2017 HOUSE HUMAN SERVICES

HB 1371

2017 HOUSE STANDING COMMITTEE MINUTES

Human Services Committee
Fort Union Room, State Capitol

HB 1371
1/24/2017
27336

☐ Subcommittee
☐ Conference Committee

Committee Clerk Signature Judy Kopp

Explanation or reason for introduction of bill/resolution:

Relating to the regulation and licensure of medical imaging and radiation therapy practitioners.

Minutes: Attachments 1 - 14

Chairman Weisz: called the committee to order. Opened the hearing on HB 1371: Is there testimony in support of HB 1371?

Rep. Jon Nelson: Introduced HB 1371. (Attachment 1)
We have seen a major swing in services in our hospitals and medical centers. Outpatient services are a large portion of what our income comes from.

Chairman Weisz: Are there Questions from the committee? Further discussion in support of HB 1371. 0:209.

Tim Blasl, Vice President of North Dakota Hospital Association. (Attachment 2) 2:44-9:43 I am here to urge a do pass recommendation on HB 1371. 4:45

Chairman Weisz: 9:45 Are there questions from the committee?

Rep. Porter: Inside the bill you have added 2 categories to the bill that have no radiology training. Why?

T. Blasl: I don't know. We support certification and education; we support continued education. When we are trying to get certification in modality. You should be able to practice in ND. We feel that restricting it to every modality is going to cause some issues with some of our members. That is why we are here supporting this bill.

Rep. Porter: My next questions on section 3 on top of page 4 near the top; it is inside the powers of the board. (Attachment 2) 14:05 Where has this board failed to do all of that? We have had lots of boards come through here with their practice acts, so we are not rookies. How do you get this in there?

T. Blasl: We support education and certification and we can't allow this or it will make it difficult to find staff.

Rep. Porter: Powers of the board top of page 4, over the last 2 years where has this board failed to do all of that you think you should be able to come here and have a seat at the table?

T. Blasl: We didn't pay close attention before, because we thought the intent of the legislation was to license radiographers to meet so they can take a vote on writing orders. When the administrative rules came out, that caught our radar in terms of being certified in five modalities. It gained traction in our association and that is why we're today. Our intent is not to get rid of the board.

Rep. Porter: You are in favor of registration, but against certification?

T. Blasl: I wouldn't say totally against certification, but certification in each modality, the answer would be yes.

Rep Porter: Is your position on grandfathering what you testified to or what is written in the bill? Page 5, lines 16 16:53 Is your position as an association is what you said in your what you said in your testimony or how it is written in the bill?

T. Blasl: Our position on grandfathering in the state at a certain point be grandfathered in terms of licensure. Yes, we think that the people, with long time experience and with no quality issues, we thought they should be grandfathered in.

Rep Porter: I have one more question. 18:27 On page 7 in the renewal process. You are removing continuing education. Why don't you think this is important or okay? Why is there not a requirement for an individual doing these radiography procedures? 19:53

T. Blasl: We do think it is important to have continuing education and certification, but not in each modality. It is an impact to our smaller facilities in terms of recruiting. So if I was sitting in in Iowa, they would be different than ND and I am looking to come to ND or Minnesota to relocate, why would I come to ND to work if it was more restricted to work than Minnesota?

Rep. Porter: How long does the radiographer take to become a CT tech?

T. Blasl: I don't have the answer to that. I will get you the answer to that. I will get you the answer.

Rep. Devlin: I can't imagine that you can ask for across the board full scale grandfathering. Hopefully this will be cleared up as we hear more testimony. Your answers are different than the way the bill is written.

T. Blasl: I can't.

Rep. Devlin: You're going to have people that are going to be licensed in ND that have not passed the certification examination and won't have to have ongoing education. That is the way I read the bill.

Chairman Weisz: Further questions? Further testimony support for HB 1371

Matt Grimshaw: CHI St. Alexis Health Williston (Attachment 3) 22:46 testifying in support of HB 1371. I am here to testify on one specific point: should we as a state, be the first in our greater region, to require certification for every modality? Two years ago to establish a license or process. We would not have been supportive had we thought the process was going to contain language at any point requiring full certification of modalities and here is why. (Attachment 3) 23.54 – 29.20.

Chairman Weisz: Questions from the committee?

Rep. Porter: In regards to the ongoing education, do you require so many hours in CT ongoing education in just that one modality or to the total modalities? How do you do it?

M. Grimshaw: We purchase membership in CT Direct Online Training. 30:03 So every employee has free of charge has access to the entire online library for online training. What is more important to us is are they still doing them under the watch of our radiologist? We make sure they are doing enough of the work to stay proficient in the areas that they work in.

Rep. Porter: When the component inside of this bill that removes continuing education out of the powers of the board, you wouldn't have any problem removing that?

M. Grimshaw: I would suggest that there is good reason to look at this; do a quality study and compare the differences? Do we have a problem in our state, let us explore it? Don't be looking to be the first state to set a new standard in a market that doesn't have enough text, I don't know why we do that.

Rep. Lefor: Re**:** continuing education points, if you're doing CT scans or mammograms, is there any new education that is required or does it largely stay the same?

Rep. McWilliams: Is there a continuing education part that is new that is required or does it always stay the same?

M. Grimshaw: We just brought in new equipment and that makes a learning curve for all of our staff. That is where the majority of new training curves take place when you roll out new protocols or you actually change out equipment and or technology changes you offer new tests.

Representative McWilliams: You are saying that your hospital has continuing updated training because of new equipment which would make it unnecessary to put it in law if they continue in training. And if the equipment is not updated, what then?

M. Grimshaw: In regards to cross training, this is an example: I was used as a test patient to study and see what my heart looked like. Our full staff was involved, our trainers, our techs, our radiologist. who cares the most because he has to read them. If there is a question on

equipment quality, he will address it. That is his role. It really does go away with nuclear medicine. We are forced to have one of those and will have a backup for that training.

Vice Chairman Rohr: Do you have a salary differential for the those who are registered in license vs. certified?

M. Grimshaw: We do! We do pay those are certified more and they get all the work.

Chairman Weisz: Further support for HB 1371

Theo Stoller: CEO of Jacobson Memorial Hospital Care Center
(Attachment 4) 33:48 – 45:30 I am here to testify on HB 1371 and I ask that you give this bill a do pass recommendation.

Chairman Weisz: Questions from the committee? Further testimony in support for HB 1371.

Mitt Grimshaw CEO of CHI St Alexis, Devils Lake: Presented testimony for Colleen Learned RT (Attachment 5)

Chairman Weisz: Further testimony in support of HB 1371?

Mike Sauro, MD: Radiologist, Bismarck, ND. In support of HB 1371. No written testimony was provided. I was an X-ray tech for and then went back to school and became a radiologist. now working out of Bismarck here for the last 17 years. I've had the privilege of working with 10 of the critical access hospitals during this time. After talking to the techs and gathering information on what is going on with HB 1371, I support the majority of this bill. My greatest criticism goes to the text that says every modality has to be licensed. I don't agree with that: to have more regulation on something that isn't broken is not necessary. When CTs moved into rural hospitals about 12 years ago, it made a big difference in the care. If a small town has a CT they can make sure that people don't need to go all the way to Bismarck or Jamestown. I do agree with the
C & U requirements. I do not agree with individual modality.

Chairman Weisz: Further support for HB 1371? Is there any opposition to HB 1371?

Shirley Porter: **President of the ND Medical Imaging and Radiation Therapy Board**
(Attachment 6) - 50:50 - 1:19:51 – In Opposition to HB 1371. The board has no final position on this bill. I am speaking on behalf of myself, not as a representative of my board. "One registry fits all" is not what is best for the patient. Just because you are registered in one modality does not make you qualified in all modalities.

Chairman Weisz: Questions from the committee? For individuals that do not meet the eligibility for the national exam how do you help them? Can more be done online?

S. Porter: We accept what you send in to your national organization for registry, the board accepts that. It is all available online. You have to complete a formal program in order to sit for the test to become a nuclear medicine tech. We recognize what the national organizations

have already done. There is a lot of free continuing education. You can pay organizations and earn your CE that way. 1:20:50

Rep. McWilliams: Can You give me an example of the continuing education in the area of study that you already mastered?

S. Porter: My certification was 6 years ago and I was performing mammography before I was certified. I thought I was a very good radiographer The education that I went through on the job training to perform some of the testing that we do for mammography which is highly regulated in the federal area. I am a better radiographer because of that.

Rep. Seibel: The cross training certification is 6 years.

S. Porter: Yes you can. You have on the job training allowing you to do the work.

Rep. Seibel: Do they have to have someone with them all the time?

Rep. D. Anderson: Each organization has their own requirements.

S. Porter: You have to have education relevant to what you are doing. Each modality has their own requirements.

Rep. McWilliams: You mentioned that Montana has moved to licensing all modalities. Do we have any statistics to show that things are better because of certification?

Rep. Westlind: Are there actual examples?

S. Porter: Yes, we do. Some of them have more than one license in different modalities.

Representative Westlind: I can't believe that a CEO in a hospital would ever allow this to happen in a properly run institution.

S. Porter: Your key statement was "in a properly run institution" I just want to make sure that they are.

Chairman Weisz: How do they do their continuing education?

S. Porter: We accept whatever they have to send in to their registry. There are lots of things on line and many of them are free.

S. Porter: At the time I started at the place I work I was doing mammography and I thought I was good, but now I have training in how to make my machine do what I need to do for the patient. It was humbling, because I thought I was good, and now I know I am better and more competent at what I do.

Representative McWilliams: Do you think this was the result of online training or on the job training that you received?

S. Porter: Both! I get on the job training every day. I learn something every day. I understand the value of on the job training. What has on line training done for you? Usually the online training is more up to date. You are learning things even if you are not using them at your institution. If someone asks questions of new things, you still might have the knowledge of those new things. Online training is very beneficial and up to date. You may not be practicing what you are learning on line but you know that you know that they are out there. Sometimes they are not relevant at your institution, but sometimes they are nice just to have the knowledge. Learn about the "new toy" through online education. All the new updates are available to you online.

Chairman Weisz: Any more questions from the committee?
Further testimony in opposition of HB 1371

Donna Newman, Serving on the ND Medical Imaging and Radiation Therapy Board
(Attachment 7) 1:27:11 – 1:36 I urge you to vote "do not pass" in its current form. I have been practicing for 25 years in medical community.
Also brought testimony from other people that were not able to be here
(Attachment 8) I have several letters from various medical fields that are opposed to this bill that I have received that amount to 750 members and 1200 licenses in North Dakota in the current form.

Chairman Weisz: Questions from the committee?
Further testimony in opposition to HB 1371

Danielle Goetz, Bismarck, ND Testimony in opposition to HB 1371
(Attachment 9) 1:36:56 – 1:47:47 I am opposed to HB 1371. This assumption is not what you think it is. We are assuming that the professional taking care of us is not only pushing a button but ensuring that they are using their experience and education to ensure the happen medium of diagnostic exam while exposing one to the least iodine radiation as possible. This is now fighting to me. They should have to show a competency of some kind in order to provide a safe and high quality exam to your family.

Chairman Weisz: Are there questions from the committee any other testimony in opposition?

Rep. Westlind: We have as rural a hospital in ND that you can get and I don't think this would ever happen in our facility.

Danielle Goetz: I think they are adding the PA as an exemption with this bill but in some small facilities you can have a small approval to receive the ability to take x-rays.

Rep. Weisz: Further testimony in opposition to HB 1371?

Chris Walski: A Radiology manager of a large imaging department in North Dakota.
(Attachment 10) I am opposed HB 1371 because Ultrasound is completely operator dependent it is easy to confuse the vein and the artery for example.

Chairman Weisz: Questions from the committee? Any further testimony?

Brent Colby (Not here, but his testimony was shared by Ann Bell-Pfeifer)
(Attachment 11)

Ann Bell-Pfeifer, Chairman of the Board of ND Society of Radiologic Technologists1:53:37
(Attachment 12) 1:48:18 I am here to testify opposed to HB 1371. Started with the testimony of Brent Colby. HB 1371 does not go far enough to protect the citizens of North Dakota against unwarranted medical radiation exposer. Standardizing imaging care in hospitals and clinics throughout the state is important. There are provisions in SB 2198 to accomplish that goal.

Chairman Weisz: Questions from the committee? Non
Further testimony in opposition to HB 1371

Diane Nelson: Radiology Manager at Jamestown Regional Medical Center
(Attachment 13). I believe that there is an "easy" way to do things and the "right" way to do things. HB 1371 is the easy way to approach licensure but it is not the right way.

Chairman Weisz: Questions from the committee? Seeing none
Is there further testimony in opposition to HB 1371?

Ted Fogarty: (Attachment 14) I am a practicing physician in a state. We need to find the balance between this house bill and the senate bill.
Where do we go with this? We are ahead of the crowd, but we need to do it.
We are all good people trying to do what is best for our state.

Chairman Weisz: Are there any questions from the committee? Any further testimony in opposition to HB 1371? We will close on HB 1371.

2017 HOUSE STANDING COMMITTEE MINUTES

Human Services Committee
Fort Union Room, State Capitol

HB 1371
2/7/2017
29735

☐ Subcommittee
☐ Conference Committee

Committee Clerk Signature Judy Kepple

Explanation or reason for introduction of bill/resolution:

Relating to the regulation and licensure of medical imaging and radiation therapy practitioners.

Minutes:

Chairman Weisz: opened the hearing on HB 1371

Representative Porter: I make a motion for do not pass on HB 1371

Representative Westlind: Seconded

Chairman Weisz: Is there any discussion? We all know what

Representative Porter: Just so that everyone is clear, the hospital association and the medical imaging board met on numerous occasions and came to a consensus on the amendments that were put on the senate bill that just received a 7 – 0 so pass out of Senate Human Services, so this one is not necessary any longer.

Chairman Weisz: The bill in the senate is 2198.

Representative Porter: I did talk with Rep. Nelson over lunch today and of course, I was going to check with him before we did this and he is in the loop on this.

Representative Westlind: What did they change in that bill that the hospital association would accept it?

Representative Porter: They kept the 6 modalities of certification and they created pathways for the OJT like for the CT techs that included then the continuing education that they had talked about in front of us and then they created a pathway for someone to get inside of those 6 modalities. They can do that OJT over a period of 6 – 8 years so that the cross training component can still exist. It seemed like that after a lot of hard work they got to a point that everybody agreed over there.

Chairman Weisz: Discussion? Seeing none, the clerk will call the roll for a do not pass on HB 1371.

Roll call vote taken: Yes 12 No 0 Absent 2
Chairman Weisz: Motion carried for a do not pass on HB 1371
Do I have a volunteer to carry it?

Representative Devlin: I will.

Chairman Weisz: Thank you. Adjourned.

Date: 2/7/17
Roll Call Vote #: 1

2017 HOUSE STANDING COMMITTEE
ROLL CALL VOTES
BILL/RESOLUTION NO. HB 1371

House Human Services Committee

☐ Subcommittee

Amendment LC# or Description:

Recommendation: ☐ Adopt Amendment
☐ Do Pass ☑ Do Not Pass ☐ Without Committee Recommendation
☐ As Amended ☐ Rerefer to Appropriations
☐ Place on Consent Calendar

Other Actions: ☐ Reconsider ☐

Motion Made By Rep. Porter Seconded By Rep. Westlind

Representatives	Yes	No	Representatives	Yes	No
Chairman Weisz	✓		Rep. P. Anderson	✓	
Vice Chairman Rohr	✓		Rep. Schneider	✓	
Rep. B. Anderson	✓				
Rep. D. Anderson	absent				
Rep. Damschen	✓				
Rep. Devlin	✓				
Rep. Kiefert	✓				
Rep. McWilliams	✓				
Rep. Porter	✓				
Rep. Seibel	absent.				
Rep. Skroch	✓				
Rep. Westlind	✓				

Total (Yes) 12 No 0

Absent 2

Floor Assignment Rep. Devlin

If the vote is on an amendment, briefly indicate intent:

REPORT OF STANDING COMMITTEE

HB 1371: Human Services Committee (Rep. Weisz, Chairman) recommends **DO NOT PASS** (12 YEAS, 0 NAYS, 2 ABSENT AND NOT VOTING). HB 1371 was placed on the Eleventh order on the calendar.

2017 TESTIMONY

HB 1371

Att. 1
HB 1371
1-24-17

Testimony for HB 1371

Rep. Jon Nelson District 14

Chairman Weisz and members of the House Human Services Committee, I am pleased to introduce HB 1371 today. This bill draft is a product of discussions that I had with radiology experts in rural hospitals throughout North Dakota.

Rural hospitals in North Dakota and across this country are in crisis. I served on my local hospital board at Heart of America Medical Center for 14 years. During that time period we have seen a major shift in services utilized. Early in my tenure inpatient revenue was the major revenue source for our hospital but that is certainly not the case anymore. Outpatient revenue has become the lifeline for keeping quality healthcare delivery available in our communities in rural North Dakota. At our facility in Rugby we added a permanent MRI to the radiology department most recently and that has added diagnostic benefits, convenience for our consumers, as well as an additional revenue stream for our facility. We are currently adding chemo therapy to cancer patients which will allow another benefit for patients and meet the continuing need for healthcare delivery in our community.

Last summer Kirk Seaver, who heads the radiology department at Heart of America Medical Center made me aware of a directive to require his staff to be certified in every modality that are used in his department. Generally speaking, CT scans, ultra sounds, and x-rays are the primary procedures that take place in the hospital and the staff that perform the procedures have been able to work between the various modalities to meet the workload demands and do so in a professional and efficient manner. Mr. Seaver was very concerned that if this directive became effective he would either have to hire more staff that would cost the facility more initially as well as lose efficiency as the volumes of each procedure wouldn't allow for a full time employee to maximize the effort. We simply could not afford to do what we now do, and as a result, healthcare delivery will suffer.

HB 1371, if passed, will allow staff in our Critical Access Hospitals to perform the duties that they currently perform and have until this directive was promulgated. Licensure will continue to be required but certification between modalities would not be required. It is important to note that every state that surrounds North Dakota has similar regulations as this bill would require.

In conclusion, with the reduction in medical service provider reimbursement that has occurred in the past year and the difficulty in attracting and retaining existing staff, it seems ill conceived to forward an unnecessary requirement like the medical imaging and radiation therapy board is considering.

There are a number of hospital leaders here today to provide on the ground practical implications of this proposed change. Please consider a Do Pass recommendation to keep our rural healthcare delivery system strong and stable going forward.

Thank you Mr. Chairman and committee.

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NDHA
North Dakota Hospital Association Est. 1934

Vision
The North Dakota Hospital Association will take an active leadership role in major Healthcare issues.

Mission
The North Dakota Hospital Association exists to advance the health status of persons served by the membership.

Testimony: 2017 HB 1371
House Human Services Committee
Representative Robin Weisz, Chairman
January 24, 2017

Good afternoon Chairman Weisz and Members of the House Human Services Committee. I am Tim Blasl, Vice President, North Dakota Hospital Association (NDHA). I am here to testify regarding 2017 House Bill 1371 and ask that you give this bill a **Do Pass** recommendation.

Last session, the Board of Medical Imaging and Radiation Therapy (the Board) was created to license individuals who perform medical imaging and radiation therapy such as x-rays, CT scans, and ultrasound. The purpose of such licensing was to allow these individuals to accept verbal orders from the practitioners who order such studies or therapy. This bill would correct some inconsistencies that were in the bill passed in 2015 and it would clarify the requirements for licensing of individuals who perform medical imaging or radiation therapy. This bill would grant a license to individuals who have completed a course of study in, and are registered with, a national organization that specializes in the registration of medical imaging and radiation therapy personnel, such as the American Registry of Radiologic Technologists (ARRT).

NDHA members believe this bill is necessary because the Board took the position that, in order to be licensed, these individuals must complete a course of study in and be registered and certified in each specific modality in which they intend to practice, such as radiography, radiation therapy, nuclear medicine technology, radiologist assistant, or sonography. NDHA members are concerned that interpretation would create workforce problems, especially in rural areas where medical imaging and radiation therapists are already difficult to hire. This bill is designed to

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clarify appropriate licensing standards to ensure quality and safety while not imposing unnecessarily restrictive requirements. It would clarify that those who were already practicing medical imaging and radiation therapy as of December 31, 2015, in the state may continue to perform the medical imaging and radiation therapy modalities the licensee was employed to perform as of that date so that we don't further reduce our workforce of personnel who have demonstrated by years of practice their ability to safely and appropriately provide medical imaging and radiation therapy.

We agree with the Board that it is important to ensure quality radiology care. We do not agree that licensing should be restricted to only those individuals who receive training in each specific modality. This interpretation as laid out in administrative rules proposed by the Board would create 15 separate licensing categories that would require individuals to get training and become certified in each specific modality in which they intend to practice. It would create a regulatory burden that is overly complicated and one which imposes much higher requirements than most states. None of our three neighboring states requires licensing by modality. South Dakota, for example, currently has no licensure laws governing radiology personnel. North Dakota would have more difficulty in recruiting qualified radiology personnel from other states if our standards are more restrictive. As some of our members who are here today will testify to, we already have trouble hiring these individuals. In addition, there are already numerous safeguards currently in place to ensure the quality and safety of radiology procedures.

There is already a great deal of education and training of medical imaging and radiation therapy personnel to ensure quality and safety. We agree with requiring these individuals to be certified and registered with a national certification organization such as the American Registry of Radiologic Technologists (ARRT) or the Nuclear Medicine Technology Certification Board. In order to be certified and registered, an individual must have completed required training and clinical experience requirements and passed proficiency examinations that demonstrate the individual has met a recognized national standard for medical imaging, interventional procedures, and radiation therapy. For example, a candidate may pursue primary pathway certification and registration in radiography, nuclear medicine technology, radiation therapy, MRIs or sonography and within a required time period must successfully complete an educational program that is accredited by a mechanism acceptable to the ARRT. As part of their education, candidates must also demonstrate competency in coursework and an ARRT-specified list of clinical procedures by completing competency requirements.
There are also ongoing annual requirements in order to maintain certification and registration. For example, ARRT annually certifies and registers individuals who agree to comply with

the ARRT Rules and Regulations, continue to comply with the standards of ethics, and meet continuing education requirements.

