologists really need SR? If it only benefits the hospital, the administration, health insurance providers or even the patient, but not the radiologist, radiologists would not use it, a considerable number of participants thought.

The future

So in which direction are we headed? Several participants expressed the opinion that an automatic link between the images and the report would be a necessity in any future system. One could even imagine reports in which particular terms, when clicked, would automatically provide the clinician with a definition, or in which the old images for comparison would only be a mouse click away.

On the other hand, some participants did not see the need to provide clinicians with all the imaging data, disregarding its relevance. A possible solution could be that the radiologist, while reviewing the images, would be able to mark relevant ones, which would then be integrated into the report without further interaction.

While many participants considered the lack of consensus among specialists a major obstacle to the introduction of SR, they believed that ready-made reports provided by the PACS/RIS manufacturer would be used widely anyhow (quote 17; Table 2).

Someone thought that the input provided by the radiologist could somehow be different from the output the referring clinician would receive (quote 18; Table 2).

So did the participants at the end of the meeting consider SR a useful or necessary way to go? Feelings about this were mixed but not negative. Some considered the question itself irrelevant, as SR seemed to be on its way, whether radiologists liked it or not. It was felt that clinical guidelines and checklists were already deeply rooted into today's medicine. A few participants believed that hospital administrators, insurance companies, governments, and other had already called for structured data, quality control being their main motive (quote 19; Table 2). Taking this seemingly inevitable evolution into account, radiologists should not offer resistance but instead take the initiative and do their best to see their own ideas implemented (quote 20; Table 2). If radiology is working well and adding significant value to the management of the patient, more money will be invested into it. The alternative would be: not being paid and fading away (quote 21; Table 2).

Discussion

Qualitative healthcare research is new to radiology. In an extensive literature search on Pubmed, we could not find any publications by radiologists based on qualitative research in general, or on focus groups more specifically.

We did, however, identify a substantial number of papers by radiographers and radiology technologists.

In a focus group, participants are allowed to say anything they want. The researcher not only listens for the content of focus group discussions, but for emotions, ironies, contradictions, and tensions. This enables the researcher to learn or confirm not just the facts, as in a survey, but the meaning behind the facts. Surveys generalize, while focus groups represent a type of group interview. Focus groups consist of 10–12 participants with similar characteristics. Focus groups rely upon words spoken by participants; quotations are therefore an integral part of the resulting report. That report should not present findings in terms of frequencies or statistics because counting leads readers to believe that percentages or frequencies are true for a wider population [9].

For many years, SR has been considered something bound to become the rule in the very near future [2, 10]. Using focus group methodology, we have tried to determine why SR—despite a clear preference among radiologists and referring clinicians for this type of reporting—is the exception rather than the standard in nearly all radiology departments. This focus group meeting has provided us with a number of possible explanations, as well as with suggestions for resolving the paradox and with topics for further quantitative study.

What did we find? In a world in which available resources become scarce and cost-benefit analyses are the cornerstone of healthcare policy, radiologists cannot sit back, relax, and practice the noble art of FT reporting they have cherished for more than a century [11]. This idea was accepted by the group, albeit reluctantly.

Participants proved to be familiar with the concept of SR, but there was no agreement on the exact content that would be expected. In a recent article, Weiss and Langlotz mentioned three SR models [9]. The first model consists of FT within standardized headings; that model is already widely in use, as was recognized by the group. The second model is based on standard templates with an itemized format, such as proposed by Naik et al. [3] and tested in practice by Siström and Honeyman-Buck [8] and Johnson et al. [4]. The third is an itemized report using standardized language with retrievable data elements. This third model raised little enthusiasm among the group and was the cause of much concern. Despite that, a considerable number of the participants were convinced it was the way SR was bound to go.

Although finding a consensus on what a structured report should look like would be difficult, the fact that radiologists can agree on examination protocols did show that personal convictions do not represent insurmountable obstacles. Moreover, instead of imposing standards, the RSNA has chosen to promote *best practices*—consensus approaches that can be adapted by individual practices [12, 13].