In addition, even after an individual is registered and certified, there are additional oversights in place to ensure safety and quality. A physician or advanced practice provider must order a particular medical imaging study and most often a radiologist must read it. The radiologist is another check and balance to make sure quality is adequate to allow the image to be properly interpreted. There is governmental oversight by agencies such as the Nuclear Regulatory Commission, the Food and Drug Administration (FDA), and the North Dakota Department of Health to ensure appropriate use of radiation. Hospitals also employ or contract with health physicists who make sure proper care is taken around X-ray machines and other sources of radiation used in medical settings.

We are aware of no findings of maladministration of radiation by a North Dakota hospital by any of these governmental agencies and so we question the need for any stricter licensing requirements. It may be that someday licensing by modality will be required by Medicare, the Joint Commission, or governmental regulatory agencies, but we are not there yet and to impose such strict requirements now will make it even harder to find the personnel necessary to provide medical imaging and radiation therapy.

NDHA hospital members are here today to discuss how hospitals currently ensure the quality and safety of medical imaging and radiation therapy procedures and how this bill will require appropriate regulation to ensure quality and safety while not making it more difficult to recruit radiology personnel in our State. I would like to introduce these individuals: Matt Grimshaw, CEO, CHI St. Alexius Health Williston; Theo Stoller, CEO, Jacobson Memorial Hospital Care Center in Elgin and Andrew Lankowicz, CEO, CHI St. Alexius Health Devils Lake.

We support this bill and ask that you give it a **Do Pass** recommendation.

I would be happy to try to answer any questions you may have. Thank you.

Respectfully Submitted,

Time Blasl, Vice President
North Dakota Hospital Association

att. 3 1-24-17
HB 1371

CHI St. Alexius Health

Imagine better health.℠

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CHIStAlexiusHealth.org

Testimony: 2017 HB 1371

House Human Services Committee

Representative Robin Weisz, Chairperson

January 24, 2017

My name is Matt Grimshaw, and I am here on behalf of CHI St. Alexius Health Williston to testify in support of HB 1371

We currently employ 18 radiology techs that cover the following modalities:

- X-Ray
- CT
- MRI
- Mammography
- Ultrasound
- Nuclear Medicine
- Dexa

We are here to support this legislation as an alternative to SB 2198 is because we believe that proposed regulation places an undue burden on our rural facilities without any documentable benefit. Licensing our radiology techs is important, and making sure they are registered is fine. However, we feel that the movement toward full certification in any modality that we may need them to perform is not doable for three clear reasons.

1) There is no evidence of clinical variation or discrepancy in the quality or safety of the work performed by our techs whether they are certified or not. Of the 5 techs who cover our CT service 24/7, only one is currently certified, and the rest have been trained here at our facility. Over the past 7 months we have performed almost 3,000 CT scans, and only 28% of them have been performed by the certified CT tech. Our locally trained techs have been trained appropriately and they do an outstanding job for our patients and we have no reason to differentiate between them based on their performance.
2) The availability of techs for all modalities is not equal across the state of North Dakota. For example, we lost one of our general x-ray techs in the summer of 2016, and finally after 6 months of searching, we have successfully recruited a replacement. If we are

unable to attract general techs how are we expected to have a full bench of certified techs for all modalities?

3) Specialized techs are even more difficult to find. In 2016 we lost our one Nuclear Medicine tech, and if we had been unable to shift one of our locally cross-trained ultrasound techs over to cover that service we would have been closed for almost 3 months. There simply are not enough of these specialized techs in rural ND to move forward with this new regulation.

Our radiology volume has grown more than 50% over the past 5 years, and we are the backbone of the healthcare delivery for the northwest region of our State. While we may agree that in a perfect world certification of all radiology techs is ideal, we simply do not feel that there is a clinical case for moving in that direction statewide at this time. We fully support the need to have our radiology techs registered and licensed, but that is as far as we believe the State should go.

I would be happy to answer any questions you may have.

Matt Grimshaw
President, CHI St. Alexius Health Williston

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Testimony: 2017 HB 1371
House Human Services Committee
Representative Robin Weisz, Chairman
January 24, 2017

Good afternoon Chairman Weisz and Members of the House Human Services Committee. I am Theo Stoller, Chief Executive Officer of Jacobson Memorial Hospital Care Center (JMHCC). I am here to testify regarding 2017 House Bill 1371 and ask that you give this bill a **Do Pass** recommendation.

This bill would allow licensing of individuals who perform medical imaging or radiation therapy if the individual has completed a course of study in, and is registered with, a national organization that specializes in the registration of medical imaging and radiation therapy personnel, such as the American registry of radiologic technologists.

Some background information on JMHCC, we are a critical access hospital in southwest North Dakota with clinics in both Elgin and Glen Ullin with our nearest referring hospital being 80 miles away. JMHCC roughly sees 7,500 patients per year in our clinics and around 650 patients in our Emergency Department. JMHCC currently offers the following services in our radiology department: general x-ray, CT, contracted ultrasound, mobile MRI, mobile mammogram, and mobile bone density. Our service area is considered the greater Grant County which also serves patients in Morton, Hettinger, and Sioux Counties.

If this bill passed, it would benefit my facility in the following ways: JMHCC's recruitment of radiology personnel will be more feasible and we will be able to be a stroke ready hospital.

JMHCC has had recruitment issues already in radiology as evidenced by in 2015 our previous radiology supervisor resigned their position and JMHCC needed to contract with a company to provide interim radiology supervisor duties so we could continue to operate our radiology

department. After three months of contract labor we were able to find a registered technologist from the state of Florida with the appropriate qualifications to relocate.

Since we have been lucky to have qualified technologists the patients of our service area were highly fortunate that JMHCC was able to receive a grant for the purchase of a new 32 Slice CT scanner which has saved patient lives. Since we have had the equipment we are furthering our mission to give patients peace of mind close to home by completing the necessary work to become a stroke ready hospital through the program of the state of North Dakota. Some of the expectations of being a Stroke Ready Hospital would be we need to be able to administer a clot busting medication within 60 minutes of arrival if the stroke had occurred within five hours, have necessary technology to assist in diagnosis of an ischemic stroke, a radiologist to read the images in a timely manner, CT staff available 24 hours a day 365 days per year, and necessary laboratory equipment. If the bill were to pass JMHCC will be able to meet the requirement to become a stroke ready hospital. If the bill were not to not pass ambulances would be given direction if a patient was having a stroke emergency to bypass an otherwise capable hospital to treat stroke due to not have appropriate radiology staff.

JMHCC wants to always provide quality patient care and we do that by ensuring our staff continues to meet education guidelines as set by the American registry of radiologic technologists, regularly have physicist oversight of the equipment, service agreements with manufacturers to ensure equipment is in working order by completing regular product maintenance, oversight from a radiologist as a radiology director, survey process from the department of health, and constant review of every exam when a radiologist reads and interprets the images. If a radiologist is reading an image and finds that images do not meet expectation they will follow up to ensure the issue is corrected.

I support this bill and ask that you give it a **Do Pass** recommendation.

I would be happy to try to answer any questions you may have. Thank you.

Respectfully Submitted,
Theo Stoller, Chief Executive Officer
Jacobson Memorial Hospital Care Center

aH 5
HB 1371
1-24-17

Testimony: 2017 HB 1371

House Human Services Committee

Representative Robin Weisz, Chairman

January 24, 2017

Chairman Weisz and members of the House Human Services Committee, my name is Colleen Learned RT (R) (CT). I am a RT, also registered in CT from Cando ND. I am currently working at the hospital in Devils Lake. I have been working in health care as an RT for 43 years and I support this bill. This bill ensures access to quality imaging services throughout the state.

In researching our neighboring states as well as several other states in the Great Plains area, I have found this to be consistent to what others have done. The importance of ensuring access to quality imaging services is vital.

On a personal level I experienced the need for a CT scanner in a critical access hospital first hand. A few years ago, my 80-year-old mother, living in Garrison ND called me. She complained of weakness and her speech was slurred. She thought she was having a stroke. She was able to call 911 and I called the Garrison Hospital to confirm they had a CT scanner. I knew Garrison Hospital had an RT to perform the scan and it was not a consideration on my part if that RT had an advanced certificate in CT. I knew he could perform a CT exam that could diagnose my mother's conditions. Without that CT scanner in Garrison she would had be taken by ambulance to Bismarck for a CT scan. That time delay could have proved to be very detrimental to her recovery.

Two years ago, our aunt fell in her driveway in Cando. She thought she was fine and just wanted to rest a while. Her condition deteriorated late in the evening and she was taken to the Towner County Memorial Hospital in Cando. They performed her head CT and confirmed she had head bleed from the fall. She was transferred to Grand Forks via helicopter to be treated. Again, showing the need for the critical access hospitals to have this service.

I am also the Lead Technologist performing Nuclear Medicine exams in Devils Lake. We perform Myocardial Perfusion studies, bone scans and Hida Scans. We have passed multiple JC reviews and two state inspections.

When we started our Nuclear Medicine department we hired the services of AMP (American Medical Physicist) to oversee our department. AMP performs quarterly audits, reviewing our Nuclear Medicine lab, patient doses, and makes sure we are in compliance with the ND State Health Rules as well as the ACR rules. We have an active ALARA (As Low as Reasonably Achievable) program and an in house RSO (Radiation Safety Officer).

There are three Cardiologists that see patients in clinics in Devils Lake. We perform MPI exams for their patients. We also have Oncologists that see patients in Devils Lake. We do bones scans for their patients saving them from having to leave town for their test. If we are unable to do Nuclear Medicine studies these patients must drive either 90 or 120 miles for their exams.

In most Critical Access Hospitals, cross training is necessary for patient access. Techs are required to train in more than one modality, especially since they are required to take call for emergency exams. All the Rad. Techs we hire must perform both radiography and CT exams to take call and work weekends. We ensure they work with an experienced technologist prior to "releasing" them to work independent.

I support HB 1371 as it provides for licensure which is consistent with area states and allows for continued access for North Dakota citizens.

Colleen Learned, RT (R) (CT)
Cando, ND

att. 6
HB1371
1-24-17

House Human Services Committee

HB1371

January 24, 2017

Good afternoon Chairman Weisz and members of the House Human Services Committee, my name is Shirley Porter. I presently serve as the President of the North Dakota Medical Imaging and Radiation Therapy Board. The board has no formal position on this bill and as such, I appear before you as a concerned radiologic technologist testifying on my own behalf.

First of all I want to thank you for recognizing my profession last legislative session by creating a board and licensing process. I also want to take a moment to explain the various modalities of medical imaging and explain why this house bill, 1371 is a bad policy for the patients we serve in North Dakota. I have included an attachment I hope you find useful as a quick reference.

I need to take a moment and vent – last year during your interim the board started the process of drafting rules and in May held a stakeholders meeting. This was even before the formal process of posting notices. We invited over 26 different groups to have their input and expertise on our draft – the board then adopted a large majority of those suggestions. In August I began having regular conversations with the ND Hospital Association (NDHA) and in October agreed to a teleconference meeting with a large number of their members. My conversations of trying to find a solution to resolve their concerns within critical assess hospitals continued right up to the first day of this legislative session. Where I was led to believe we had met their concerns within SB2198. Little did I know a week later they were contacted by Legislative Council to assist in drafting legislation – I can only assume we are now seeing a product of their labor in HB1371. Just this last Friday was the first day I heard their formal position of being opposed to SB2198 and in favor of HB1371. As embarrassing as it is to say I am a rookie, I really did believe that in all of those meetings and phone

conversations since last May the NDHA was sincere in working with me to help protect the patient. Education and continuing education only helps to ensure the safety of our patients. Again little did I know I was only assisting them in providing information, explaining the complexity of the imaging field with all of the different modalities, registries, certifications, and **then even going back to my board and convincing them to a compromising provision in SB2198 for their critical access hospitals** believing we were both working together for the safety of the patient. Again I am rookie and apparently that is politics, but no one likes to feel as though they were used. In my opinion they were even so bold as to draft themselves into this bill on the top of page four – "before the board can adopt any rules it must collaborate and consult" with them and others. We did that by having the Stakeholders meeting last May before formally starting the rule process, it was the right thing to do by having all of the groups input before rules were proposed. I get politics it's everywhere – it's in healthcare and at my work too but at least there it's done in the name of trying to improve patient care. Here at the Capitol, I don't know how you legislators sort through it and do it every session. I will use this experience as a teaching moment and will not allow myself to be put in a similar situation again. I will work hard on the board, I will try to be a good president, and I will make you proud of me AND I will not pick up a piece of wood to build a fence. Thank you legislators for what you do, for me I will stick with patient care that is a job I love and do very well – my mammogram patients are the best. Please excuse the rant, but no one likes to feel as though they were used.

Brief background information, the ND Medical Imaging and Radiation Therapy Board (NDMIRT) was created last legislative session with nine members appointed by Governor Dalrymple. As of this month, January 2017 we currently have about 1215 medical imaging and radiation therapy professionals licensed. Also as of January 2017, North Dakota became the 40th of 41 states that now have standards of regulation for imaging professionals, which leaves only ten states with no

standards of regulation for imaging professionals, our neighbor South Dakota is one those states. It is becoming a common precedent of licensure states to license by modality.

The board has repeatedly assisted applicants by issuing Conditional Licenses to individuals allowing them to continue to practice in their facilities while either regaining their registry they allowed to lapse or while gaining a registry they do not even currently possess. The board has not caused any imaging services to be discontinued at any facility at any time – we have required education of individuals before we would allow them to continue practicing after we found critical access hospital employees using radiation doses being 3-times what they should be for CT scans of the head. Of the 1215 licenses issued only 20 are Conditional, with only 6 in the modality of radiography. The majority are in sonography (which is Ultrasound) for those individuals who have finished the formal ultrasound program but are required to have one year of work experience before they are allowed to take the ultrasound registry.

It is important to clarify modality certification is ONLY in the areas you are <u>actually performing</u> – you do NOT need to be certified or become certified if you are NOT performing in the modality. The cross-training process to earn certification is 6 years with a one-time renewal of 2 years this equates to 8 years to earn certification again ONLY if you are actually performing in that modality do you need certification. Certification is on-the-job training (OJT) that is done within your facility and then an examination through a national organization, American Registry of Radiologic Technologists (ARRT). This is also the same national organization that registers radiographers, and other imaging professionals. This is again the same organization the board may contract with to provide "state certification" for those individuals that may not meet the eligibility requirements of the national organization, ARRT. The Board may contract with ARRT for **ANY** registry or certification modality

exam that ARRT currently has to offer. This can be offered as a "state administered" exam. This would be a perfect avenue for the on-the-job trained (OJT) Ultrasound and Nuclear Medicine technologists to be able to earn registry through the state administered process because currently some individuals do not meet national eligibility requirements. "Certification attests to the fact that the individual has met initial education, examination, and ethics requirements. Annual registration demonstrates that the individual continues to meet continuing education and ethics requirements. ARRT certification is the best indicator of qualifications to perform radiologic imaging and radiation therapy procedures." – statement by ARRT.

I have many concerns within HB1371:

1. The registry requirement change that would now mean "a registry" meaning only ONE registry would be needed to practice any and/or all of the different specialties within medical imaging is not safe for the patient. Specialty areas have separate registry patient care disciplines with their own educational curriculum, practice standards, and examination. Each specialty area also differs from the others in the way radiation is managed and images are produced. In my radiology training program I did not learn how to perform ultrasounds or nuclear medicine examinations. Our student rotations in those areas where to observe but not perform examinations.

   Scenario A – Imagine the ultrasound technologist, scanning your carotid arteries holding a current ultrasound registry also performs your pre-op Chest x-ray. The ultrasound technologist has NO background or education in the use of ionizing radiation but with this "one registry fits all" concept this would be considered ok. The education, training, and scopes of practice between radiography and ultrasound are starkly different.

Scenario B – Imagine after 2 days of shoveling snow your doctor orders an x-ray of your lower back and a nuclear medicine stress test of your heart: a radiographer, who has a radiography registry, performs the x-rays of your lower back and then also performs the stress test of your heart. The radiographer has training in the use of ionizing radiation but does not have the structured training, education and scope of practice of that of a registered nuclear medicine technologist, who is educated in the use of radioactive isotopes that are injected into your body and the use of specialized cameras to study your heart. Again the "one registry fits all" approach would not protect the patient.

The removal of certification requirements, which represents competency and is only needed in the modalities you are currently practicing ensures an applicant has met initial education, examination, and ethics requirements. This practice of licensing by modality is becoming standard practice across the nation especially with the rapid pace of new technologies. The concerns of recruitment to North Dakota should not be an issue, the applicants can be recruited and on-the-job trained (OJT) to the areas needed for certification within your facility.

An example: you recruit a registered radiographer from Montana, which is a licensure state, you on-the-job (OJT) that individual in computed tomography (CT) the way your department has set protocols and procedures with the ability to cover call. That recruit would have 8 years to earn their CT certification under our proposed guidelines. It is common practice within facilities that certification must be completed within 2 years; that is an instructional policy which is more stringent the board's guidelines.

Radiography programs across our state have also recognized the need for more radiographers in the workplace and have risen to the challenge by accepting more students into their radiography programs. This will assist in the shortage of registered radiographers and help to ease the burden of

recruitment. There is simply nothing better than North Dakota trained, the work ethic is superior, and our radiography programs are top-notch.

2. The grandfathered license provision would require the board to issue a grandfathered license to anyone who was employed as a medical imaging or radiation therapy technologist before January 1, 2016 in perpetuity. For example, a radiographer with NO current registry working before January 1, 2016 could apply for and receive a license in 2025 even though they have not been performing x-rays for 10 years and have not been doing any continuing education. How is that good patient care? The most difficult aspect of the grandfathered license provision for me is not having to complete ANY continuing education requirements to renew their license. So this applicant may not have a current registry and could be practicing in multiple modalities of imaging (radiology, ultrasound, and CT) and NOT have to do any continuing education at all. This is NOT a safe patient practice and if allowed they should be required to disclose it to their unknowing patients. I am not aware of any other medical profession that does not require continuing education. This could potently set an undesirable precedent for other boards.

   Due to 21st century accelerated advancements in technology, patient safety becomes even more of a concern. The time is now and the urgency to promote education and safety is paramount; the mindset of "see one, do one, teach one" is of years past. Ongoing education is readily available, reasonable priced, and at the touch of the fingertips on-line. We want to do better for the citizens of ND, no matter where they live – elevating their level of care can be achieved by elevating the standards of medical imaging. Continuous quality improvement is something all imaging facilities work for on a daily basis.

3. The exclusion of recognizing the different scopes of practice for the different imaging modalities leaves us with the "one registry fits all" and then "the one license to do all" leading to a danger that you may perform imaging in all scopes of practice without the proper structured training, education, and continuing education. I currently do not hold personal liability insurance but with one registry, one license, and no specific scope of practice recognized perhaps all imaging technologists should consider having it. Brief comparison: An advanced practice nurse practitioner (NP), a registered nurse (RN), and a licensed practical nurse (LPN) all hold a different type of license that has a different scope of practice but this exclusion leaves medical imaging as one license to perform any and/or all medical imaging. This is not a safe patient care practice and may even open the door to increase liability for technologists. In the current society we live in, if I perform an examination that may not be part of my scope of practice with the proposed "one registry, one license fits all" I would be named in a lawsuit. I am listed as the preforming medical imaging technologist in the electronic medical record (EMR). I realized I am at the bottom of the food chain after the institution, the radiologist (medical doctor who specialize in diagnosing and treating disease using medical imaging) but I would have to assume I would still make the list. I am just unsure with this proposed change just how much I would be protected by the institution's umbrella of coverage.

In closing, **I would like to leave you with the thought that the overall general impression the public has of licensed individuals is that they already possess the proper training, have the education, and are staying up to date by doing continued education**. HB1371 does not ensure this to be true for the licensing of medical imaging technologists and actually may provide a false pretense in law to the

contrary. As an advocate for my patients their safety comes first; there is another piece of legislation in the Senate - SB2198 that would help to ensure patient safety and patient protection comes first.

As you may be aware from your own personal experiences medical imaging is extremely useful to help diagnosis and treat. My desire for each of you and all the citizens of North Dakota is to have a qualified and educated individual performing your medical imaging. Education and continuing education are the keys to patient safety.

Mr. Chairman and Committee members, that concludes my formal testimony and I would be happy to answer any questions you may have.

Thank you

Shirley Porter BS RT (R) (M) ARRT

Medical Imaging Quick Reference Handout

-this is not an all-inclusive list of imaging modalities

-this is intended to be a Quick Reference overview only

Modality	Brief explanation	Common exams	Length of training to earn certification or registry	Required continuing education hours (CEUs)	State-administered exam pathway intention
Radiography (Registry) *(*one registry: American Registry of Radiologic Technologists ARRT)*	x-ray equipment used to produce 2D & 3D images of tissue, organs, bones & vessels	-Chest X-rays, Abdominal X-rays -Hand & Wrist -Leg or Ankle	Associates OR Bachelor degree *24 month program	24 CEUs in 2 years	Eligible to use pathway, do continuing education requirements
Nuclear Medicine (Registry) **2 different competing registries: (ARRT) & Nuclear Medicine Technology Certification Board(NMTCB)*	Uses radiopharmaceuticals & special cameras to produce images of organs & reveal their function	-Gallbladder scan -Bone scan -Heart scan	Associates OR Bachelor degree *24 month program	24 CEUs in 2 years *(*ARRT & NMTCB registry have same CEU requirements)*	Eligible to use pathway, do continuing education requirements
Ultrasound *(sonography is same thing)* (Registry) *(*3 different competing registries: ARRT, American Registry of Diagnostic Medical Sonographers(ARDMS), & Cardiovascular Credentialing International(CCI)*	Uses high-frequency sound waves to create images of anatomy	-OB -Carotid Arteries -Echo -Abdomen -Breast	Associates OR Bachelor degree *24 month program	24 CEUs in 2 years for *ARRT* *OR* 30 CEUs in 3 years for *ARDMS* *OR* 36 CEUs in 3 years for CCI	Eligible to use pathway, do continuing education requirements
Radiation Therapy (Registry) *(one registry: ARRT)*	Administers highly focused forms of radiation to treat cancer & other diseases	-Breast -Prostate	Associates OR Bachelor degree *24 month program	24 CEUs in 2 years	Eligible to use pathway, do continuing education requirements
Radiologist Assistant (RA) (Registry) **two competing registries: ARRT & Certification Board for Radiology Practitioner Assistants(CBRPA)*	Experienced radiographers with additional training that are radiologist extenders	-Performing imaging exams -Joint injections -Barium studies	Master's Degree *must be a radiographer first & complete formal RA program	ARRT:50 CEUs in 2 years *OR* CBRPA: 50 CEUs every year OR Recertify by exam	Eligible to use pathway, do continuing education requirements
Bone Densitometry (BD) (Certification) **OR** International Society of Clinical Bone Densitometry (ISCD) (Certification) *(*two competing pathways: ARRT & ISCD)*	Uses x-ray to measure bone mineral density of a specific site **ARRT Certification is on-the-job (OJT) training, examination, & CEU.*	-Spine -Hip -Heel -Wrist	ARRT Registry *must be a Radiographer, Nuclear Medicine or Radiation Therapist first **OR** ISCD certification *must have a degree in Allied Health field	ARRT: 24 CEUs in 2 years *OR* ISCD: 35 CEUs in 5 years OR Recertify by examination	Eligible to use pathway, do continuing education requirements

Modality	Brief Explanation	Common Exams	Length of training to earn certification or registry	Required continuing education hours (CEUs)	State-administered exam pathway
Computed Tomography (CT) (Certification)	Uses rotating x-ray unit to obtain "slices" of body to view inside of organs	-Head CT -Abdomen CT	*must be a radiographer first, Pass certification exam **ARRT Certification is on-the-job (OJT) training, examination, & CEU.*	12 of 24 CEUs must be specific to CT	Eligible to use pathway, do continuing education requirements
Magnetic Resonance Imaging (MRI) (Certification)	Uses radiofrequency pulses & powerful magnetic field to create detailed images of anatomy	-Breast MRI -Knee MRI -Brain MRI	*must be a radiographer first, Pass certification exam **ARRT Certification is on-the-job (OJT) training, examination, & CEU.*	12 of 24 CEUs must be specific to MRI	Eligible to use pathway, do continuing education requirements
Mammography (Certification)	Uses x-rays to image breast tissue to diagnosis cancer	-Screening mammogram -Diagnostic mammogram	*must be a radiographer first, Pass certification exam **ARRT Certification is on-the-job (OJT) training, examination, & CEU.*	24 CEUs in 2 years plus: (15 CEUs specific to Mammography in 3 years): *Federal requirement*	*Eligible to use pathway, do continuing education requirements (*still checking on Federal requirements if possible)
Quality Management (QM) (Certification)	Individuals that monitor the quality of process & system in an imaging department	-Quality Control tests, monitor timer accuracy & reproducibility	*must be a radiographer first, Pass certification exam **ARRT Certification is on-the-job (OJT) training, examination, & CEU.*	12 of 24 CEUs must be specific to QM	Eligible to use pathway, do continuing education requirements
Cardiac-Interventional Radiology (CI) (Certification)	Fluoroscopic procedures specifically targeted for diagnosis & treatment of cardiac diseases	-Cardiac Cath -Angioplasty	*must be a radiographer first, Pass certification exam **ARRT Certification is on-the-job (OJT) training, examination, & CEU.*	12 of 24 CEUs must be specific to CI	Eligible to use pathway, do continuing education requirements
Vascular-Interventional Radiology (VI) (Certification)	Fluoroscopic procedures specifically targeted for catheter placement & the treatment of vascular diseases	-Stent placement -Vena cava filter placement -Guidance for catheters	*must be a radiographer first, Pass certification exam **ARRT Certification is on-the-job (OJT) training, examination, & CEU.*	12 of 24 CEUs must be specific to VI	Eligible to use pathway, do continuing education requirements

Again this is NOT an all-inclusive list of modalities, this is only meant to be a quick reference guide to help in the understanding of the imaging field and level of education and continuing education.

Sorry for the brevity of handout and/or errors it may contain.

Hope you find it helpful!

Thank you, Shirley Porter

Two Categories: Primary and Post-Primary

Primary

ARRT offers a primary category of certification and registration in five disciplines of radiologic technology:

Radiography
Radiographers apply ionizing radiation to demonstrate portions of the human body — on a radiograph, fluoroscopic screen, or other imaging system — to assist physicians in diagnosis of disease and injury.

Nuclear Medicine Technology
Nuclear medicine technologists use radioactive materials in specialized studies of body organs to assist physicians in diagnosis and treatment of disease.

Radiation Therapy
Radiation therapists use ionizing radiation-producing equipment to administer therapeutic doses of radiation as prescribed by physicians for treatment of disease.

Magnetic Resonance Imaging
Magnetic resonance imaging technologists utilize the resonant frequency properties of atoms within a magnetic field to image anatomic and/or physiologic conditions of the body to assist physicians in the diagnosis of disease.

Sonography
Sonographers use nonionizing, high-frequency sound waves to image portions of the human body to assist physicians in making diagnoses.

Post-Primary

ARRT offers a post-primary category of certification and registration in mammography, computed tomography, magnetic resonance imaging, quality management, bone densitometry, cardiac-interventional radiography, vascular-interventional radiography, sonography, vascular sonography and breast sonography. ARRT also offers certification and registration for radiologist assistants.

Post-primary candidates must be certified and registered by ARRT (except where noted) in the appropriate disciplines as indicated below.

	Radiography is a supporting discipline for	**Nuclear Medicine Technology*** is a supporting discipline for	**Radiation Therapy** is a supporting discipline for	**Sonography**** is a supporting discipline for	**Magnetic Resonance Imaging** is a supporting discipline for
Mammography	■				
Computed Tomography	■	■	■		
Magnetic Resonance Imaging	■	■	■	■	
Quality Management	■	■	■		
Bone Densitometry	■	■	■		
Cardiac-Interventional Radiography	■				
Vascular-Interventional Radiography	■				
Sonography	■	■	■	■	■
Vascular Sonography	■	■	■	■	
Breast Sonography	■***			■	
Radiologist Assistant	■				

** Supporting discipline of Nuclear Medicine Technology may be through ARRT or NMTCB.*
*** Supporting discipline of Sonography may be through ARRT or ARDMS.*
**** Certification and registration in both Radiography and Mammography as supporting disciplines is needed for Breast Sonography eligibility.*

Att. 7
HB 1371
1-24-17

Testimony for Public Hearing
Human Services Committee
Public Hearing on House Bill 1371
January 24th, 2017

Good morning, my name is Donna Newman. I have been practicing for 25 years in Nuclear Medicine in a community hospital. I am currently serving on the North Dakota Medical Imaging and Radiation Therapy board as the Nuclear Medicine appointee. I am also a life member our State society, the North Dakota State Society of Radiologic Technologist (NDSRT) and a past president and member of our national society for the last 21years, the American Society of Radiologic Technologist (ASRT). I would like to take this opportunity to offer testimony on behalf of myself and to ask the committee to vote "do not pass" on House Bill 1371.

In Section 1, "Certification organization" has been removed and "Registration organization" has been added. With this change, reference to standards for the organizations has been removed. Therefore, any national organization which claims to specialize in the registration of medical imaging and radiation therapy personnel would qualify the applicant for a license. This would include the equivalent of "diploma mills" which could register unqualified individuals if they are willing to pay the requested price. These unqualified individuals could include people who have been removed from training programs for substandard academic work, cheating or criminal offenses.

Section 4 states that the board "shall issue a license to an applicant who, as of December 31, 2015, was employed in this state to perform medical imaging or radiation therapy procedures". These individuals are then exempt from any requirement for continuing education for the rest of their careers. If the person was working on December 31, 2015 and then stopped working for 20 years, they could still apply for a license and the board would be required to issue a license. This group could also include individuals who may have minimal training but would never be required to have further education, even though other applicants who have a four-year degree would be required to have continuing education. Other licensed medical professionals in this state, such as physicians, nurses, social workers, and physical therapists, are required to have continuing education to maintain and improve their skills, but any medical imagers working on Dec 31, 2015 would not be required to have continuing education. This does not seem to be in the best interests of the citizens of North Dakota who would be their patients. Also, it seems that anyone grandfathered in, and then had their license revoked, could simply apply for a new license. Since any applicant who had been working on December 31, 2015, "shall" receive a license regardless of qualifications, it appears that the board would be required to issue a new license.

Section 5 removes any educational standards for applicants. An applicant would be considered qualified for a license if they are simply eighteen years of age and currently registered with a registration organization, regardless of the legitimacy of that organization. There would be no minimum education that an applicant would need to work in medical imaging or radiation therapy in this state. The deliberate removal of standards for the education of individuals using radiation on the patients or doing other diagnostic studies such as sonography or magnetic resonance imaging on patients in North Dakota may cause significant harm.

Section 6 deletes the board's ability to establish the scope of practice for individuals who are licensed. The training for medical imagers working in sonography is very different from someone trained specifically for radiography or nuclear medicine. The education regarding the risks and use of ultrasound, x-rays and gamma rays are not interchangeable. Someone trained and hired to do nuclear medicine should not be expected or allowed to do the other types of imaging without adequate additional training simply because they have a license form North Dakota to do medical imaging.

In summary, this bill removes standards for the training of individuals who would be doing imaging studies and radiation therapy for the citizens of North Dakota. It also provides no standards for organizations registering these individuals. Without scope of practice standards, someone trained in radiography may start doing nuclear medicine or sonography without the necessary training to safely and properly do the studies the patients need. Anyone employed for medical imaging or radiation therapy as of December 31, 2015, would no longer be required to have any continuing education in contrast to other medical professionals in this state who are required to have continuing education to maintain and improve their skills. Also, they could be unemployed for five or ten years after having been employed on December 31, 2015, and apply for a license which the board would apparently be required to issue.

Thank you for allowing me the opportunity to offer my testimony regarding this bill. In the interests of the people of North Dakota, I urge you to vote "do not pass" on House Bill 1371.

Att. 8 HB1371
1-24-17

North Dakota Society of Radiologic Technologists

NDSRT

www.NDSRT.org

January 23, 2017

Dear Chairman Lee and Senators and Chairman Weisz and Representatives,

The North Dakota Society of Radiologic Technologists Board are in support of the Senate Bill 2198 in establishing medical imaging technologist and radiation therapist licensure and against House Bill 1371. We were the driving force for licensure of technologists in the State of North Dakota which allows us to take verbal orders and perform our job fully within our appropriate scope of practice in each modality we may be practicing.

We believe the proposed Senate bill 2198 which is used to clarify language and puts in revisions for rural critical access hospitals strengthens the original bill while protecting the patient. We believe this will maintain the integrity of medical imaging and radiation therapy licensure programs to protect the residents of North Dakota and ensures patients will receive the safe and effective medical imaging and radiation therapy they deserve.

With House Bill 1371 removing certification and education requirements it puts our patients at risk of sub optimal care. Specific education, knowledge and competency requirements are needed to ensure our patients are taken care of to the best of our abilities.

The NDSRT Board supports Senate Bill 2198 and is against House Bill 1371.

Sincerely

Brenda Krogen M.I.S., R.R.A., R.T.(R)(CT)(MR)
Chairman of the Board

/

January 20, 2017

Dear Chairman Weisz and Representatives,

The North Dakota chapter of the American College of Radiology opposes the enactment of HB 1371 and urges the North Dakota House and House Human Services Committee to not move this bill forward.

On a national level and as a matter of policy, the Council of the American College of Radiology supports licensure and certification of all persons operating equipment emitting ionizing radiation. The norm in most states is in support of radiologic technologist licensure and the delivery of healthcare to support a culture of safety and quality. Most importantly, insuring radiologic technologists are certified in the modalities where they practice is in the best interest of the patient. Radiologists work with technologists collaboratively to insure patients are receiving accurate diagnosis for medical testing and treatment. Imaging is a complex field with specialized imaging modalities that include: nuclear medicine, positron emission tomography (PET), interventional radiography, ultrasound, magnetic resonance imaging (MRI), computed tomography (CT), cardiovascular radiography, fluoroscopy, and general radiology. Each of these areas requires special skills and continuing education to insure the most current medical practices are performed at the highest level of competency.

It is in the best interest of patients for radiologic technologists to utilize certifying bodies to insure competency. House Bill 1371 seeks to remove certification and education requirements which are needed to provide optimal patient care. Allowing any licensee to perform specialized imaging procedures or radiation therapy without any specific knowledge, education or competency assessment puts our patients at risk. Inaccurate diagnoses, excessive use of radiation, or incomplete examinations are examples of the potential effects on patients.

Exempting physician assistants and certified registered nurse anesthetists from complying with education and certification standards also puts our patients at risk. It is not appropriate for them to perform imaging exams for which they have not been educationally prepared or certified.

The North Dakota chapter of the American College of Radiology does not support House Bill 1371 as it diminishes the safety and quality of care which North Dakota patients will receive.

Sincerely,

Donald Stallman, MD
North Dakota Chapter of the American College of Radiology

TO: House Human Services Committee

FROM: Amy Hofmann, MBA, R.T.(R)(CT), RDMS, CRA

DATE: January 23, 2017

RE: TESTIMONY in Opposition of House Bill NO. 1371

Honorable Committee members, I am a medical imaging practitioner that has been educated and trained in North Dakota, receiving my bachelor degree in radiologic science from Minot State University and my Masters in Business Administration from the University of Mary. I have had the privilege of working in various positions in radiology departments at a number of healthcare facilities in this state for 36 years. I have worked as an imaging technologist in general radiology, CT, Nuclear Medicine and sonography, as a managing director and currently as the program director/educator for a hospital sponsored and a JRCERT accredited school of radiologic technology. I have voluntarily served on the North Dakota Society of Radiologic Technologists (NDSRT) board of directors and on various NDSRT committees since 1995. I was presented NDSRT Life Member status in 2005 and most recently, I served as the NDSRT 2014-2015 Licensure Committee Co-Chairman. Additionally, I have been a very active member of the American Society of Radiologic Technologists (ASRT), serving in the House of Delegates well over 13 years.

I am opposed to HB 1371. The bill addresses a number of issues regarding chapter 43-62 of the North Dakota Century Code relating to the licensing and regulation of medical imaging and radiation therapy practitioners with a significant number of proposed amendments and the creation of a new section to the chapter. The amendments seek to eliminate the language and references to **certification** of practitioners, but retaining language and references of **registration**. In professional publications of rules and regulations, **the two terms are used together, always**. Once a practitioner has achieved initial certification and registration, they must renew their certification and registration annually. Many practitioners have multiple certifications in medical imaging or radiation therapy. I include for your review the following wording from the American Registry of Radiologic Technologists (ARRT) website www.arrt.org

> "Initial certification and registration is the process of recognizing individuals who have satisfied certain standards within a profession. A person is certified and registered by ARRT after meeting educational requirements (such as graduating from an approved educational program or completing clinical experience requirements), complying with ethics standards and passing an examination. The Certification and registration is the recognition of an individual who satisfies certain standards within a profession. Employers, state licensing agencies, and federal regulators look at the ARRT credential as an indication that a person has met a recognized national standard for medical imaging, interventional procedures, and radiation therapy professionals.

As outlined in ARRT's "Equation for Excellence," candidates for ARRT certification and registration must meet basic education, ethics, and examination requirements to become eligible.

SECTION 5. AMENDMENT. Section 43-62-14 The proposed amendments would eliminate the requirement of an applicant to provide documentation of satisfactorily completing an appropriate course of study and pass a certification exam specific to the modality they seek to be licensed under. This would greatly compromise patient safety and quality care in medical imaging as each modality has separate and distinctly unique knowledge, skill and aptitude requirements of practitioners in radiation physics and radiobiology, radiation safety, equipment operation, equipment quality assurance as well as procedural knowledge.

SECTION 6. AMENDMENT. Section 43-62-15 The proposed amendments would eliminate the requirement that the board adopt licensure standards that address scope of practice or practice standards. Again, this would greatly compromise patient safety and quality of care if a practitioner is allowed to perform medical imaging procedures on patients that they are not educationally prepared and clinically competent to perform. Professional Practice Standards and associated Scope of Practice **define the practice and the limits of the radiography practice**. They establish general criteria to determine compliance with rules of conduct established by the authority, legislation, or custom of a given community or group. The group, in the case of the imaging technologist, includes ARRT and ASRT. The standards are general in nature by design to keep pace with the rapidly changing environment in which we live and work. I strongly believe each state licensing board should be given the responsibility and the authority to establish current best practice standards to ensure high quality and safe patient care for the citizens of their state. It is also important to note that federal and state laws, accreditation standards necessary to participate in government programs, and lawful institutional policies and procedures supersede these standards. For example, ASRT Scope of Practice for a Radiologic Technologist includes:

- Performing venipuncture as prescribed by a licensed independent practitioner.
- Starting, maintaining and/or removing intravenous access as prescribed by a licensed independent practitioner.
- Identifying, preparing and/or administering medications as prescribed by a licensed independent practitioner.

IV fluids are frequently administered in imaging as part of the procedure and diagnostic plan of care. However, in situations where a patient is being treated in an acute care hospital, it is not within the radiographer's scope of practice to select the intravenous solutions to be administered.

Thank you for this opportunity to present testimony.

asrt
American Society of
Radiologic Technologists

15000 Central Ave. SE, Albuquerque, NM 87123-3909
505-298-4500 • 800-444-2778 • Fax 505-298-5063 • www.asrt.org

January 23, 2017

Representative Jon Nelson
North Dakota House of Representatives
State Capitol, 600 East Boulevard
Bismarck, ND 58505

Dear Representative Nelson:

The American Society of Radiologic Technologists (ASRT) represents 725 medical imaging and radiation therapy professionals in North Dakota. After reviewing House Bill 1371, ASRT has concerns about this bill and the effect it will have on patient care delivered by licensed medical imaging and radiation therapy professionals in the state.

HB 1371 proposes to make significant changes to Chapter 43-62, NDCC. This bill removes the North Dakota Medical Imaging and Radiation Therapy Board of Examiners' ability to issue discipline-specific licenses for medical imaging technologists based on the education and certification requirements of the discipline. Medical imaging technologist is a collective term for individuals who are certified in radiography (x-ray), nuclear medicine and sonography. Each of these disciplines of medical imaging use different modalities of imaging techniques – radiography is performed with external x-ray and fluoroscopy; nuclear medicine is the detection and creation of images based on internal radioactive substances administered to patients; sonography is imaging performed with non-ionizing radiation that has different physical properties from the ionizing radiation used in radiography or nuclear medicine. The educational curriculum and certification process for each of these imaging disciplines is very different, as is the advanced educational requirements and certification to be a radiologist assistant and the curriculum and certification process for radiation therapists who use ionizing radiation to treat cancer patients.

Specific concerns with HB 1371:

- By striking the term "certification organization" and replacing it with "registration organization," HB 1371 will remove accreditation standards for medical imaging and radiation therapy certification organizations. Currently certification organizations recognized by the North Dakota Medical Imaging and Therapy Board of Examiners must meet nationally recognized accreditation standards to ensure exam content is psychometrically valid and that accepted exam administration procedures are followed.
- HB 1371 will exempt physician assistants and certified registered nurse anesthetists from complying with education and certification standards that ensure medical imaging and radiation therapy care is safely and effectively provided to North Dakota's patients. Any profession that is exempted from medical imaging or radiation therapy licensure laws

should be able to document specific education and competency assessment in radiation safety, radiation protection, image acquisition.

- HB 1371 will allow any licensee to perform any type of imaging procedure or radiation therapy treatment using any type of imaging modality without any specific knowledge, education or competency assessment in the discipline he or she is performing.
- ASRT believes nuclear medicine, radiation therapy, radiography, radiologist assistant and sonography are separate patient care disciplines each with its own educational curriculum, practice standards and certification examination. Each discipline is different from the others in the way radiation is managed, how images are produced and how the imaging modality displays the best diagnostic information for physicians to use in treating patients. Having a radiographer who specializes in taking diagnostic x-rays performing nuclear medicine examinations for which they are not educationally prepared can result in poor patient care, as is allowing a sonographer who has no background in ionizing radiation to treat a cancer patient with radiation therapy that uses ionizing radiation. Each imaging or therapy discipline is highly specialized, and has different educational program content and competency assessment through certification examinations. Removing discipline specific requirements and issuing a general "medical imaging and radiation therapy license" is a disservice to patients and diminishes the need for technologists to have specialized clinical skills.
- HB 1371 will allow individuals who are not certified by any recognized certification organization and who hold a grandfathered license to represent specific imaging disciplines on the North Dakota Board of Medical Imaging and Radiation Therapy Examiners. (43-62-04.1(a)).
- The grandfathering provision in House Bill 1371 would allow the Board to issue grandfathered licenses to anyone who was employed as a medical imaging or radiation therapy technologist before January 1, 2016 in perpetuity. For example a non-certified individual who was working as a radiographer, as long as it was before January 1, 2016, could apply for and receive a license in 2025 even though he or she may not have performed imaging examinations for 10 years.
- Non-certified Individuals who have a grandfathered license will not have to complete continuing education requirements to renew their license.
- Repeal of the Board's ability to create a scope of practice by license type may result in facilities and radiology practices to not be able to receive Medicare reimbursement for examinations and procedures performed by radiologist assistants.

43-62, NDCC, was enacted in 2015 to ensure that individuals performing medical imaging examinations and radiation therapy procedures for North Dakota patients met licensure standards demonstrating educational preparation and clinical competence in specific disciplines as determined by the North Dakota Medical Imaging and Radiation Therapy Board of Examiners. Discipline-specific licensure is in the best interest of patients in regards to patient safety, radiation protection and clinical effectiveness. Enactment of HB 1371 will remove many of the safeguards for patients created by licensing medical imaging and radiation therapy personnel.