There did not seem to be any fundamental resistance against the concept of SR. In the case of outsourcing reporting to nonnative speakers, imposing SR using retrievable data elements was even considered an excellent idea. This suggests that objections to SR are mainly rooted in self-defense. That may sound rather negative, but it is not. In the course of their careers, radiologists develop reporting skills and methods they consider optimal. In a recent large-scale survey, 37% of the responding radiologists believed their own reports were better than their colleagues'. Just 6% did not agree, and the rest were undecided [5]. Most advantages of SR are beneficial for stakeholders other than the radiologists, who fear they will only see the downside. In order to have the radiologists constructively collaborate, they have to be convinced it is also in their interest [9]. Money could be a decisive factor, either in situations where radiologists would lose some (or all) by refusing to practice SR, or in systems that reward those who embrace it. All participants were convinced that any SR system with retrievable data elements should allow FT remarks and reflections or the expression of uncertainty or doubt.

That implementing an SR system would require time, energy, and a lot of goodwill is self-evident, but there are more fundamental concerns. A cause of concern is that SR using existing systems is laborious and detracts the radiologist from his key task of image interpretation. Moreover, radiologist productivity and possibly accuracy may be compromised [9]. The group was well aware of this inherent danger to the quality and efficiency of diagnostic imaging, but there is more. An old saying in information technology is GIGO: *garbage in, garbage out*. Siström and Honeyman-Buck have demonstrated that SR and FT reporting are equally efficient and accurate for transmitting case-specific interpretative content to reviewers of the document [11]. However, in a cohort study by Johnson et al. SR suffered from a large decline in completeness and a small reduction in accuracy, both of a magnitude likely to affect patient care [4]. If the input is defective, the output cannot be better! The plea of one of our participants for a system in which input (dictation) and output (the report) are not necessarily identical needs attention. In fact, a large number of objections to SR would evaporate if today's radiologists could continue to dictate in FT and computers would do the structuring. At the time this paper was written, several companies were developing such systems, and some were already being tested in practice. A possible further development could be a system in which clinicians receive itemized reports with retrievable fields, while radiologists store these itemized reports as well as their original free text reports. Future methods for report distribution should then automatically consider the different parts and the different roles of the recipients of the information.

In the last 10 years, RSNA has undertaken several initiatives to support and facilitate SR [13]. A well-known

example is the development of structured reporting templates to be integrated into radiology information systems [14]. Today, these reporting templates are still mostly used as macro's in text-based reporting systems, but the much more versatile Extensive Markup Language (XML) version of the templates is ready for integration into dedicated, more powerful software, especially after extension of the DICOM standard [15].

Within RSNA, a reporting forum has been created where relevant research is presented or referred to [16].

As for lexicons, RadLex, BI-RADS, and the lexicon of the Fleischner Society are examples of successful nationwide and even worldwide collaboration. BI-RADS has already been implemented into mammography screening SR systems by several providers. Intensive research on ways to make RadLex and the RSNA SR templates the backbone of structured is ongoing [17, 18].

The meticulous work of developing a comprehensive underlying lexicon, however, will take time. Do we have to go on as usual in the meantime? Not according to this group! If, in the meantime, RIS/PACS providers were to offer workable solutions, they would use them. It would be unwise for the industry to wait for a consensus on a comprehensive system.

These conclusions may be challenged by some. Indeed, qualitative research cannot assess the weight of participants' views and arguments within the radiological community. Other studies have addressed this issue in North America as well as in Europe [3, 6]. Qualitative research does not seek to quantify data or identify a statistically representative set of respondents [19]. What our study does offer is a naturalistic impression of the hopes, expectations, and concerns of a group of "ordinary" radiology professionals from eight countries with divergent backgrounds.

Our focus group was certainly biased, as all participants were using PACS and/or RIS systems of the same provider. We chose to collaborate with that provider for practical and logistical reasons, but the initiative to organize the meeting was entirely ours, and so was the design of the study. North America was not represented in the group and Germany probably over-represented, but national and local situations were never quoted by any participant as a cause of dissent with the rest of the group. The main weakness of this study is that, according to focus group theory, the meeting should have been repeated with other focus groups with a similar composition. We regret that, within the logistical framework of this initiative, we did not have the opportunity to do so.

Our conclusions have to be interpreted with these limitations in mind. We do believe, however, that this meeting has brought up a considerable number of ideas that need to be considered by those who develop or implement

structured reporting systems. Follow-up quantitative studies may be required to test if the ideas described here represent mainstream thinking in the radiological community.