ASRT opposes the enactment of HB 1371 as introduced and urges that North Dakota Assembly to instead enact SB 2198 to refine the Board's licensing process. As the professional organization representing radiographers, radiation therapists, nuclear medicine technologists,

radiologist assistants and sonographers we truly hope that we can work together to the benefit North Dakota's patients and the medical imaging professionals providing their care.

On a personal level as someone who was born, raised, educated and worked in North Dakota for half my life I believe that my family that still resides there along with all of the state's residents deserve the best possible radiologic health care. The best care is provided by appropriately educated and certified medical imaging and radiation therapy professionals licensed under the statute enacted in 2015, with the potential enactment of SB 2198.

Sincerely,

Greg Morrison

Greg Morrison, M.A., R.T.(R), CNMT, CAE
Associate Executive Director

Testimony for Public Health
HUMAN SERVICES COMMITTEE
Public Hearing on House Bill 1371
January 24th, 2017

Mr. Chairman and members of the committee, my name is Danielle Goetz. I am from Bismarck and come before you today to explain the reasons why I am opposed to House Bill 1371.

I have lived in North Dakota my whole life and grew up on a small farm in a rural community. By growing up in this manner I understand the "North Dakota" work ethic and values for which that also stands for. For these reasons, this has urged me to come before you in opposition to these bill revisions. By passing this bill we are eliminating these standards of higher quality. We are now letting all of our communities "assume" they are getting optimal patient care. This assumption is not always what you think it is. We are assuming that the professional taking care of us is not only pushing a button, but ensuring that they are using their experience and education to ensure the happy medium of a diagnostic exam while exposing you to the least amount of ionizing radiation as possible.

With the proposed amendment that would allow a person to be grandfathered without continuing education will allow an individual who hasn't been in the field for 10 years to now work in a modality and take care of you. So why is this frightening to me? Technology advances at an astonishing rate. Take cell phones for example. In 2005 a camera on a cellphone was able to take a 2-mega pixel photo. Also, cameras on phones were still cutting edge with the first camera in a cellphone to come out in 2000. Cellphones now are sleek, touch screen and have a 16-megapixel camera. You can control the lights in your house, change your thermostat, close your garage door, start your car and see who is at your front door all from your desk at work. These same advancements in technology have also advanced our imaging fields. By allowing people a grandfathered license and not having them complete any continuing education is unacceptable. These people will have missed out on all of the advancements that their fields have undergone. They should have to show a competency of some kind in order to provide a safe and high quality exam to your family.

A regional hospital now in need of a CT tech only has an x-ray tech that has applied to the position. With the proposed amendment this person can now perform these CT's and any other imaging modality that this facility would need. Now, this may seem like a great option for a small town, but I argue that it only seems to be. I understand the limited applicant pool that these facilities have and I understand the desire to have a one size fits all person. I don't want my family to be taken care of by a one size fits all person. If the facility wants to hire a Radiologic Technologist and have them perform many other modalities they should have to first show competency in those areas. After all, we are putting our family's life in their hands. We are asking that they prove competency and complete continuing education in those modalities. Without this continuing education we would literally only be a button pusher. How can we hold such high standards for quality when we don't apply these same standards to the people exposing your children to radiation? By currently working in my field of quality I understand that there are more technical components of safety than just the manufactured specs of the installed

piece of equipment. Any amount of x-rays produce an image. If a person is not sure of what they are doing they will venture on the side of caution and expose you to a higher dose. I have personally seen this more times that I would care to admit. It is for these reasons of holding my standards to higher level that I encourage you to rethink this proposal. We should have Technologists prove competency and perform continuing education in any of the modalities they are working in. After all, a large component to our field is technical. It requires an educated professional to know why they are doing what they are doing.

This brings me to my final argument. Allowing Physician Assistant and CRNA's exemption from complying with education and certification standards. I understand the importance that a Physician Assistant has especially in a rural community. Their roll can sometimes encompass all of the imaging modalities because they are the only staff on site. While I know they have gone to many years of school and know a lot about their profession, they still do not know my profession, they know how to follow a chart and push a button. I have been in my field for 12 years and it took me many years to understand this field and I am still learning. A CRNA for example is ever-present in the operating rooms and this would allow them to now provide assistance or even operate a c-arm. This equipment provides continuous radiation that is used to assist a physician with their operating case. This piece of equipment if not properly handled can cause adverse effects of radiation. Including skin burns, hair loss and of course the obvious carcinogenic effects of Radiation. These effects may be latent for years until you come in with bizarre cancer. You need to ensure proper education and safety precautions for these types of imaging to ensure our patients and communities are being taken care by an educated personnel. If you are looking into allowing this exemption for PA's and CRNA's I ask that they comply with the same educational and certification standards that I follow. After all, we are talking about the safety of your family and our communities.

I leave you with one final thought. The assumption of quality care and higher standards is what I am fighting for today. I want you to walk into a facility and have your assumptions be correct.

aH. 10
HB1371
1-24-17

Testimony for Public Hearing
HUMAN SERVICES COMMITTEE
Public Hearing on House Bill 1371
January 24th, 2017

HB No. 1371 - An Act to amend sections of the North Dakota Century Code, relating to a grandfathering provision and regulation and licensure of medical imaging and radiation therapy professionals.

Good Morning, my name is Chris Walski. I am a Radiology manager of a large imaging department in North Dakota, a Diagnostic Medical Sonographer and registered Radiographer. I want to thank fellow members of the Human Services Committee for the opportunity to speak to you today about House Bill 1371. All of us here today value quality healthcare. To keep quality a priority in healthcare we need technology, expertise and experience.

First to provide perspective on the impact of technology a quick history of ultrasound. In 1973 a Diagnostic sonographer was first recognized as an occupation through the US office of Education, only 44 years ago. At that time 2D echo, pulsed wave and color Doppler were being developed by pioneers in the field. These first imaging machines would often fill a room measuring 12 feet by 12 feet. Real-time ultrasound imaging started to become available in the 1980's and 3D/4D images in the 1990's. Patients could finally recognize their baby during OB ultrasound exams. The digital technology with ultrasound continues to change at a rapid pace. Comparable to cell-phones it is hard to keep up at times. Today in ultrasound there are wireless transducers, voice command imaging, machines that fit into the palm of your hand and even some cell-phones are capable to perform ultrasound exams. House Bill 1371 discusses grandfathering for imaging professionals allowing them to perform diagnostic imaging in North Dakota. Don't dismiss the fact technology continually changes our work environments. The people working with the equipment also need to keep up with changes. Patients believe they are receiving care from competent professionals.

Next, ultrasound is a unique modality that is completely operator dependent for both the quality of images and images archived. Expertise to distinguish normal from abnormal is key and often is under estimated. Allowing untrained professionals to use ultrasound as a diagnostic tool creates unsafe patient care. For example, ultrasound is used as a guidance tool for vascular access. I have experienced individuals learning ultrasound unable to point out the difference between an artery and vein on the ultrasound screen (appendix A). It is easy for an untrained eye to confuse. Proper training is an expectation, when a provider places the needle unknowingly into the artery instead of a vein it creates a critical situation. Another common ultrasound exam is a vein scan to check for blood clots. Trained sonographers are taught clot looks differently if it is new or chronic. A "quick look" ultrasound can miss clot. The reason it is a problem is clot can break free causing stroke, clots in the lung or even death.

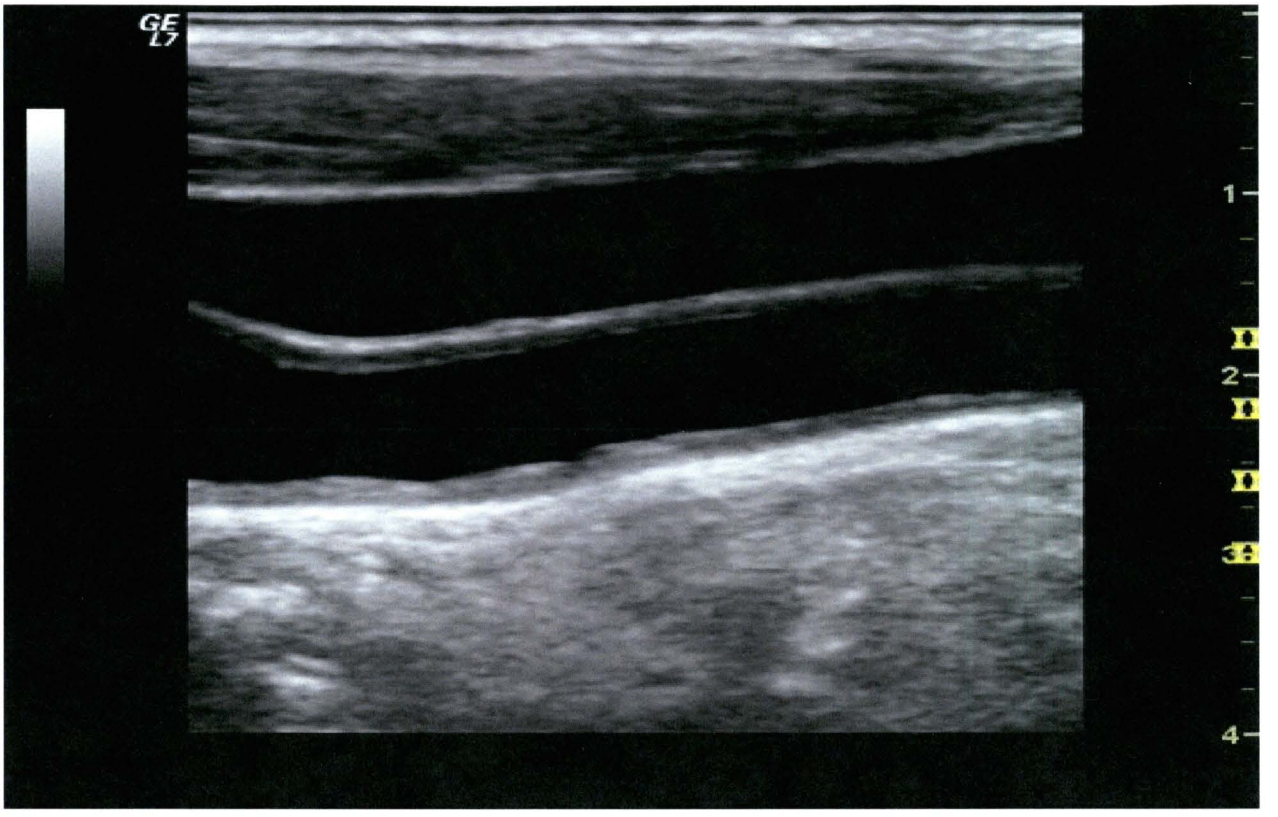
Finally, as a Registered Diagnostic Medical Sonographer actively in the profession for over 15 years I know the importance of receiving specific instruction to perform ultrasound exams. There are days I see something new for the first time because the machines keep getting better. Continued education over the years has maintained my clinical competence. I oppose House Bill 1371 and urge you to vote against it in the House.

Thank you for your time.

Chris Walski, BS, RT (R), RDMS, RVT
4395 45th Avenue S.
Fargo, ND 58104
701-893-6223

Appendix A

Ultrasound image of an artery and vein.



SOCIETY OF DIAGNOSTIC MEDICAL SONOGRAPHY
2745 N Dallas Pkwy Ste 350, Plano, TX 75093-8730
(214) 473-8057 | (800) 229-9506 | (214) 473-8563 FAX | sdms.org

January 23, 2017

Chris Walski, RT(R), RDMS, RVT
Ultrasound Services Manager
Sanford Health Fargo
801 Broadway North
Fargo, ND 58104

Dear Ms. Walski:

Thank you for contacting the Society of Diagnostic Medical Sonography (SDMS) regarding the recent introduction of legislation in North Dakota that would impact the sonography profession and the use of ultrasound in medical imaging. Unfortunately, I will not be able to attend the Committee hearings scheduled in Bismarck on January 24th. But the SDMS would be happy to provide you, the Human Resources Committees, or the Legislative Assembly with any assistance necessary. As you know, the SDMS does not have state chapters, but rather works closely with our members in each state, as we did on the 2015 North Dakota bill (SB 2236) that established medical imaging and radiation therapy licensure. Since then, we have continued to work with our members and the North Dakota Medical Imaging and Radiation Therapy Board of Examiners ("NDMIRTB") on administrative rules to implement this important program.

SENATE BILL 2198

THE SDMS SUPPORTS PASSAGE OF SB 2198 (introduced by Senators Judy Lee and Dick Dever and Representatives Thomas Beadle and Robin Weisz). The proposed bill incorporates several "clean-up" provisions that strengthen and clarify the original statute. It maintains the integrity of the medical imaging and radiation therapy licensure program to protect the citizens of (and visitors to) North Dakota and ensures patients will receive the safe and effective medical imaging and radiation therapy they expect (and deserve).

HOUSE BILL 1371

THE SDMS STRONGLY OPPOSES HB 1371 (introduced by Representatives Jon Nelson, Tracy Boe, Robin Weisz, Greg Westlind and Senators Brad Bekkedahl, Larry Robinson, David Rust). We do not believe the bill language is salvageable and would encourage our members to oppose HB 1371 and support SB 2198 instead.

The reality is that most of the individuals who were practicing within the medical imaging and radiation therapy professions in North Dakota had voluntarily become certified and registered by a recognized certification organization. The proposed bill devalues the hard work of these professionals by permitting the least common denominator (no certification) to become North Dakota's standard.

It is critically important that legislators and the public understand that medical imaging and radiation therapy procedures have risks and improper application of ionizing radiation can be harmful both to the patient and to the person performing the procedure. Although sonography uses non-ionizing radiation (i.e., high-frequency sound waves), it is not without risk, particularly when applied improperly. Physicians rely on the medical images obtained by the sonographer – if the examination is not performed properly, the physician may make the wrong diagnosis or treatment decision based on incorrect information, leading to unnecessary and costly invasive procedures (e.g., surgery) or the physician may discharge a patient (e.g., when the carotid artery is actually blocked) and the patient subsequently experiences a stroke or dies.

The following highlights just a few of the many areas of concerns we have regarding HB 1371:

Section 1. This section incorrectly deletes the existing statutory definition of "certification organization" and replaces it with "registration organization." While the medical imaging and radiation therapy organizations often require maintaining an annual "registration," they are in fact "certification organizations" (i.e., accredited certification bodies by the *National Commission for Certifying Agencies* (NCCA) or the *American National Standards Institute* (ANSI) based on the International Standard ANSI/ISO/IEC 17024). These accredited medical imaging and radiation therapy certification organizations issue both certifications and credentials to those who have met their requirements. To our knowledge, no state or federal statute uses "registration organizations" to describe these entities. This erroneous phrase is used throughout the bill.

Section 3: This section removes the power of the NDMIRTB to issue interpretations of the statute, effectively restricting the NDMIRTB in its purpose and function. Thus, the only interpretation of the statute allowed would be through the Courts or by returning to the Legislative Assembly each year in hopes of modifying the statute to clarify an issue. This will undoubtedly lead to unnecessary litigation and expense for the State of North Dakota. It will also cause unnecessary and complicated legislation that explicitly states every possible requirement and interpretation, effectively negating the Administrative Procedures Act (APA) and creating an unnecessary future burden on the Legislative Assembly.

This section also unnecessarily adds an explicit requirement that the NDMIRTB must collaborate and consult with affected parties – yet this requirement already exists under APA. The APA also provides for the petition for reconsideration of rules, Administrative Rules Committee objection and action, publication, and adjudicative proceedings related to proposed or adopted rules, etc. It is our understanding that the NDMIRTB followed the procedures outlined in the APA. The APA should not be undermined because a bill's supporters disagree with the administrative rules proposed or adopted by an agency established by the Legislative Assembly.

Section 4: This section adds a broad "Grandfathered Licenses" paragraph that negates both the purpose and the intent of the original statute – those who are entrusted with performing medical imaging and radiation therapy must have completed the appropriate education and training and demonstrated minimum competency through a recognized certification examination. The proposed grandfathered licenses would shift the burden to each patient to ask (if conscious) whether the person performing the medical imaging or radiation therapy procedure is certified or not (since both certified and non-certified individuals would be granted licenses by the State of North Dakota under this bill). Most patients simply would not know to ask this critical question.

A review of Title 43 (Occupations and Professions), North Dakota Century Code finds only two references to grandfathering provisions among the many occupations and professions regulated. The first, Section 43-15-16, relates to a pharmacist who failed to take an examination before the law became effective (almost 90 years ago, on July 1, 1927) to become licensed, but still only after taking and passing the examination. The second, was repealed in 2013 (by section 3 of chapter 334, S.L. 2013 –effective August 1, 2013).

Section 5: This section codifies two different standards, yet seems to recognize the importance of certification (but only for those entering the profession after 2015). The medical imaging certification programs are not new – they have been in place for decades and hundreds of thousands of medical imaging and radiation therapy professionals have been certified. All medical imaging and radiation therapy professionals should be expected to meet the same licensure standards.

Section 6: This section removes the authority of the Board to adopt a scope of practice for each medical imaging and radiation therapy modality. It even removes the requirement that a medical imaging or radiation therapy professional operate within any scope of practice.

Section 7: This removes the requirement that a licensee comply with continuing education or other requirements – in fact, the licensee would not have to comply with any rule adopted by the NDMIRTB – licensees would only be required to comply with the statutory provisions of Chapter 43-62. However, those entering the medical imaging and radiation therapy professions after 2015 would still be required to comply with the applicable certification organization's continuing education or recertification requirements.

Living in a rural state should not mean the citizens (or visitors) must settle for lower standards related to medical imaging and radiation therapy quality and patient safety. A pregnant woman should not have to ask if the person who is about to perform a sonogram has had adequate education, training, and experience to competently perform the procedure. And, when a patient goes to a hospital or other medical facility, they simply expect that the healthcare providers (i.e., physicians, nurses, respiratory therapists, speech therapists, radiologic technologists, radiation therapists, sonographers, etc.) have met the standards established for each profession.

I would also ask that you share with any North Dakota sonographers who wish to become certified (for the first time or to obtain an additional sonography specialty certification), that the SDMS Foundation (a public charity affiliated with the SDMS) continues to provide Certification Examination Grants to SDMS members each year. These grants include print and online study materials, as well as funds to help cover the cost of the certification examination. More information is available on the SDMS Foundation website at http://www.sdms.org/?ID=17.

Again, the SDMS is available to provide any assistance that may be needed as these bills are considered by the Legislative Assembly. Please feel free to contact me at 800-229-9506 x184 or dkerns@sdms.org. Thank you again for your continued support of the sonography profession and helping to protect the patients that sonographers serve in North Dakota.

Sincerely,

Donald E. Kerns, JD, CAE
Chief Executive Officer/Executive Director

Att. 11
HB 1371
1-24-17

HB 1371

January 24, 2017

My name is Brent Colby. I was born and raised in Williston and Crosby, ND, and have lived in Fargo, ND for the past 24 years. I am a Diagnostic Radiological Physicist, and am certified in Diagnostic Radiological Physics by the American Board of Radiology. I have been a Diagnostic Radiological Physicist since 1991, and have served as the Physicist for facilities in the States of ND, SD, MN, IA, WI, MT and CO. I currently serve as the Physics member of the North Dakota Medical Imaging and Radiation Therapy Board. I also serve as a member of the examination writing committee for the American Registry of Radiologic Technologists (ARRT), specifically as a member of the Registered Radiologist Assistant examination committee.

As a Physicist and lifelong North Dakota resident, I am opposed to HB 1371 as it is currently written. I am convinced that the bill does not go far enough to ensure access to high quality Radiology and Radiation Oncology within the State of North Dakota.

Medical radiation is now the largest source of manmade, and therefore controllable, radiation exposure to the US population. Average US medical radiation exposures have increased from approximately 0.5 mSv (50 mRem) per person per year in the 1990s to approximately 3.0 mSv (300 mRem) per person per year in 2017 (they have increased by a factor of six). For perspective, the average radiation dose from Radon is approximately 2 mSv (200 mRem) per person per year in the US.

The biological consequences of radiation exposure include, but are not limited to:

Cancer

Cataracts

Hair loss

Skin damage (generally characterized as radiation burns)

While somewhat controversial, we generally describe the risk of radiation induced cancer exposure as linear, with no threshold. Rephrased, any dose carries with it a risk, and the risk is proportional to the dose (twice the dose equals twice the risk). The other risks (cataracts, hair loss, skin damage, etc) generally

happen only above a very high "threshold" dose. All of these effects are well described in the medical literature, in a recent series by Bogdanich in the New York Times in 2011, and in Congressional hearings in 2010.

Diagnostic Radiological Physicists are generally charged with oversight of medical radiation exposures. Medical exposures can and do vary for many reasons, for example, equipment characteristics, Physician preferences and operator training. I have personally seen medical radiation exposures vary for the same procedure by more than a factor of thirty (recall that the cancer risk is proportional to dose, so it, too would vary by a factor of thirty).

It is my view that the variation in medical radiation exposure within the State of ND is unwarranted. One significant and preventable cause of this variation is insufficient training in the theory and operation of medical radiation equipment. All too frequently, when insufficient knowledge and/or training are the cause of an unnecessarily high radiation exposure, the people running the equipment have little idea of the dose used, the cause of the high dose, or an appropriate remedy to the high dose.

It is my observation that the Technologists possessing advanced registry in their specific areas of work generally have a better grasp of their technology, the radiation doses used and how to properly control those doses. Because I help write one of the ARRT's advanced registry examinations, I am reasonably acquainted with the content of the advanced registries and I am not surprised that those examinations help to prepare Technologists for their modalities. The examination content and requirements are straightforward and appropriately rigorous in my view.

As the bill is currently written, HB 1371 does not require advanced registry in the advanced modalities of Radiology. Because it does not require that advanced registry, HB 1371 does not go far enough to protect the citizens of North Dakota from unwarranted medical radiation exposure variation.

Thank you. S Brent Colby, MS, DABR 2

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HB 1371
1-24-17

Testimony for Public Hearing
HUMAN SERVICES COMMITTEE
Public Hearing on House Bill 1371
January 24th, 2017

Good morning Chairman Weisz and members of the committee, my name is Ann Bell-Pfeifer. Thank you to the members of the Human Services Committee for listening to my testimony today. I have served the North Dakota Society of Radiologic Technologists (NDSRT) as chairman of the board, president and licensure chair. Today I am speaking on my behalf, to reject House Bill 1371. As one of more than 1000 registered radiologic technologists in the state of North Dakota, I have been serving patients in radiology for the past 23 years. My roles as a radiologic technologist have allowed me to experience first-hand patient care in general radiology, mammography and quality management. I believe in providing the best possible patient care and have focused many years of my career focusing on optimal image quality and patient safety.

The imaging field is constantly changing as new technology is applied to the equipment which medical imaging professionals operate. New imaging procedures are also used to diagnosis and treat patients. As experts in our field, radiologic technologists, sonographers, nuclear medicine technologists, positron emission technologists, computed tomography technologists, magnetic resonance technologists, and radiation therapists are required to be knowledgeable about technical advances in radiology as well as deliver safe, effective patient care.

House Bill 1371 seeks to eliminate continuing education requirements and initial certification for all areas of imaging, many which utilize high risk procedures. Removing critical components to insure radiologic technologists are educated and certified puts North Dakota patients at risk. Imagine you are a patient in a hospital in North Dakota. Would you want a general radiographer who has not received advanced education and

certification to perform your CT scan? What if the patient is your child and they receive more than four times the necessary amount of radiation for their exam? What if when that child grows up, they are diagnosed with breast or lung cancer? Radiation is a known carcinogen. The problem is that its effects are not always immediately visible as radiation doses accumulate over time. Radiation doses and image quality matter, and the misadministration of radiation have consequences.

There are examples of potential misadministration of radiation in other imaging modalities as well. Radiation therapy uses very high doses with specialized equipment to treat cancer. Would you want an undereducated, non-certified technologist, to administer radiation doses to you or your family? Would you want a registered nurse anesthetist or physician assistant to perform radiation therapy treatments, nuclear medicine studies, positron emission tomography (PET) imaging, computed tomography (CT), or magnetic resonance imaging (MRI) studies on your neighbor? How will you know if they have been trained or are competent to perform any imaging studies? HB 1371 is requesting an exemption for them too. Why, to what purpose? Should technologists be exempt from administering anesthesia? No, they shouldn't as they are not certified or educated to perform such a high risk task. It is important for medical professionals to be educated certified and competent in every aspect of patient care for which they are responsible. We cannot afford to be casual about qualifications in medicine.

Inaccurate diagnoses, excessive use of radiation, or incomplete examinations are examples of potential effects on patient care. The utilization of certifying bodies and requiring continuing education to insure competency is in the best interest for the patients of North Dakota. Standardizing imaging care in hospitals and clinics throughout the state is important. There are provisions in SB 2198 to accomplish that goal. As stated in SB 2198, on a case - by - case basis, the board may establish unique individualized licensing and practice standards and requirements for an applicant who does not meet the licensure

requirements to receive a license in one or more modalities of medical imaging or radiation therapy. This subsection is limited to an applicant who was practicing at a critical access hospital before January 1, 2017. Under this subsection, standards and requirements the board requires of a licensee must be designed to maintain reasonable services and public safety at a critical access hospital. This section of the bill offers a path for imaging professionals in small communities to practice safely with provisions for educational requirements. Radiologic technologists have the opportunity to acquire certification in special modalities within an eight year time period through cross training. North Dakota hospitals and clinics employ many medical professionals: doctors, nurses and others. They are required to be educationally trained, certified and competent before caring for patients. Those standards need to apply to all imaging professionals too. Every medical professional should be accountable to serve patients within their scope of practice utilizing the best care possible.

Thank you for listening to my concerns. Your support in recommending a do not pass on House Bill #1371 is greatly appreciated.

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Att. 13
HB1371
1-24-17

North Dakota House Committee

HB1371

January 24, 2016

Committee Members:

I appreciate the opportunity to speak to you today.

My name is Diane Nelson. I am the Radiology Manager at Jamestown Regional Medical Center and I am currently registered in radiology, mammography, CT, quality management, ultrasound, and nuclear medicine. I am also a member of the North Dakota Medical Imaging and Radiation Therapy Board.

I have worked in the field of Radiology for over 45 years. I have experienced a great deal of change and I have observed the evolution of what was once simply "X-ray" to the multiple, individual modalities that are now under the "Medical Imaging" umbrella. Radiology modalities are essential in the assessment of pain and the diagnosis and treatment of trauma-related injuries and disease processes. Each of those modalities- Radiology, Mammography, CT, MRI, Nuclear Medicine, Ultrasound, Cardiovascular/Cath Lab, and Radiation Therapy- is unique; each requires a specific technical skill set for performing exams and utilizes specific concepts for image production. Misunderstanding those concepts or using them inappropriately can have serious consequences that could result in a life or death missed or delayed diagnosis. Mis-use of radiation or magnetic fields can create serious health and safety risks to the patient, the imaging professional, and the general public.

I would like to express my concerns with HB 1371

- The bill makes no provision for licensure specific to the modalities. Under this bill any individual with registration from a "registration organization" could perform medical imaging. This means that, legally, a nuclear medicine technologist could perform your mammogram; a mammography technologist could perform your CT procedure; a cardiac cath technologist could perform your MRI; and any technologist could perform radiation therapy. All of these tests could then be performed by someone who does not have the education, training, knowledge, or expertise to competently perform the test. But he or she could do so according to ND law. Hopefully, facilities would not allow it. But the concept would be there; it would be legal; and it is frightening.
- The "grandfather" clause would allow licensure of individuals for many years to come without any requirement for competency or consideration for patient or public safety.

I believe that certification in the various modalities is attainable as we have done and continue to do at Jamestown Regional Medical Center. I believe that there is an "easy" way to do things and the "right"way to do things. HB1371 is the easy way to approach licensure but it is not the right way.

Thank you,

Diane Nelson CRA RT R M CT QM RDMS RVT CNMT

Att. 14
HB1371
1-24-17

House Human Services Committee

HB1371

January 24, 2017

Committee Members, I am a practicing physician of our state in the specialty of radiology, currently with a multi-state telemedicine/teleradiology focus. I have served our North Dakota physicians who practice radiology in the past as the secretary of the state chapter of the American College of Radiology. Currently I am a Counsilor for our chapter which is a designation of political liaison for the ACR and the state chapter. I am on the North Dakota Board of Integrative Health Care and the North Dakota Board of Medical Imaging and Radiation Therapy. I serve as the Chair of the Department of Radiology in the University of North Dakota School of Medicine. I also am the President of the International Hyperbaric Medical Foundation. I mention all these positions as a disclosure but am speaking to you as a citizen of our great state rather than as a representative of the above organizations. My testimony will focus on patient safety and education issues that directly impact the specialized licensure needs of some of our most learned technologists in the field.

The bill at hand has a simple reduction of language that creates a grandfather effect of the lowest common form of the many types of imaging professionals around our state. This is in addition to the temporal grandfather clause. It certainly would be easier to implement, but there are some problems with lowering the bar that may expose our hospitals to hiring or maintaining poor quality healthcare workers. Having specific sub-specialized recognition of advanced

modality training protects our citizens and our hospital administrators by the higher bar already set in the state in previous legislation (SB 2236) and proposed legislation in SB 2198.

As a physician of North Dakota with a multi-state view of rural medical imaging through tele-radiology, I have an opportunity to see the work product of other technologists in other states. Most states are currently well regulated like ours. There are only a few left without any licensure such as South Dakota. As a concept, licensure is bringing up the bottom of the class in the continuing education realm in the same way that national certification bodies have done for a long time. As an educator, it is my core belief that learning and continued education within all fields of high technology such as this, is a must. I would be hard pressed to tell you as a patient to see a physician colleague of mine that has not kept up with any continuing education across decades of practice. This bill appears to allow an unmotivated healthcare worker to continue to care for our families, friends, parents, and children without the professional responsibility of continuing education for the sake of self-improvement that we expect as a society of learned individuals in the industry.

The history of the movement towards licensure of imaging technologists in North Dakota started with a keen observation by a health insurance company rightly recognizing that certain medical imaging orders acted out by unlicensed technologists are not truly legitimate actions as physician order modifications require a designated licensed professional. Several hundred dollars stood ground in the macroeconomics here to motivate our imaging professionals to the cause of licensure a few years ago. In our state's economy, healthcare is one of the big three and we know the other two have regulatory burdens but nationally healthcare certainly beats agriculture.

On a person by person basis healthcare beats oil as well. I am from an extended farm family and have been working with the Petroleum Engineering Department at UND on Department of Energy and National Science Foundation grants for CT scanning of our state shale core library. The average healthcare worker has many more regulatory hurdles than the average farmer and the average oil worker.

Our Center for Rural Health at the University of North Dakota has published economic data on the impact of our small town hospitals which ranges on community by community basis from roughly $5-10 million dollars for our smaller communities like Elgin and Carrington while the whole sector is approximately $2 billion dollars. For our state's citizens, it would be best to keep the existing language and approach of specialty recognition on the grounds that it elevates our workforce educationally on very little dollars and cents in that economic pie. To strike the language and add the grandfather clause specifically is to make a concession to mental sloth in my opinion. As a state dollar expenditure to preserve the language now struck-out in the current proposed bill is a matter of a mere couple hundred dollars of education for less than a handful of people.

Education within the field leading to specialization from a generic radiology technologist to a mammography, CT, US, Nuclear Medicine, or MRI technologist is discredited by a law that does not recognize these subspecialties in imaging. Although we could look to the physicians' licensure rules as a one size fits all path such as this bill provides, it probably is not in the best interests of our state to approach licensure of imaging technologists in this fashion. One of the practical issues or problems in the education and training of imaging technologists is that they do

not have as well regulated and nationalized curriculum of training, learning, and testing as we do in the practice of medicine. For instance, a person can go straight into ultrasound without "passing through" the core curriculum of radiographers. These are not people who go through the same base curriculum and then specialize as is the case with physicians.

All of this regulation dovetails with the further legal and regulatory infrastructure of a safety conscious work community. The more publicly well understood safety concerns of the use of radioisotopes and X-rays have been the roots of the "safety culture" development for the imaging community here and around the world. Outside of the radiobiology issues in imaging, there are safety issues of a bit different nature involving the non-ionizing modalities of ultrasound and MRI which you may not have heard in prior testimony.

MRI units are actually the most dangerous imaging devices in our hospitals and outpatient facilities from the perspective of an immediate patient death. The magnetic strength of these devices place patients, first responders, and physicians involved in resuscitation or any other type of emergency at grave harm if safety rules are not followed in the heat of a crisis. I have appended figure 1 from the ACR White Paper on MRI Safety for the committee's understanding of just how important these magnet strength issues are for the safe design of an MRI imaging suite. In the public eye, a series of deaths and accidents in MRI units have prompted the development of many safety regulations in the field and a great respect for the power of these magnets. In July of 2001 at a Valhalla, NY hospital, a 6 year old boy was killed instantly as an oxygen tank flew off a gurney into the magnet bore crushing his head. In the same year, a Rochester, NY police officer supervising an incarcerated individual having an MRI

exam had a handgun pulled into the magnet where it discharged. The patient was not struck by the bullet, and presumably had his day in court. Thousands of examples exist for this ferromagnetic effect. Something as innocuous as a tattoo or body piercing that might be an embarrassment to disclose can generate severe burns. Pacemakers, medication pumps, and recently placed stents or hardware are also a liability. Our state's MRI technologists have the greatest acute liability and safety awareness issues of all of the various specialty modalities of imaging. Their training deserves the respect of licensure focused towards their required marks.

Ultrasound is truly the safest waveform but even here there are hidden dangers. Overuse of fetal ultrasound has been associated with higher rates of birth defects, the epidemiologists debate that this may be a selection bias effect. There certainly are more ultrasounds on fetuses with ultrasound documented deformities once they are found. However, there are animal models of autism in mice that can be induced by prolonged ultrasound exposures in utero. Heat shock proteins are generated at fetal bone interfaces in animal models with current ultrasound strengths. We also now have the capability of combining ultrasounds with MRI units to destroy tissues inside the body. These FUS or focused ultrasound devices are much more powerful than the clinically utilized devices. Transcranial doppler and power doppler ultrasound modifications for neonatal medicine are in place under the ALARA principle to limit unneeded sound beam intensity for or youngest patients. I have personally witnessed many fetuses turn away from extend scanning of facial features for the production of "pre-baby" photography. These images are of no scientific value unless done when a cleft lip has been discovered. They may be of some minor bonding value for mothers and fathers but should be done in the context of a medically supervised situation.

Most important in the ultrasound technology realm is the impact of the technologist and their role in image acquisition. Of all imaging modalities, ultrasound is the most operator dependent. If the technologist is not able to perceive an abnormality as they scan each organ, then it won't be documented appropriately. They are akin to flashlight laden Navy Seals scouring a ravine at night, a small camouflaged IED might get missed. The other modalities are analogous to satellite maps or overhead grid directed drone images in surveillance imaging terms.

A close call in my own career with these issues occurred one weekend a few years back when a small tumor was found in a patient's testicle. The images were all labelled "right" and I reported the abnormality on the right just a few hours before the patient's surgery. A kindly urologist, visiting from another state had noted the discrepancy and ask me to have the technologist and I redo the exam together as he hadn't seen the patient yet but heard from the emergency room physician that the mass was on the left side-which it was. Although rare, this safety net of professionals was employed for the correction of a potentially devastating point of misinformation. Errors of sidedness or image annotation are the most common issues in ultrasound. Errors of perception in technologists from inappropriate gain or depth focus are issues in the less frequent practitioners of the technology, so to perform this art well requires an active ongoing practice of examination. Additionally, within ultrasound technologists designations are cardiology specific certifications. One only need ask one of our well trained North Dakota echocardiography technologists to go do a stat ER exam for belly pain to see the real lack of confidence on doing exams they may be years from having previously performed. Clearly, production of misinformation is a grave risk of ultrasound in the hands of the untrained

or poorly rehearsed in this modality. Having North Dakota licensure law reflect the specific needs of education and concurrent practice is important for this area in particular.

In this ever-changing landscape of medicine in the information age, my career situation has given me a new understanding of the world of radiology that now spans a telemedicine practice with a footprint in multiple other states throughout the nation. My observation from this experience is that we are doing a good job across the board in many of our smaller North Dakota hospitals. This is especially true against some of the rural hospital studies I interpret from several other states. I believe the history of our community of technologists' professionalism and networking through the NDSRT group that spans the last several decades, combined with an culture of learning from our many radiologists across the state who have trained at some of the nations finest hospitals and universities has led to a core community ethic of excellence already.

The national landscape here is that of a regulatory system that has recognized through the efforts of national bodies such as the ACR and the ASRT that regulatory efforts in medicine left out the imaging technology crowd decades ago and the states are now playing catch-up. As federal influence of medicine goes, the most regulated medical procedure is mammography. The Mammography Quality Standards Act (MQSA) has created a systems improvement that has extolled technical excellence and education as pillars in imaging at the federal level. This standard is an example of how medical imaging has progressed in improving processes so that one technologists' image in one state at a small hospital is of the same quality as the Mayo Clinic technologists images. Understand that this is happening at the state level in all other imaging specialty areas through a more forgiving pathway of licensure. I would guess our state's

community of technologists in these specialty areas and the patient's they care for on the ground in these various dangerous imaging environments would appreciate the respect of our legislative teams in the recognition of their knowledge base through maintaining existing language that does not open the door for the unmotivated few who cannot keep up on their homework.

As a citizen and physician of North Dakota, I now more intimately understand the difficulties of licensure legislation for this disparate group of professionals stratified by various waveforms in the realm of physics. It is actually because of these complexities that we are better off as a society with a soft handed regulatory structure such as we have now, needing only minor modifications. I hope the assembled House Committee is not intimidated by these complexities as I openly ask you to please approach me with any questions you might have for clarification or deeper understanding of the issues at hand, even if these questions may have arisen at other points in the afternoon.

Thank you for your time,

Ted Fogarty, MD

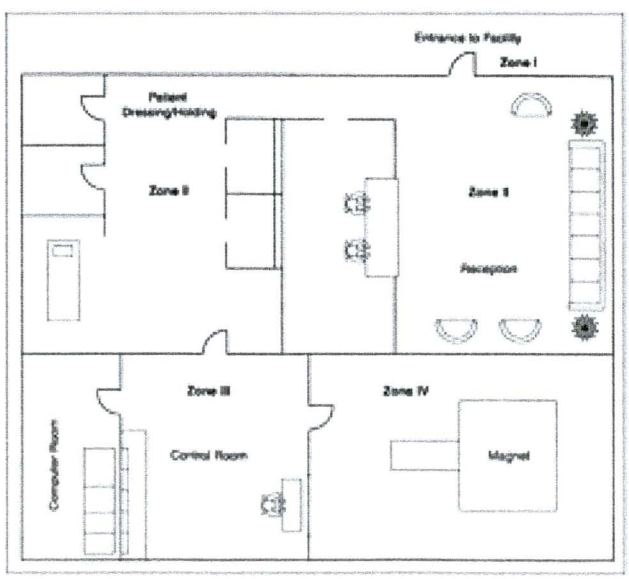
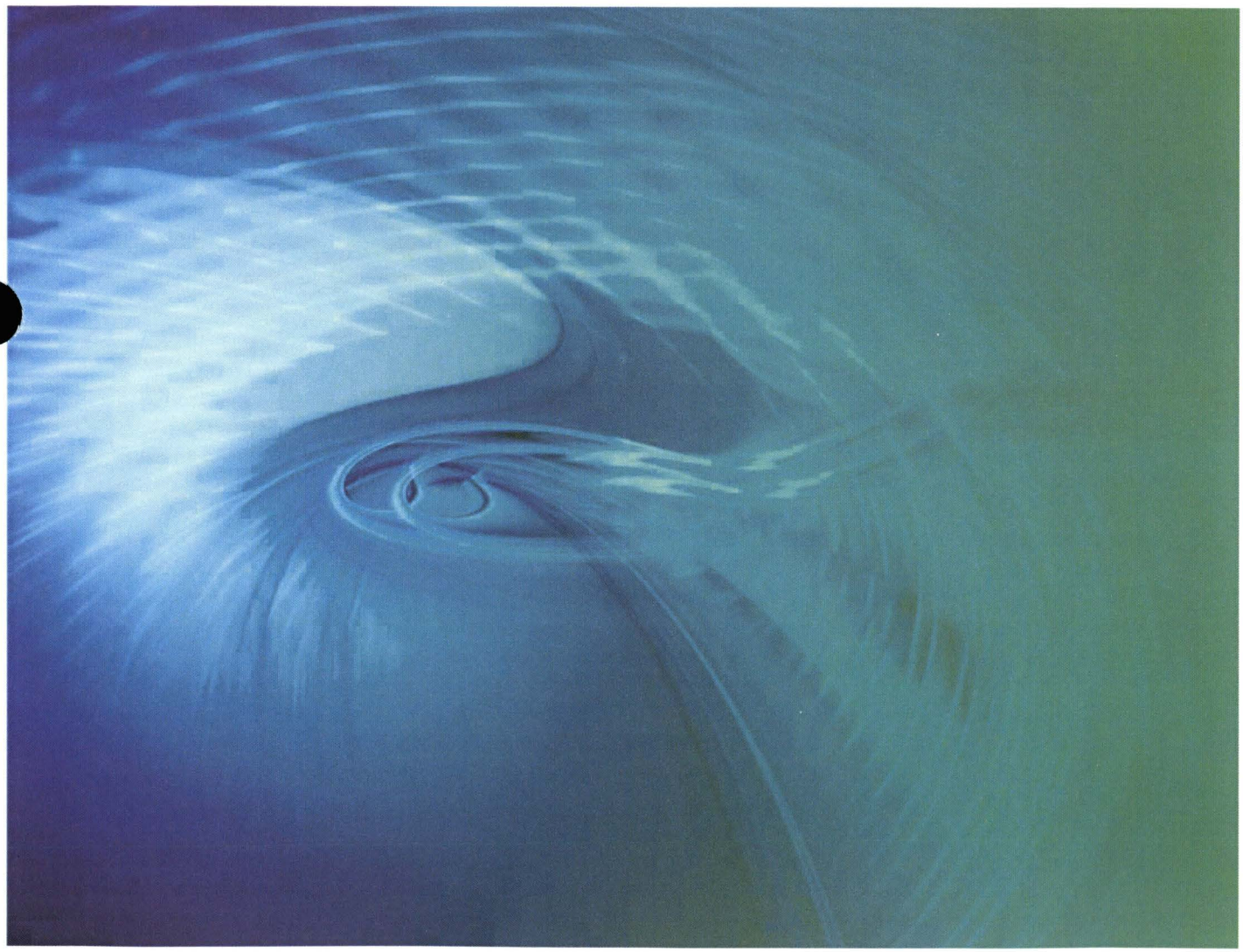


Fig 1.—MR site floor plan

Patient Safety and Quality in Medical Imaging: The Radiologic Technologist's Role

Liana Watson, DM, R.T.(R)(M)(S)(BS), RDMS, RVT, FASRT and Teresa G. Odle, BA, ELS for
The ASRT Foundation Health Care Industry Advisory Council
Subcommittee on Patient Safety and Quality in Medical Imaging



Patient Safety and Quality in Medical Imaging: The Radiologic Technologist's Role

Liana Watson, DM, R.T.(R)(M)(S)(BS), RDMS, RVT, FASRT and Teresa G. Odle, BA, ELS,
for The ASRT Foundation Health Care Industry Advisory Council Subcommittee on Patient Safety and Quality in Medical Imaging

Radiologic technologists are at the forefront of patient safety and quality. The Code of Ethics of the American Registry of Radiologic Technologists (ARRT), which forms the first part of the ARRT *Standards of Ethics*, includes these four statements:

- The radiologic technologist acts to advance the principal objective of the profession to provide services to humanity with full respect for the dignity of mankind.
- The radiologic technologist assesses situations; exercises care, discretion, and judgment; assumes responsibility for professional decisions; and acts in the best interest of the patient.
- The radiologic technologist uses equipment and accessories, employs techniques and procedures, performs services in accordance with an accepted standard of practice, and demonstrates expertise in minimizing radiation exposure to the patient, self, and other members of the healthcare team.
- The radiologic technologist practices ethical conduct appropriate to the profession and protects the patient's right to quality radiologic technology care.[1]

Physicians, researchers, physicists, engineers and other creative and clinical partners have worked together over the years to continually develop and introduce evolutionary medical imaging equipment. On a regular basis, the medical imaging community announces faster and more accurate features, methods to improve image quality or lower patient exposure, new applications for imaging equipment and new technologies and modalities.