Since March 2009, when this focus group meeting was held, there has been considerable progress in the implementation of SR in radiology. Today, more than 140 RSNA templates are online to be integrated freely into any radiology information system [14]. DICOM supplement 155 is in development, which describes templates for sub-sections of CDA and SR documents to capture common radiology specialty techniques and findings. All this fits into the international Integrating the Healthcare Enterprise initiative (IHE) [20].

As a participant at our meeting put it, SR is indeed coming our way, whether we want it or not. The growing active interest of the radiological community suggests that we will be able to successfully tackle the challenges posed by this paradigm shift in radiology reporting.

Conclusion

SR offers radiologists opportunities to improve their service to other stakeholders, such as referring clinicians, administrators, health insurance providers, and healthcare authorities. For many radiologists, the traditional way of FT reporting has high emotional value. If radiologists can be convinced of the advantages of SR, it is likely that they will become early adopters, rather than face the potential risk of having it forced upon them. We identified a demand for the healthcare industry to develop technology allowing radiology departments to produce reports in formats required by their clients without compromising accuracy, completeness, workflows, and cost-benefit balance. RadLex and the RSNA reporting templates may become the backbone of such a system. Complementarily to this, systems that allow radiologists to continue dictating FT reports and automatically transform these into structured reports seem to meet the expectations of radiologists as well as other stakeholders.

References

1. Reiner B, Siegel E (2006) Radiology reporting: returning to our image-centric roots. *AJR Am J Roentgenol* 187:1151–1155
2. Langlotz CP (2009) Structured reporting: are we there yet? *Radiology* 253:23–25
3. Naik SS, Hanbidge A, Wilson SR (2001) Radiology reports: examining radiologist and clinician preferences regarding style and content. *AJR Am J Roentgenol* 176:591–598
4. Johnson AJ, Chen MY, Swan JS, Applegate KE, Littenberg B (2009) Cohort study of structured reporting compared with conventional dictation. *Radiology* 253:74–80
5. Plumb AA, Grieve FM, Khan SH (2009) Survey of hospital clinicians' preferences regarding the format of radiology reports. *Clin Radiol* 64(386–94):395–396
6. Bosmans JML, Weyler JJ, De Schepper AM, Parizel PM (2011) The radiology report as seen by radiologists and referring clinicians. Results of the COVER and ROVER surveys. *Radiology* 259:184–195. doi:10.1148/radiol.10101045
7. Huston P, Rowan M (1998) Qualitative studies. Their role in medical research. *Can Fam Physician* 44:2453–2458
8. Pope C, Ziebland S, Mays N (2000) Qualitative research in health care. Analysing qualitative data. *BMJ* 320:114–116
9. Grudens-Schuck N, Allen BL, Larson K (2004) Focus group fundamentals. Iowa State University, Ames. <http://www.extension.iastate.edu/publications/pm1969b.pdf>
10. Weiss DL, Langlotz CP (2008) Structured reporting: patient care enhancement or productivity nightmare? *Radiology* 249:739–747
11. Reiner BI (2009) The challenges, opportunities, and imperative of structured reporting in medical imaging. *J Digit Imaging* 22:562–568
12. RSNA (2011) Radiology reporting initiative. <http://reportingwiki.rsna.org/>
13. Kahn CE Jr, Langlotz CP, Burnside ES, Carrino JA, Channing DS, Hovsepian DM, Rubin DL (2009) Toward best practices in radiology reporting. *Radiology* 252:852–856
14. RSNA (2011) RSNA informatics reporting. <http://radreport.org/>
15. Kahn CE Jr, Langlotz CP, Channing DS, Rubin DL (2011) Informatics in radiology: an information model of the DICOM standard. *Radiographics* 31:295–304
16. [Anonymous] (2011) RSNA reporting forum. <http://groups.google.com/group/rsna-reporting-forum>
17. Hong Y, Zhang J, Heilbrun ME, Kahn CE Jr (2011) Analysis of RadLex coverage and term co-occurrence in radiology reporting templates. *J Digit Imaging* 25(1):56–62
18. Shore MW, Rubin DL, Kahn CE Jr (2011) Integration of imaging signs into RadLex. *J Digit Imaging* 25(1):50–55
19. Siström CL, Honeyman-Buck J (2005) Free text versus structured format: information transfer efficiency of radiology reports. *AJR Am J Roentgenol* 185:804–812
20. IHE (2011) Homepage of Integrating the Healthcare Enterprise. <http://www.ihe.net>