Health care patients benefit from the dedication of budgets and brilliant minds; use of medical imaging can speed and improve diagnosis of a myriad of diseases. Over the past few decades, use of many medical imaging modalities has grown exponentially. For example, 26 million computed tomography (CT) examinations were conducted in the United States in 1998; by 2008, more than 70 million CT examinations were conducted. During the same 10 years, nuclear medicine studies increased from 12 million to nearly 20 million.[2]

The tremendous growth in medical imaging has improved patient care in the United States and around the world. However, some risks and drawbacks have accompanied that growth. Appropriate use and associated costs are of concern to payers and policymakers. Most notably, increased use of diagnostic studies involving ionizing radiation can add to patients' cumulative exposure.[3] Medical imaging contributes to about 15 percent of the average effective dose per capita of people in the United States, and background radiation accounts for 83 percent.[2]

In particular, CT and nuclear medicine have been the focus of concerted efforts to estimate and reduce patient exposure. Use of these imaging modalities has increased and certain CT and nuclear medicine examinations introduce higher doses of radiation than do conventional radiography examinations.[3] Estimates show that CT accounts for about 49 percent of patient

exposure to ionizing radiation from medical imaging, and nuclear medicine examinations account for 26 percent of patient exposure.[4]

The number of radiographic and fluoroscopic studies skyrocketed from 25 million in 1950 to 293 million in 2006.[5] Fluoroscopy is used in a range of diagnostic and therapeutic imaging procedures, and has been the focus of improved technique and monitoring in recent years because of the potential for high skin dose and radiation effects.[6,7] As medical imaging departments transition from an analog to digital environment, there has been a potential for increased patient exposure as radiologic technologists adjust to digital imaging technology.[8] The American Society of Radiologic Technologists (ASRT), American College of Radiology (ACR) and other organizations continue to address this issue in white papers and with educational campaigns, and the vendor community has supported efforts with education and equipment standardization.[9]

Fluoroscopy is one imaging modality used in cardiovascular imaging. Along with radionuclide myocardial perfusion imaging and CT angiography, cardiovascular examinations can introduce high radiation exposures.[10] The total effective dose from contrast-enhanced coronary CT angiography has been estimated to be between 2.1 and 21.4 mSv.[11] In some cardiovascular and interventional examinations, radiologic technologists perform additional patient care duties such as placing peripherally inserted central catheters.

Use of medical imaging that does not involve ionizing radiation, such as ultrasonography and magnetic resonance (MR) imaging, has increased partly in response to concerns regarding cumulative exposure.[2,12] For example, ultrasonography traditionally has been used as an alternative imaging method to modalities that use ionizing radiation for women who are pregnant.[13] Ultrasonography and MR imaging can replace some radiation-based imaging for appropriate cardiovascular indications.[14,15] Safety still is a factor with any medical imaging examination. For example, MR imaging uses high magnetic field strengths and MR technologists typically are responsible for controlling access to the region in which access by non-MR personnel or introduction of ferromagnetic objects or equipment could result in serious injury or death to patients or staff.[16]

According to the U.S. Food and Drug Administration, ultrasonography has been used safely in medical imaging for more than 20 years. Because ultrasonic waves produce effects in the body, such as heating tissues slightly or producing cavitation, U.S. and international organizations have advocated for sensible use of ultrasonography as a diagnostic medical examination, and discouraged its use for nonmedical purposes for fetuses.[17]

The risks vs benefits of mammography continue to be debated, and mammograms must be conducted within the parameters of the Mammography Quality Standards Act.[18] Because this medical imaging modality is regulated, facilities and vendors must meet particular quality specifications and personnel qualification measures. The ACR and the Society of Breast Imaging addressed misinformation regarding thyroid exposure with an April 2011 statement. The thyroid receives no direct radiation exposure from mammography and scattered exposure is minimal, equivalent to about 30 minutes of natural background radiation that average Americans receive.[19]

As researchers and regulatory, advocacy and clinical organizations continue to explore the issue of safety in medical imaging, they consider the delicate balance of effective diagnosis and treatment of disease with the required exposure to radiation or other potential hazards.[10] Among strategies to improve radiation safety are justification, education and optimization of images and technique.[12] The ASRT and its partners recognize the critical role of the radiologic technologist in all aspects of medical imaging patient safety.

The Role of the Radiologic Technologist

It is clear that medical imaging is integral to health care, and scrutiny of imaging examinations is on the minds of policymakers and the general public.[3] To some extent, media reports have produced a degree of fear and anxiety among patients regarding the relationship between medical imaging examinations and cancer.[2] Radiologic technologists often are the health care providers who must deal with the results of media information — or misinformation — and help alleviate patients' concerns.[20]

Radiologic technologists continue to conduct all examinations with concern for patient dose and following ALARA (as low as reasonably achievable) principles

to balance dose and image quality. At times, they do so under the challenges addressed in this paper, such as tighter staffing ratios and declining opportunities for communication with radiologists.

It is critical to health care administrators and medical imaging managers to recognize that the radiologic technologist usually is the first and often the only health care staff member who interacts with patients having medical imaging examinations.[3] The technologist is charged with producing a quality image with the lowest possible patient exposure, under the oversight of the radiologist. In addition, the technologist often is the only health care professional who might recognize that an ordering physician has requested an examination that duplicates one the patient recently has undergone or is questionable in terms of indication or appropriateness.[3]

Because of the technologist's critical role, the ACR has encouraged that radiology practices support regularly scheduled in-service education on radiation safety for technologists and phase in requirements that at least one technologist per site hold advanced certification in the modalities offered by the site.[21]

Certification standards are the purview of the American Registry for Diagnostic Medical Sonography, American Registry of Radiologic Technologists, Cardiovascular Credentialing International and the Nuclear Medicine Technology Certification Board. These certification agencies are governed by independent boards made up of physician and technologist representatives. All of these certification agencies also establish rules and regulations, ethics standards and continuing education requirements for renewing registration.[22-25]

The ASRT is a professional organization with more than 149,000 medical imaging and radiation therapy members. The organization's mission is to advance the medical imaging and radiation therapy profession and to enhance the quality of patient care. The ASRT conducts related research, provides curricula and support to radiologic science educators, develops position statements and practice standards, publishes peer-reviewed journals and offers online courses, Directed Reading articles and other continuing education opportunities to its members.

The ASRT supports certification standards for all technical personnel who perform medical imaging and radiation therapy procedures.[26] The ASRT Practice Standards for Medical Imaging and Radiation Therapy state that technologists should be educationally prepared and clinically competent in all aspects of the work they perform and that technologists should be appropriately certified in all modalities they practice.[27]

Purpose and Scope of Paper

The ASRT Foundation's Health Care Industry Advisory Council (HCIAC) includes representatives of important companies in the medical imaging and radiation oncology industries who work together to advance patient care.[28] Members meet annually, and occasionally form subcommittees to discuss significant issues in the radiologic sciences. The HCIAC Subcommittee on Patient Safety and Quality in Medical Imaging met Nov. 7, 2012, in Albuquerque, N.M.

The ASRT met with the committee of radiologic technologists, many of whom work in the corporate sector of the industry, with the goal of collaboratively improving patient safety and quality in medical imaging. They discussed the current state of medical imaging as well as challenges associated with providing consistently high-quality care and education on equipment and new and emerging technologies. Committee members also discussed the desired state for radiologic technologist workplaces to ensure consistent quality in patient care and to maximize education and understanding of equipment and new technology. This white paper and its recommendations are the direct result of the committee's input. The primary focus of the committee and resulting recommendations is quality and safety in CT, computed radiography/digital radiography, along with all medical imaging specialties.

Current State of Medical Imaging

In an environment of rapid growth and technological advancement, radiologic technologists face a number of challenges when new and emerging technologies are introduced or when equipment upgrades occur. The challenges described in this white paper do not constitute an all-inclusive list of those faced daily by radiologic technologists and medical imaging department managers, but address many of the issues that affect the technologist's ability to continue to provide quality patient care under ALARA principles when adjusting to

new and emerging technologies. In addition, these challenges can interfere with the effectiveness of education by vendors during new or upgraded equipment installations.

Workplace and Staffing

The workplace presents many daily challenges to busy radiologic technologists and medical imaging department managers. One of these challenges is continuing to staff the medical imaging department regardless of budgetary constraints. According to the ASRT Radiology Staffing Survey 2010, more than 70 percent of respondents reported that the number of budgeted full-time equivalents in their medical imaging departments did not increase in 2010.[29] The estimated number of unfilled positions in medical imaging declined significantly (8 percent) between 2003 and 2010 to approximately 2 percent.[29] As budgets and staffing ratios tighten, shifts lengthen and medical imaging departments have less scheduling flexibility. In many small and rural facilities, radiologic technologists often must cross-train and multitask, helping to staff more than one modality.

Studies of nurse staffing have shown that extended shifts can lead to burnout, fatigue and most importantly, can compromise patient safety. Overtime also might be required by some employers. There is also a trend in health care cultures to blend the distinction between voluntary and mandatory overtime, making workers feel as if they must take overtime.[30] When health care workers fail to receive adequate sleep time, they can experience lapses in attention, reduced motivation and diminished ability to solve problems.[31] Vacation time and personal days off are also important.

The culture that demands tight staffing and often long shifts and overtime also makes for difficult scheduling of education. Yet learning a new or emerging technology requires time and attention, and can place additional strain on department scheduling.[32] Radiologic technologists often find it difficult to find personal time for continuing education endeavors, and managers cannot adequately free up schedules for applications training when vendors install new or upgraded equipment.

Education on use of new technology has been cited as a factor that can contribute to eliminating avoidable patient radiation exposure,[33] yet vendors observe that department workflows prevent radiologic technologists from fully attending applications training. This is a workplace and cultural issue that is problematic in medical imaging departments and health care in general. A survey regarding barriers to new technology adoption revealed that finding time necessary to train staff was the second largest barrier to successful adoption, topped only by cost.[34]

An advanced user model (also called a "super user") has been shown to alleviate some of the time constraints. In addition, social persuasion can help people in the workplace learn by observing others' performance and through verbal persuasion.[35] In other words, effective advanced users can train and encourage adoption through modeling ongoing proper use of equipment, answering questions and providing positive reinforcement.

Communication between radiologists and radiologic technologists is an additional workplace issue that can affect image quality and patient exposure, along with the background knowledge technologists need to prepare for new technologies. The ability of technologists to alert radiologists about issues such as multiple examinations on patients and to receive constructive feedback on image quality and exposure from radiologists depends on effective communication. However, technologists have reported that as use of technology has increased, traditional technologist-radiologist communication has decreased. What little interaction that takes place in many busy medical imaging departments and large practices now occurs through electronic notes that accompany digital images transmitted through a network to the physician interpretation room.

Studies have shown that implementation of picture archiving and communication systems (PACS), electronic health records (EHR) and digital imaging shorten turnaround times and increase medical imaging department volume without a subsequent staffing increase.[36] Although use of information technology can help prevent errors and adverse events and help providers track events that occur,[37] the advantages afforded by technology have changed workflow and workplace dynamics in radiology. Technologists no longer enter reading areas to hang radiographs for physicians and potentially discuss technical aspects of the studies in real time. Radiologic technologists often must rely on interpretation of infrequent notes from radiologists, input from their managers or their own

initiative for education regarding image quality and exposure improvement.

Technology Gaps

The importance of information technology to health care cannot be overlooked. Congress appropriated more than $20 billion for health information technology within a 2009 economic stimulus package, and electronic health records are a national priority.[38] Medical imaging depends entirely on technology, perhaps more than any medical specialty.[39] The technological convergence of clinical equipment and computers has occurred rapidly and become ubiquitous in all medical imaging modalities. The advances have occurred so rapidly that many clinicians in the workplace still are uncomfortable with computers.[37] A lack of computer literacy affects perceptions of self-efficacy and expectations of outcome regarding use of or training in new technologies involving health information technology. When a learner believes that he or she can execute the necessary skill or behavior, outcomes from the learning experience generally are better.[35,40]

Technologists are among health care workers who might lack computer skills. Naturally, computer literacy and comfort levels vary. Because skills and comfort levels can vary greatly, there can be wide gaps in the levels of ease technologists have on the job with computer-based job functions. Further, the disparate knowledge complicates education in new technologies and equipment. Applications trainers need to focus on specific equipment functions and features, and should be able to assume that all trainees begin with basic computer skills.

Some of the differences in comfort with technology could be attributed to generation gaps. The Pew Research Center has shown that only 76 percent of those from the older baby boom generation (born between 1946 and 1954) are online, but 95 percent of people from the millennial generation (born between 1977 and 1992) say that they are active online.[41] In a recent study of technology ownership, those aged 19 to 29 owned more cell phones and laptop computers than people from any other age group. People aged 50 and older consistently owned the fewest cell phones, desktop and laptop computers, e-readers and tablets than those younger than aged 50.[42]

Although assigning consistently lower computer literacy and comfort levels strictly according to age or generation could be considered stereotyping, vendors and radiologic technologists have observed some gaps between the skills and comfort levels of recent graduates and technologists who have been in practice for many years. By 2015, the age of radiologic technologists in the workplace will represent workers from the baby boom, generation X and generation Y demographics more evenly. Regardless of the current or future demographics, there is a lack of appropriate skills assessment and training in information technology skills in the health care setting,[43] including assurance that all radiologic technologists have basic computer literacy that help them learn and feel comfortable with new and emerging clinical technologies.

Technology gaps also can exist in basic knowledge of new or emerging medical imaging modalities. For example, some technologists still lack comfort with understanding the basic principles of imaging with digital radiography, and others might rely too heavily on new digital equipment to correct technique factors that once were the purview of the radiologic technologist.[9] Many technologists must cross-train in CT or cardiovascular interventional for department coverage, but conduct examinations infrequently, which provides less opportunity to become familiar with equipment operation and technique. Equipment manufacturers use different terminology and branding to name similar features. This issue is being addressed in digital radiography through efforts to make exposure indicator terminology consistent among vendors and to develop a uniform response relationship between receptor exposure and exposure indicator.[44]

Ensuring that radiologic technologists have the foundation for any current, upgraded or emerging technology is the responsibility of multiple parties. Although accountability rests primarily with the technologist, managers are responsible for hiring, assigning and promoting staff appropriately to ensure patient safety and high-quality imaging examinations in their respective departments. Radiologists ultimately are responsible for the images they review, and should work with managers and technologists to recognize potential shortcomings and help educate as appropriate. Vendors are responsible for providing thorough

training on new and upgraded equipment with cooperation from managers and staff at the facilities where equipment is installed. The medical imaging community and policymakers are responsible for maintaining a focus on patient safety and high-quality imaging through support of measures that ensure only qualified personnel conduct medical imaging examinations.

Workplace Culture

The rapid technological convergence might have advanced more rapidly than technologists' computer capabilities and faster than medical imaging workplace cultures have adapted. For example, lack of certain skills can affect self-efficacy and the focus health care workers have on continued education. Managers, particularly administrators outside of medical imaging departments, often fail to understand the critical nature of applications training and changes technology can cause in technique and patient exposure factors. Further, medical imaging departments might not use the new tools available to them for reporting and tracking dose and for process improvement.

Even when staff is given time to attend applications training, scheduling does not always afford staff time to attend the entire session uninterrupted, or attendees might not be focused on the training. This could be due to concerns regarding coverage or the self-efficacy factor; learners who have high self-efficacy are more likely to visualize a successful training experience and remain more focused than those who have low self-efficacy. A technologist's self-efficacy can be based on individual skills or knowledge, along with the context and culture in which the training and equipment installation takes place. High self-efficacy can assist in training focus and persistence, and with persistence throughout implementation of a new technology.[35,40]

The culture that can lead to low self-efficacy among radiologic technologists and other health care professionals when adopting new technology begins with planning by administrators and nonradiology managers, and teams charged with capital purchases. When implementing converging technologies, inadequate planning can involve failing to include users in the planning process, the mistaken reliance on new or upgraded equipment to solve inefficiencies that actually result from internal departmental problems and failing to consider best practices.[32]

Poor planning and support that lacks a clear structure can lead to inadequate focus or adoption and failure to adequately schedule radiologic technologists for applications training. In addition, inadequate planning for new technology and equipment installations can complicate workflow and cause inefficiencies throughout the entire process — including potentially purchasing suboptimal equipment or features, creating clerical, clinical or technical inefficiencies, extending length and cost of installation, failing to achieve buy-in and training focus from users and repeated operational problems after installation. Having multiple vendors represented can complicate planning for new technology, installations and education, particularly for a new site.

Important patient care aspects are introduced with medical imaging technology that some physicians and leaders outside medical imaging might not fully understand. Adequately adhering to the principles of ALARA requires the cooperation of referring physicians and a supportive and safety-minded culture. Culture change is possible at local and broader levels; pediatric radiation dose offers an excellent example. When the media and public became actively involved in concerns about childhood radiation, organizations, clinicians, government agencies and representatives of a number of resources worked together to address the issue, educate stakeholders and effect change. Eventually, a culture change occurred that modified medical imaging practice.[45]

Thorough planning and strategizing in a safety-minded culture optimizes the use of tools available for reporting and tracking estimated doses and for process improvement. Most medical imaging equipment provides estimated dose information along with the examination, usually in the digital imaging and communications in medicine (DICOM) header.[8,46] Medical and vendor societies have worked together to begin standardizing digital medical imaging exposure indicators (EIs).[8,21] A standard EI value provides an estimate of incident radiation exposure to the detector for each acquired image.[9]

Regardless of standardization, medical imaging equipment offers a variety of data associated with imaging studies, such as estimated dose, dosimetric quantities, demographics and radiographic technique

information that can be compiled and studied for process improvement. Vendors observe that many of these features of equipment are not used by medical imaging departments to the software's capacity. Yet they could be used as part of carefully planned quality management and continuous improvement programs.

Desired State

The challenges that can affect training in medical imaging, and ultimately image quality or patient exposure, can be overcome by observing best practices regarding workplace, technological and cultural issues. The HCIAC committee discussed desired states for medical imaging departments, administrators and industry in terms of best practices.

Workplace and Staffing

Best practice: Medical imaging departments develop staffing policies and procedures that facilitate safe patient care.

Because extended shifts, burnout and fatigue can compromise patient safety, managers should set realistic expectations for staffing that consider high-quality patient care as a priority. Staffing is particularly important when radiologic technologists are required to perform complicated procedures and in MR imaging, where radiologic technologists are responsible for controlling access to the equipment's magnetic field. Failing to staff adequately can affect patient satisfaction, a critical factor in scores now assigned to providers by the Centers for Medicare and Medicaid Services (CMS), and thus in reimbursement.[47]

These policies should include staffing adequately to free time for training on new and upgraded imaging equipment and education about evolving technologies. A 2008 Joint Commission sentinel event alert that addressed safety issues when implementing health information and converging technologies stated that although the time and attention required to learn new technologies can strain already demanding schedules, hospital leadership should establish a training program for all clinical and operations staff who might use new technology. The alert also recommended that the orientation for new technology occur near the time of implementation and that refresher courses be held.[32]

Best practice: Efforts focus on better facilitating radiologist/radiologic technologist collaboration on care, feedback and quality improvement.

In The Joint Commission's 2011 sentinel event alert regarding radiation risks in medical imaging, communication among clinicians, medical physicists, technologists and staff was cited as one of the contributing factors to avoidable radiation dosing.[33] Traditionally, radiologic technologists have learned from radiologists about improving radiographic technique, and radiologists ultimately are responsible for "mastery of technology and dedication to quality and safety" in their practices.[3] In today's digital imaging environment, collaboration between the technologist and radiologist does not occur as often as it did in the film-screen environment. This lack of interaction has resulted in fewer opportunities for the technologist to learn from radiologists and talk about the quality of their images.

Departments should adopt communication strategies and policies in the new digital environment to allow for and even encourage radiologist oversight, involvement and feedback on image technique, exposure and quality. Radiologic technologists usually have sole medical imaging department contact with patients and are the only professionals who might notice duplicate or inappropriate examinations before they occur. Technologists need radiologist input and cooperation to effectively communicate with patients and a departmental system in place in which they can report concerns regarding ordered examinations or technique questions and exposure issues.

Technology Gaps

Best practice: Medical imaging departments provide effective and efficient applications training for new and upgraded medical imaging equipment.

Regular radiologist communication helps radiologic technologists improve basic and advanced technical skills and guidance for patient exposure and ALARA principles. When new and emerging technologies are introduced, radiologic technologists and radiologists must rely on a number of sources for professional development.

Before new or upgraded equipment is installed, radiologic technologists should have a core knowledge of the basics in the modality. The basics of some modalities have changed considerably since radiologic

technologists completed their educational programs. Certification in a modality provides an excellent foundation, but when certification is not practical, there are other avenues. Though employers should make every effort to ensure that application training is effective, it is up to the individual technologists participating to ensure that they are prepared to learn the new technology. For example, computers and health information technology are ubiquitous in medical imaging, and technologists should ensure that they have basic computer skills before attending applications training for the installation of their department's first digital imaging equipment. Radiologic technologists should follow their standards of practice and continue to enhance the perception of their professionalism by participating in lifelong learning, research and publishing opportunities, and adopting new best practices.

Managers and vendors can assist radiologic technologists in determining some of the specific skills needed before applications training begins. Vendors should provide managers with information regarding basic skills and knowledge trainees should possess so that applications training can focus on the equipment and run more efficiently when all attendees are at similar levels in terms of technical and technological skills. Managers can use this information to provide preassessments of trainees' skills before the applications specialist arrives. Similarly, the vendor can work with the medical imaging department manager to provide information for accurate postassessment, so that managers can ensure that radiologic technologists fully understand how to safely and efficiently operate new and upgraded equipment.

Providing effective and efficient applications training requires a certain degree of cooperation between vendors and managers, but also among medical imaging vendors. Once all vendors accept best practices regarding preassessment and postassessment, for example, managers can expect similar processes and deliverables regardless of the manufacturer involved in the equipment installation and training.

Best practice: Recognize that multivendor environments introduce new layers of complexity and require cooperation among vendors and management.

The variation in vendor-specific features necessitates effective and ongoing applications training for medical imaging equipment. Vendors should make available charts with terminology that is specific to their equipment brands to assist radiologic technologists and radiologists, particularly at sites with equipment in the same modality from multiple vendors. Medical imaging department managers should post these charts in conspicuous and convenient locations to assist staff.

Encouraging vendors across all medical imaging modalities to adopt consistent terminology in a manner similar to efforts to standardize digital radiography exposure indicators should decrease complexity for radiologic technologists. This is particularly true for those who cross-train and perform procedures in several modalities and for traveling radiologic technologists. The ASRT has published a white paper that addresses this issue in more detail for digital radiography, along with recommended best practices.[9]

Workplace Culture
Best practice: Medical imaging departments have quality management processes in place; vendors provide documentation and analysis tools that management uses effectively.

Maintaining a regular quality management program is essential to patient care, ALARA principles and a safety culture. Radiologic technologist practice standards address the role of technologists in assessing and adhering to quality management action plans for materials, processes and regular equipment quality control.

In addition, managers can record technique and exposure information provided by medical imaging equipment manufacturers. By investigating patterns outside the range of appropriate technique or dose, radiologists and managers can address and resolve problems by providing education or through other suitable measures. Management should work with vendors to ensure that dosing and technical information from medical imaging examinations captured by equipment is used as intended.

Information gathered from reports, peer-to-peer communication and education and other quality management processes should support patient care and quality improvement efforts. A safety culture encourages openness, communication and nonpunitive follow-up when appropriate. In a culture that emphasizes safety, there are opportunities for peer-to-peer learning and an importance placed on continuous learning. For this to be

successful, radiologic technologists must be dedicated to lifelong learning and be open to accepting constructive criticism from radiologists, managers and peers.

Best practice: Radiologic technologists are educationally prepared, clinically competent and certified in their respective modalities.

When radiologic technologists are dedicated to lifelong learning and professional development, they maintain appropriate clinical competence for their respective modalities. Although maintaining educational preparation and clinical competence is a personal responsibility and an important component of the technologist's practice standards and ethics, the workplace culture should support technologists' efforts. In addition, radiologic technologists should recognize that their professional self-worth and self-efficacy should be connected more closely to professional development than compensation.

When medical imaging departments require that only technologists certified in, or working toward certification in, a respective modality perform procedures in their departments, they support professionalism. Managers can perform and present to administrators cost-benefit analyses of policies such as continuing education reimbursement to support continued competence and new or maintained certifications. Vendors, managers, radiologists, administrators, radiologic technologists and other stakeholders can advocate for legislation to ensure registered radiologic technologists conduct examinations.

Best practice: Vendors and managers collaboratively develop a detailed training agreement that outlines both parties' expectations before finalizing a medical imaging equipment purchase.

Ensuring that radiologic technologists receive effective and efficient education on new and upgraded medical imaging equipment requires detailing site and vendor expectations well in advance of applications training. Vendor expectations might include core knowledge of trainees, amount of time needed from attendees during training, mix and number of procedures to train on, coordination with ancillary equipment set-up or training, and site acceptance and readiness of equipment. Managers should express their expectations regarding education outcomes, scheduling, cost and follow-up assistance from the vendor.

Vendors and managers should work together to discuss education goals and outline the information needed for managers to perform preassessments and postassessments. Likewise, if the manager determines that an advanced user model is the best solution, the manager and vendor should work together to develop identifying characteristics of advanced users and how the user will support the vendor and ongoing education at the site. By identifying advanced users in medical imaging departments whose schedules can be made free for complete applications training, managers can have on-site champions to follow up with staff and contribute to improved learning and operational outcomes. A HCIAC subcommittee on the Definition of the Advanced User in Applications Training developed an advanced user definition in June 2012 to assist managers in identifying advanced users and developing expectations for their assistance in training.

In short, it is critical that the training agreement be carefully planned in as much detail as possible and that appropriate vendor and facility personnel have input to ensure an effective and efficient applications training and successful long-term integration of the new technology into the medical imaging workplace.

Conclusion

Patients now have more information than ever and are empowered to understand the importance of safety and dose when undergoing medical imaging procedures. Radiologic technologists are poised to educate and protect patients. Collaboration of medical imaging stakeholders to support radiologic technologists' education and efforts and to promote a culture of safety and lifelong learning can effect change in medical imaging.

In the busy, budget-driven environment of health care, training time and attention often are sacrificed, yet training is critical to successfully implementing new and emerging technologies.[35] Quick fixes and workarounds are counterproductive, costing more in the long run and compromising safety.[32] Placing a priority on setting expectations for applications training, collaboration among vendors and managers and training appropriately can help ensure effective and safe implementation of new and emerging technologies. Emphasizing a communicative and safe culture in

medical imaging departments supports effective education, along with improving self-efficacy of radiologic technologists and helping them to maintain clinical competence and certification.

References

1. American Registry of Radiologic Technologists. ARRT Standards of Ethics. ARRT website. www.arrt.org/pdfs/Governing-Documents/Standards-of-Ethics.pdf. Revised September 1, 2012. Accessed January 30, 2013.
2. Hendee WR, O'Connor MK. Radiation risks of medical imaging: separating fact from fantasy. *Radiology.* 2012;264(2):312-321.
3. Amis ES, Butler PF, Applegate KE, et al. American College of Radiology white paper on radiation dose in medicine. *J Am Coll Radiol.* 2007;4(5):272-284.
4. Ikuta I, Sodickson A, Wasser EJ, Warden GI, Gerbaudo VH, Khorasani R. Exposing exposure: enhancing patient safety through automated data mining of nuclear medicine reports for quality assurance and organ dose monitoring. *Radiology.* 2012;264(2):406-413.
5. Mettler FA, Bhargavan M, Faulkner K, et al. Radiologic and nuclear medicine studies in the United States and worldwide: frequency, radiation dose, and comparison with other radiation sources—1950-2007. *Radiology.* 2009;253(2):520-531.
6. Balter S, Miller DL, Schueler BA. Radiation dose measurements and monitoring for fluoroscopically guided interventional procedures. *J Am Coll Radiol.* 2012;9(8):595-597.
7. Hernanz-Shulman M, Goske MJ, Bercha IH, Strauss KJ. Pause and pulse: ten steps that help manage radiation dose during pediatric fluoroscopy. *AJR Am J Roentgenol.* 2011;197(2):475-481.
8. Castañon PG, España Lopez ML, Fernandez Bedoya V, Bermudez Luna R, Rodriguez Martin G. A dose index as a tool to estimate paediatric patient doses in digital projection radiography. *Radiat Prot Dosimetry.* 2012;149(4):417-423.
9. Hermann TL, Fauber TL, Gill J, et al. Best Practices in Digital Radiography. American Society of Radiologic Technologists website. www.asrt.org/docs/whitepapers/asrt12_bstpracdigradwhp_final.pdf. Accessed November 29, 2012.
10. Douglas PS, Carr JJ, Cerqueira MD, et al. Developing an action plan for patient radiation safety in adult cardiovascular medicine. *Circ Cardiovasc Imaging.* 2012;5(3):400-414.
11. Foley SJ, McEntee MF, Achenbach S, Brennan PC, Rainford LS, Dodd JD. Breast surface radiation dose during coronary CT angiography: reduction by breast displacement and lead shielding. *AJR Am J Roentgenol.* 2011;197(2):367-373.
12. Radiation safety in imaging: best practices in health care. *The Joint Commission Perspectives on Patient Safety.* 2011;11(5):1-4.
13. American College of Radiology. ACR Practice Guideline for Imaging Pregnant or Potentially Pregnant Adolescents and Women With Ionizing Radiation. ACR website. www.acr.org/~/media/ACR/Documents/PGTS/guidelines/Pregnant_Patients.pdf. Revised 2008. Accessed November 16, 2012.
14. Harthun NL. Current issues in the treatment of women with abdominal aortic aneurysm. Gend Med. 2008;5(1):36-43.
15. American College of Radiology. ACR appropriateness criteria: Acute nonspecific chest pain, low probability of coronary artery disease. ACR website. www.acr.org/~/media/ACR/Documents/AppCriteria/Diagnostic/AcuteNonspecficChestPainLowProbabilityCoronaryArteryDisease.pdf. Reviewed 2011. Accessed November 20, 2012.
16. Khan E, Barkovich AJ, Bel C, et al. ACR Guidance Document for Safe MR Practices: 2007. ACR website. www.acr.org/~/media/ACR/Documents/PDF/QualitySafety/Radiation%20Safety/Guidance%20Document%20on%20MR%20Safe%20Practices.pdf. Published June 2007. Accessed December 2, 2012.
17. U.S. Food and Drug Administration. Radiation-emitting products. FDA website. www.fda.gov/Radiation-EmittingProducts/RadiationEmittingProductsandProcedures/MedicalImaging/ucm115357.htm. Updated June 6, 2012. Accessed December 2, 2012.
18. American College of Radiology. ACR Practice Guideline for the Performance of Screening and Diagnostic Mammography. ACR website. www.acr.org/~/media/ACR/Documents/PGTS/guidelines/Screening_Mammography.pdf. Published 2008. Accessed November 20, 2012.
19. American College of Radiology. The ACR and Society of Breast Imaging Statement on Radiation Received by the Thyroid from Mammography. ACR website. www.acr.org/~/media/ACR/Documents/PDF/QualitySafety/Resources/Breast%20Imaging/ThyroidStatement.pdf. Accessed December 10, 2012.
20. Keen CE. Techs often bear brunt of media misinformation about imaging. AuntMinnie.com website. www.auntminnie.com/index.aspx?d=1&sec=sup&sub=imc&pag=dis&itemid=101812&wf=5217. Published November 30, 2012. Accessed December 4, 2012.
21. Amis ES, Butler PF. ACR white paper on radiation dose in medicine: three years later. *J Am Coll Radiol.* 2010;7(11):865-870.
22. About us. American Registry of Radiologic Technologists website. www.arrt.org/About-ARRT. Accessed December 20, 2012.

23. Overview of ARDMS. American Registry for Diagnostic Medical Sonography website. www.ardms.org/about_ardms/overview_of_ardms. Accessed January 30, 2013.
24. About CCI. Cardiovascular Credentialing International website. www.cci-online.org/content/about-cci-0. Accessed January 30, 2013.
25. NMTCB Home Page. Nuclear Medicine Technology Certification Board website. www.nmtcb.org/root/default.php. Accessed January 30, 2013.
26. Federal legislative affairs: CARE Bill. American Society of Radiologic Technologists website. www.asrt.org/main/standards-regulations/federal-legislative-affairs. Accessed December 20, 2012.
27. Practice standards for R.T.s. American Society of Radiologic Technologists website. www.asrt.org/main/standards-regulations/practice-standards. Accessed January 8, 2013.
28. Health Care Industry Advisory Council (HCIAC). ASRT Education and Research Foundation website. www.asrtfoundation.org/Content/Corporate_Relations/HCIAC. Accessed November 28, 2012.
29. American Society of Radiologic Technologists. Radiology Staffing Survey 2010. ASRT website. www.asrt.org/docs/research/ASRTRadStaffingSurvey2010.pdf. Published June 2010. Accessed December 1, 2012.
30. Stimpfel AW, Sloane DM, Aiken LH. The longer the shifts for hospital nurses, the higher the levels of burnout and patient dissatisfaction. *Health Aff.* 2012;31(11):2501-2509.
31. The Joint Commission. Sentinel Event Alert: Health care worker fatigue and patient safety. www.jointcommission.org/assets/1/18/sea_48.pdf. Issued December 14, 2011. Accessed December 3, 2012.
32. The Joint Commission. Sentinel Event Alert: Safety implementing health information and converging technologies. www.jointcommission.org/assets/1/18/SEA_42.PDF. Issued December 11, 2008. Accessed December 3, 2012.
33. The Joint Commission. Sentinel Event Alert: Radiation risks of diagnostic imaging. www.jointcommission.org/assets/1/18/SEA_47.pdf. Issued August 24, 2011. Accessed August 20, 2012.
34. Golzweig CL, Towfigh A, Maglione M, Shekelle PG. Costs and benefits of health information technology: new trends from the literature. *Health Aff.* 2009;28(2):w282-w293.
35. McAlearney AS, Robbins J, Kowalczyk N, Chisolm DJ, Song PH. The role of cognitive learning theories in supporting successful EHR system implementation training: a qualitative study. *Med Care Res Rev.* 2012;69(3):294-315.
36. Nitrosi A, Borasi G, Nicoli F, et al. A filmless radiology department in a full digital regional hospital: quantitative evaluation of the increased quality and efficiency. *J Digit Imaging.* 2007;20(2):140-148.
37. Bates DW, Gawande AA. Improving safety with information technology. *N Engl J Med.* 2003;348(25):2526-2534.
38. Kaplan B, Harris-Salamone KD. Health IT success and failure: recommendations from literature and an AMIA workshop. *J Am Med Inform Assoc.* 2009;16(3):291-299.
39. Reiner B. Chairman's editorial: reprioritizing radiologist education: teaching old dogs new tricks. *J Digit Imaging.* 2003;16(3):241-244.
40. Compeau DR, Higgins CA. Application of social cognitive theory to training for computer skills. *Information Systems Research.* 1995;6(2):118-143.
41. Pew Internet. Through the generations: how the Web is being used. SiteJabber website. www.sitejabber.com/blog/wp-content/uploads/2011/01/sjgen.png. Accessed December 3, 2012.
42. Pew Internet. A closer look at gadget ownership: demographics. Pew Internet website. www.pewinternet.org/Infographics/2012/A-Closer-Look-at-Gadget-Ownership.aspx. Published June 28, 2012. Accessed December 3, 2012.
43. Graham-Jones P, Jain SH, Friedman CP, Marcotte L, Blumenthal D. The need to incorporate health information technology into physicians' education and professional development. *Health Aff.* 2012;31(3):481-487.
44. American Association of Physicists in Medicine. An exposure indicator for digital radiography. Report of AAPM Task Group 116. AAPM website. www.aapm.org/pubs/reports/RPT_116.pdf. Published July 2009. Accessed January 27, 2012.
45. Slovis TL. Where we were, what has changed, what needs doing: a decade of progress. *Pediatr Radiol.* 2011;41(suppl 2):456-460.
46. Rehani MM, Vano E. Medical radiation protection in the next decade. *Radiat Prot Dosimetry.* 2011;147(1-2):52-53.
47. O'Reilly KB. Patient satisfaction: when a doctor's judgment risks a poor rating. American Medical Association website. www.ama-assn.org/amednews/2012/11/26/prsa1126.htm. Published November 26, 2012. Accessed December 20, 2012.

Appendix A

Summary of Best Practice Recommendations

Workplace and Staffing Current State/Challenges:

- Tight staffing ratios, long shifts and overtime lead to high stress and minimize time for learning new technologies and applications.
- Managers have difficulty scheduling adequate time for education about new and upgraded equipment installations.
- There is decreased personal interaction between radiologists and radiologic technologists, largely because of technological advancements.

Workplace and Staffing Desired State/ Best Practices:

- Medical imaging departments develop staffing policies and procedures that facilitate safe patient care.
- Efforts focus on better facilitating radiologist/ radiologic technologist collaboration on care, feedback and quality improvement.

Technology Gaps Current State/Challenges:

- Gaps are evident in computer literacy, understanding basic principles of imaging with digital equipment and comfort levels with technology among radiologic technologists.
- Equipment manufacturers use different terminology and branding to name similar features, causing further confusion with new and existing technologies.
- Ensuring patient safety and image quality requires accountability of multiple and varied parties, particularly radiologic technologists.

Technology Gaps Desired State/Best Practices:

- Medical imaging departments provide effective and efficient applications training for new and upgraded medical imaging equipment.
- There is recognition that multivendor environments introduce new layers of complexity requiring cooperation among vendors and management.

Workplace Culture Current State/Challenges:

- Managers and administrators often fail to understand the critical nature of medical imaging concepts and applications training.
- Inadequate planning and support for new and upgraded technologies can complicate workflow, cause problems with or failure of applications training and contribute to low radiologic technologist self-efficacy.
- Low self-efficacy among radiologic technologists can limit effectiveness of applications training preparation and completion.
- Medical imaging equipment features that help reduce dose or improved quality and processes often are not used to their capacity in medical imaging departments.

Workplace Culture Desired State/Best Practices:

- Medical imaging departments have quality management processes in place; vendors provide documentation and analysis tools that management uses effectively.
- Radiologic technologists are educationally prepared, clinically competent and certified in their respective modalities.
- Vendors and managers collaboratively develop a detailed training agreement that outlines both parties' expectations before finalizing a medical imaging equipment purchase.

Appendix B

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The following is a report of the American College of Radiology Blue Ribbon Panel on MR Safety, chaired by Emanuel Kanal, MD, FACR, to the Task Force on Patient Safety, chaired by James P. Borgstede, MD, FACR. Under the auspices of the Task Force, the panel met in November 2001 consisting of the following members: A. James Barkovich, MD; Charlotte Bell, MD, (Anesthesia Patient Safety Foundation); James P. Borgstede, MD, FACR; William G. Bradley, MD, PhD, FACR; Joel Felmlee, PhD; Jerry W. Froelich, MD; Ellisa M. Kaminski, RTR, MR; Emanuel Kanal, MD, FACR; Elaine K. Keeler, PhD, (NEMA); James W. Lester, MD; Elizabeth Scoumis, RN, BSN; Loren A. Zaremba, PhD (FDA); and Marie D. Zinninger (American College of Radiology Staff). The following document is intended to be used as a template for MR facilities to follow in the development of an MR safety program.

Recent articles in the medical literature and electronic/print media [1, 2] detailing Magnetic Resonance Imaging (MRI) adverse incidents involving patients, equipment, and personnel spotlighted the need for review. The Panel was charged with reviewing MR safety practices and guidelines and issuing new ones as appropriate for MR examinations and practices today [3–7]. The document restates existing practices and articulates new ones. This document will continue to evolve, as does the MRI field.

There are potential risks in the MR environment, not only for the patient but also for the accompanying family members, attending health care professionals, and others who find themselves only occasionally or rarely in the magnetic fields of MR scanners, such as security or housekeeping personnel, firefighters, police, etc. These MR Safe Practices Guidelines have been developed to help guide MR practitioners regarding these issues and provide a basis for them to develop and implement their own MR policies and practices. It is intended that these MR Safe Practice Guidelines (and the policies and procedures to which they give rise) be reviewed and updated on a regular basis.

It is the intent of the American College of Radiology (ACR) that these MR Safe Practice Guidelines will be helpful as the field of MR evolves and matures, providing patient MR services that are among the most powerful, yet safest, of all diagnostic procedures to be developed in the history of modern medicine.

ACR Magnetic Resonance Safe Practice Guidelines

A. Establish, Implement, And Maintain Current MR Safety Policies And Procedures

1. All clinical and research magnetic resonance imaging sites should maintain MR Safety Policies and Procedures, which are to be established, implemented, maintained, and routinely reviewed and updated, as appropriate. The level of compliance by staff will be assessed and documented annually. The policies and procedures manual should be readily available to the MR professionals on site at all times of operation.
2. These policies and procedures should also be reviewed concomitant with the introduction of any significant changes in safety parameters in the MR imaging environment of the site's MR service (e.g., adding faster/stronger gradient capabilities, higher RF duty cycle studies, etc.) and updated as needed. In this review process, national and international standards and recommendations should be taken into consideration prior to establishing local guidelines, policies, and procedures.
3. Each site will name an MR Medical Director whose responsibilities will include ensuring that these MR Safe Practice Guidelines are established and maintained as current and appropriate for the site. It is the responsibility of the site's administration to ensure that the policies and procedures that result from these MR Safe Practice Guidelines are implemented and adhered to at all times by all of the site's personnel.
4. Procedures should be in place to ensure that any and all adverse events, MR safety incidents, or "near incidents" that occur in the MR site are to be reported to the Medical Director of the MR site in a timely fashion (e.g., within 24 hours/one business day of their occurrence) and used in continuous quality improvement efforts.

B. STATIC MAGNETIC FIELD ISSUES: SITE ACCESS RESTRICTION

1. Zoning:
   The MR site is conceptually divided into four Zones (Fig. 1) as follows.
   a. Zone I: This includes all areas that are freely accessible to the general public. This area is typically outside of the MR environment itself and is the area through which patients, health care personnel, and other employees of the MR site access the MR environment.
   b. Zone II: This area is the interface between the publicly accessible uncontrolled Zone I and the strictly controlled Zone III and IV (see below). Typically patients are greeted in Zone II and are not free to move throughout Zone II at will, but are rather under the supervision of MR Personnel (see Section 2b, below). It is in Zone II that the answers to MR screening questions, patient histories, medical insurance questions, etc., are typically obtained.
   c. Zone III: This area is the region in which free access by unscreened non–MR Personnel and/or ferromagnetic objects and equipment can result in serious injury or death as a result of interactions between the individuals/equipment and the MR scanner's particular environment. These interactions include but are not limited to those involving the MR scanner's static and time varying magnetic fields. All access to Zone III is to be strictly restricted, with access to regions within it (including Zone IV, see below) controlled by, and entirely under the supervision of, MR Personnel (see Section 2b, below). Specifically identified MR Personnel (typically—but not necessarily only—the MR Technologists) are to be charged with ensuring that this MR Safe Practice Guideline is strictly adhered to for the safety of the patients and other non–MR personnel, the health care personnel, and the equipment itself. This function of the MR Personnel is directly under the authority and responsibility of the MR Medical Director or the Level Two–designated (see section 2b, below) physician of the day for the MR site.

   Zone III regions should be physically restricted from general public access—for example, by key locks, pass-key locking systems, or any other reliable physically restricting method that can differentiate between MR Personnel and non–MR Personnel. The use of combination locks is to be discouraged as combinations often tend to become more widely distributed than initially intended, resulting in site restriction violations being more likely with these devices. Only MR Personnel shall be provided with free access, such as the access keys/passkeys, to Zone III regions.

   There should be NO exceptions to this guideline. Specifically, this includes hospital/site administration, physician, security, and other non–MR Personnel (see section 2b, below). Non–MR personnel are not to be provided with independent Zone III access until such time as they undergo the proper education and training and become MR Personnel themselves. Zone III regions or at the very least the area within them wherein the static magnetic field's strength exceeds 5-gauss should be clearly marked and demarcated as being potentially hazardous.
   d. Zone IV: This area is synonymous with the MR scanner magnet room itself—i.e., the physical confines of the room within which the MR scanner itself is located. Zone IV, by definition, will always be located within Zone III as it is the MR magnet and its associated magnetic field that generates the existence of Zone III itself. Zone IV regions should also be clearly marked and demarcated as being potentially hazardous due to the presence of very strong magnetic fields. As part of the Zone IV site restriction, all MR installations should be installed in such a way as to provide for direct visual observation by Level II MR Personnel to access pathways into Zone IV regions. By means of illustration only, the MR Technologists would be able to directly observe and control, via line of site or via video monitors, the entrances or access corridors to Zone IV regions from their normal positions when stationed at their desks in the scan control room.

   Zone IV/MR magnet rooms should be clearly marked with a lighted sign and red light stating, "The Magnet is On." Except for resistive systems, this sign/red light should be illuminated at all times and should be provided with a backup energy source to continue to remain illuminated for at least 24 hours in the event of a loss of power to the site.

   In case of cardiac or respiratory arrest or other medical emergency within Zone

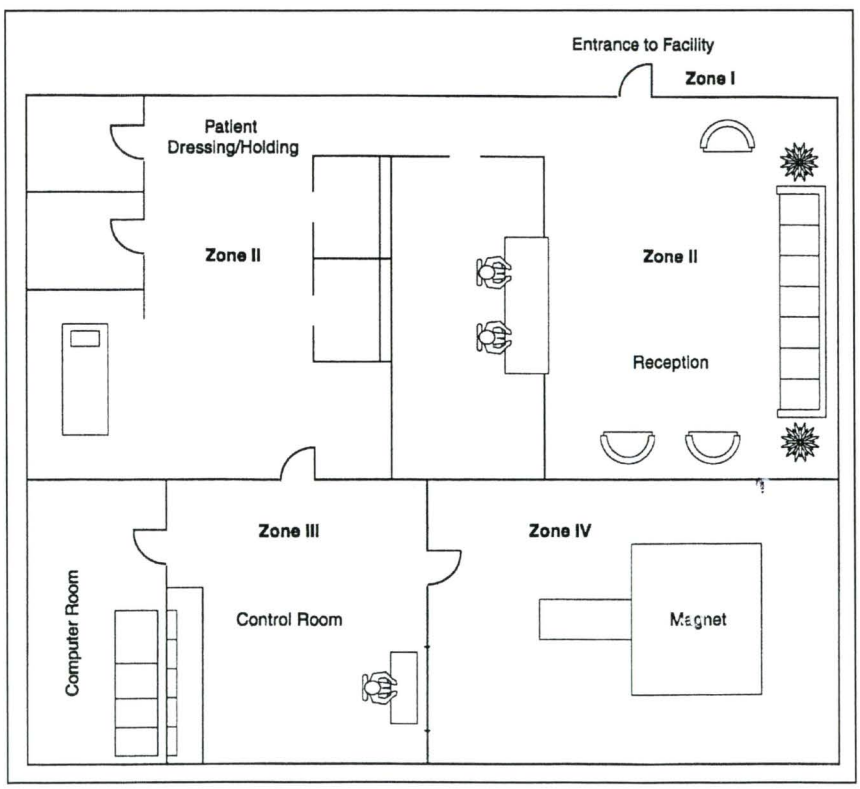

Fig. 1.—MR site floor plan.

IV for which emergent medical intervention and/or resuscitation is required, appropriately trained and certified MR Personnel should immediately initiate basic life support and/or CPR as required by the situation WHILE the patient is being emergently removed from the MR magnet room/Zone IV to a predetermined magnetically safe location. ALL PRIORITIES SHOULD BE FOCUSED ON STABILIZING (E.G., BASIC LIFE SUPPORT WITH CARDIAC COMPRESSIONS AND MANUAL VENTILATION) AND THEN EVACUATING THE PATIENT AS RAPIDLY AND SAFELY AS POSSIBLE FROM THE MAGNETIC ENVIRONMENT THAT MIGHT RESTRICT SAFE RESUSCITATIVE EFFORTS.

Further, for logistical safety reasons, the patient should always be removed from ZONE IV (the magnet room itself) to the prospectively identified location where full resuscitative efforts are to continue.

Quenching the magnet (for superconducting systems only) is not routinely advised for cardiac or respiratory arrest or other medical emergency, since quenching the magnet itself and having the magnetic field dissipate could easily take more than a minute. Furthermore, as quenching a magnet can theoretically be hazardous, ideally one should evacuate the magnet room, when possible, for an intentional quench. One should rather use that time wisely to initiate life support measures while removing the patient from Zone IV/the MR magnet room to a location where the strength of the magnetic field(s) is insufficient to be a medical concern. ZONE III AND ZONE IV SITE ACCESS RESTRICTION MUST BE MAINTAINED DURING RESUSCITATIONS AND/OR OTHER EMERGENT SITUATIONS FOR THE PROTECTION OF ALL INVOLVED.

2. MR Personnel/Non–MR Personnel
   a. All individuals working within at least Zone III of the MR environment should be documented to have completed successfully at least one of the MR site's approved MR safety live lectures or prerecorded presentations as approved by the MR Medical Director. Attendance should be repeated at least annually, and appropriate documentation should be provided. These individuals shall be referred to henceforth as MR Personnel.
   b. There are two levels of MR Personnel.
      1. Level One MR Personnel: Those who have passed minimal safety educational efforts to ensure their own safety as they work within Zone III regions will be referred to henceforth as Level One MR Personnel.
      2. Level Two MR Personnel: Those who have been more extensively trained and intensively educated in the broader aspects of MR safety issues including, for example, issues related to the potential for thermal loading/burns, direct neuromuscular excitation from rapidly changing gradients, etc., shall be referred to henceforth as Level Two MR Personnel. It is the responsibility of the MR Medical Director of the site not only to identify the necessary training, but also to identify those individuals that qualify as Level Two MR Personnel. It is understood that the Medical Director of the MR site will be one whose education and experience in MR safety qualifies them for designation as Level Two MR Personnel.
   c. All those not having successfully complied with these MR safety instruction guidelines shall be referred to henceforth as Non–MR Personnel.
3. Patient/Non–MR Personnel Screening
   a. ALL Non–MR Personnel wishing to enter Zone III regions of the MR Site must have first successfully passed an MR safety screening process to be performed by authorized MR Personnel. Only MR Personnel are authorized to perform an MR safety screen prior to permitting Non–MR Personnel into Zone III areas.
   b. Metal Detectors
      The usage of metal detectors in MR environments is NOT recommended. Reasons for this recommendation include, among others:
      1. They have varied—and variable—sensitivity settings.
      2. The skills of the operators can vary.
      3. Today's metal detectors cannot detect, for example, a 2 × 3 mm, potentially dangerous ferromagnetic metal fragment in the orbit, near the spinal cord, or heart, etc.
      4. Today's metal detectors do not differentiate between ferromagnetic and nonferromagnetic metallic objects/implants/foreign bodies.
      5. Metal detectors should not be necessary for the detection of large metallic objects such as oxygen tanks on the gurney with the patients. These objects are fully expected to be detected—and physically excluded—during the routine patient screening process.
   c. Non–MR Personnel should be accompanied by, or under the immediate supervision and visual/verbal contact with, one specifically identified Level Two MR Person for the entirety of the duration during which the Non–MR Personnel remain within Zone III or Zone IV restricted regions. However, it is acceptable to have them in a changing room or restroom not in visual contact in Zone III as long as personnel and the patient can verbally communicate with each other.

      In the event of a shift change, lunch break, etc., no Level Two MR Personnel shall relinquish their responsibility to supervise the Non–MR Personnel still within Zone III or Zone IV under their charge until such supervision has been formally transferred to another of the Level Two MR Personnel of the MR Site.
   d. Non-emergent patients should be MR safety screened onsite by a minimum of two separate individuals. At least one of these individuals should be one of the Level Two MR Personnel of the MR site. At least one of these two screens should be performed verbally/interactively.

      Emergent patients and their accompanying Non–MR Personnel may be screened only once providing that the screening individual is one of the site's Level Two MR Personnel.

      There should be no exceptions to this.
   e. Any individual undergoing an MR procedure must remove all readily removable metallic personal belongings and devices on or in them (e.g., watches; jewelry; pagers; cell phones; body piercings, if removable; contraceptive diaphragms; metallic drug delivery patches; and clothing items that may contain metallic fasteners, hooks, zippers, loose metallic components, or metallic threads; cosmetics containing metallic particles, such as eye makeup). It is therefore advisable to require that the patients or research subjects wear a site-supplied gown with no metal fasteners during the MR procedure when feasible.
   f. All patients/Non–MR Personnel with a history of a potential ferromagnetic foreign object penetration must undergo further investigation prior to being per-

mitted entrance to Zone III of the MR site. Examples of acceptable methods of screening include patient history, plain x-ray films, prior CT or MR of the questioned anatomic area, or access to written documentation as to the type of implant or foreign object that might be present. Once positive identification has been made as to the type of implant/foreign object that is within a patient, best effort assessments should be made to attempt to identify the MR compatibility or MR safety of the implant/object. Efforts at identification might include written testing on the implant prior to implantation (preferred), product labeling regarding the implant/object, peer-reviewed publications regarding MR compatibility, and MR safety testing of the make/model/type of the object, etc. MR safety testing would only be of value assuming that the object/device has not been altered since such testing had been published.

All patients who have a history of orbit trauma by a potential ferromagnetic foreign body **for which they sought medical attention** are to have their orbits cleared by either plain x-ray orbit films (two views) [8, 9] or by a radiologist's review and assessment of contiguous cut prior CT or MR images (obtained since the suspected traumatic event) if available.

g. Conscious, non-emergent patients and research and volunteer subjects are to complete written MR safety screening questionnaires prior to their introduction into Zone III regions. Family/guardians of non-responsive patients or of patients who cannot reliably provide their own medical histories are to complete a written MR safety screening questionnaire prior to their introduction into Zone III regions. These completed questionnaires are then to be reviewed orally with the patient/guardian/research subject in their entirety prior to permitting the patient/research subject to be cleared into Zone III regions.

The patient/guardian/research subject as well as the screening MR staff member must both sign the completed form. This should then become a part of the patient's medical record. No empty responses will be accepted—each question MUST be answered definitively with a "Yes" or "No" or provide specific further information as requested. A sample of a pre–MR screening form is provided (Appendixes 2–5). This is the minimum information to be obtained; more may be added if the site so desires.

h. Screening of the patient/Non–MR Personnel with, or suspected of having, an intracranial aneurysm clip should be performed as per the separate MR Safe Practice Guideline addressing this particular topic (see section K, below).

i. Screening of all unconscious/unresponsive patients and/or patients who cannot provide their own reliable histories, or when the history cannot be reliably obtained from others, regarding prior possible exposures to surgery, trauma, and/or metallic foreign object history/exposure, in whom an MR examination is deemed clinically indicated/necessary:

   1. If no reliable patient metal exposure history can be otherwise obtained and if the requested MR examination cannot reasonably wait until such a time that a reliable such history might be obtained, it is recommended that such patients be physically examined by Level Two MR Personnel. All areas of scars or deformities that might be anatomically indicative of an implant such as on the chest or spine region, etc., and whose origins are unknown and which may have been caused by ferromagnetic foreign bodies, implants, etc., should be subject to plain film radiography (if such recently obtained plain films or computer tomographic or magnetic resonance studies of such areas are not already available). The investigation described above should be made to ensure that there are no potentially harmful embedded/implanted metallic foreign objects or devices. All such patients should also undergo plain film imaging of the skull/orbits and chest to exclude metallic foreign objects (if recently obtained such radiographic and/or MR information is not already available).
   2. Monitoring of patients is sometimes necessary in the MR scanner. The potential for thermal injury from possibly excessive radiofrequency power deposition exists. Sedated, anesthetized, and/or unconscious patients may not be able to express symptoms of such injury. This potential for injury is greater on especially higher field whole-body scanners (e.g., 1 Tesla and above). Much patient monitoring information can be satisfactorily acquired via pulse oximetry and/or other means without utilization of electrocardiographic tracing and its inherent thermal injury risks. Patients who require EKG monitoring and who are, unconscious, sedated, and/or anesthetized should be examined with potential repositioning, after each imaging sequence, of the EKG leads and any other electrically conductive material with which the patient is in contact. Alternatively, cold compresses or ice packs could be placed upon all necessary electrically conductive material that touches the patient during scanning.

j. Final determination of whether or not to scan any given patient with any given implant, foreign body, etc., is to be made by the Level Two designated attending MR radiologist, or the MR Medical Director, or specifically designated Level Two MR Personnel following criteria for acceptability for MR scanning predetermined by the Medical Director.

k. All Non–MR Personnel (e.g., patients, volunteers, varied site employees and professionals, etc.) with implanted cardiac pacemakers, autodefibrillators, diaphragmatic pacemakers, and/or other electromechanically activated devices on whose function the Non–MR Personnel is dependent should be precluded from the MR magnet room/Zone IV and physically restrained from the 5-gauss line unless specifically cleared in writing by a Level Two MR Personnel–designated radiologist attending physician or the Medical Director of the MR site. In such circumstances, specific defending risk/benefit rationale should be provided in writing and signed by the authorizing radiologist.

Should it be determined that Non–MR Personnel wishing to accompany a patient into an MR scan room require their orbits to be cleared by plain film radiography, a radiologist must first discuss with the Non–MR Personnel that plain x-ray films of their orbits are required prior to permitting them access to the MR scan room. Should they still wish to proceed with access to Zone IV and/or within the 5-gauss line, and should the attending radiologist deem it medically advisable that they do so (e.g., for the care of their child about to undergo an MR study), written informed consent should be provided by these accompanying Non–MR Personnel prior to their undergoing x-ray examination of their orbits.

l. MR scanning of patients/prisoners/parolees with metallic prisoner restraining devices or radiofrequency ID/tracking bracelets could lead to theoretical potential adverse events including: 1) ferromagnetic attractive effects and resultant patient injury, 2) possible ferromagnetic attractive effects and potential damage to the device and/or its battery pack, 3) radiofrequency (RF) interference with the MR imaging study and secondary image artifact, 4) RF interference with the functionality of the device, 5) RF power deposition and heating of the bracelet tagging device or its circuitry and secondary patient injury (if the bracelet would be in the anatomic volume of the RF transmitter coil being imaged). Therefore, in cases where requested to scan a patient/prisoner/parolee wearing radiofrequency tagging bracelets and/or metallic handcuffs or anklecuffs, request that the patient be accompanied by the appropriate authorities who can and will remove the restraining device prior to the MR study and be charged with its replacement following the examination.

m. Firefighter/Police/Security safety considerations: For the safety of firefighters and other emergent services responding to an emergent call at the MR site, it is recommended that all fire alarms, cardiac arrests, or other emergent service response calls originating/located in the MR site should be forwarded simultaneously to a specifically designated individual from amongst the site's MR Personnel. This individual should, if possible, be on-site prior to the arrival of the firefighters/emergent responders to ensure that they do not have free access to Zone III or Zone IV. The site might consider assigning appropriately trained security personnel, who have been trained and designated as MR Personnel, to respond to such calls.

In any case, all MR sites should arrange to prospectively educate their local fire marshals/firefighters associations and police/security personnel about the potential hazards of responding to emergencies in the MR suite.

It should be stressed that even in the presence of a true fire (or other emergency) in Zone III and/or Zone IV, the magnetic fields may be present and fully operational. Therefore, free access to Zone III or Zone IV by firefighters and/or other Non–MR Personnel with air tanks, axes, crowbars, other firefighting equipment, guns, etc., might prove catastrophic or even lethal to those responding or others in the vicinity.

As part of the Zone III/IV restrictions, all MR sites must have clearly marked MR-compatible fire extinguishing equipment physically stored within and readily accessible to Zone III/IV regions. All Non–MR compatible fire extinguishers and other firefighting equipment should be restricted from being brought into Zone III regions.

For superconducting magnets, the helium (and the nitrogen as well, in the older magnets) is not flammable and does not pose a fire hazard directly. However, the liquid oxygen that can result from the supercooled air in the vicinity of the released gases might well increase the fire hazard in this area. If there are appropriately trained and knowledgeable MR personnel available during the emergency to ensure that emergency response personnel responding to the fire call are kept out of the MR scanner/magnet room and 5-gauss line, then quenching the magnet during response to an emergency or fire should not be a requirement.

HOWEVER, if the fire is in such a location where Zone III/IV needs to be entered for whatever reason by the firefighting and/or emergency response personnel and their firefighting and emergent equipment such as air canisters, crowbars, axes, defibrillators, etc., a decision to quench a superconducting magnet at that point should be VERY seriously considered to protect the health and lives of the emergent responding personnel in such an emergency situation. Should a quench be performed, appropriately designated MR personnel still need to ensure that ALL non–MR personnel (including and especially emergently responding personnel) continue to be restricted from Zone III/IV regions until the designated MR Personnel have personally verified that the static field is either no longer detectable or at least sufficiently attenuated so as to no longer present a potential hazard to one moving by it with, for example, large ferromagnetic objects such as oxygen tanks, axes, etc.

For resistive systems, the magnetic field of the MR scanner should be shut down as completely as possible and verified as such prior to permitting the emergency response personnel access to the magnet/Zone IV. For permanent or resistive or hybrid systems whose magnetic fields cannot be completely shut down, MR personnel should be available to warn the emergency response personnel that a very powerful magnetic field is still operational in the magnet room/Zone IV.

4. MR Personnel Screening

All MR Personnel are to undergo an MR screening process as part of their employment interview process to ensure their own safety in the MR environment. For their own protection and for the protection of the Non–MR Personnel under their supervision, all MR Personnel must immediately report to the MR Medical Director any trauma, procedure, or surgery that they experience or undergo in which a ferromagnetic metallic object/device may have become introduced within or on them. This will permit an appropriate screening to be performed upon the employee to determine the safety of permitting that MR Personnel–designated employee into the Zone III environment of the MR site.

5. Device/Object Screening

As part of the Zone III site restriction and equipment testing/clearing responsibilities, all sites should have ready access to a strong handheld magnet (≥1000-gauss). This will enable the site to test external and even some superficial internal devices or implants for the presence of grossly detectable ferromagnetic attractive forces.

a. All portable metallic or partially metallic devices that are on or external to the patient (e.g., oxygen cylinders) are to be positively identified in writing as non-ferromagnetic and either MR safe or MR compatible prior to permitting them into Zone III regions. For all device/object screening, all verification and positive identification should be in writing. Examples of such devices that need to be positively identified include fire extinguishers, oxygen tanks, aneurysm clips, etc.

b. If external devices/objects are demonstrated to be ferromagnetic and Non–MR safe/MR compatible, they may

still, under specific circumstances, be brought into Zone III regions if, for example, they are deemed by MR Personnel to be necessary and appropriate for the care of the patient. They should only be brought into Zone III regions if they are under the direct supervision of specifically designated either Level One or Level Two MR Personnel who are thoroughly familiar with the device, its function, and the reason supporting its introduction into the Zone III designated region. The safe utilization of these devices at all times while they are present in Zone III will be the responsibility of a specifically named Level One or Two MR Personnel. This device must be appropriately physically secured or restricted at all times during which it is in Zone III regions to ensure that it does not inadvertently become introduced too close to the MR scanner and accidentally become exposed to static magnetic fields/gradients that might result in its becoming either a hazardous projectile or no longer accurately functional.

c. Never assume MR compatibility or safety information about the device if it is not clearly documented in writing. All unknown external objects/devices being considered for introduction beyond Zone II regions should be tested with a strong handheld magnet (≥1000-gauss) for ferromagnetic properties prior to permitting them entry beyond Zone II regions. The results of such testing as well as the date, time, and name of tester, and methodology used for that particular device should be documented in writing. If a device has not been tested and/or its MR compatibility/safety status is unknown, it should NOT be permitted unrestricted access beyond Zone II regions.

d. All portable metallic or partially metallic objects that are to be brought into Zone IV regions (i.e., the MR magnet room itself) must be labeled with either a green "MR Safe" label or a red "Not MR Safe" label. As noted in section 5 introduction above, testing for the purpose of this labeling is to be accomplished by the site's MR personnel by exposing the metallic object to a handheld magnet (≥1000-gauss). If grossly detectable attractive forces are observed between the metallic object or any of its components and the handheld magnet, it is to be labeled with a red label. If no such forces are observed, a green label is to be affixed to the device/object prior to its introduction into Zone IV.

e. Decisions based on published MR compatibility or safety claims should recognize that all such claims apply to specifically tested static field and static gradient field strengths. For example, "MR compatible up to 3.0 Tesla at gradient strengths of 400-gauss/cm," or "MR safe tested up to 1.5 Tesla up to maximum static gradient fields experienced in an unshielded 1.5 Tesla [manufacturer name] whole body MR scanner tested 1.5 feet within the bore."

f. It should be noted that alterations performed by the site on MR safe/compatible equipment or devices may alter the MR safety and/or compatibility properties of the device. For example, tying a ferromagnetic metallic twisting binder onto a sign labeling the device as MR compatible might result in artifact induction—or worse—if introduced into the MR scanner in that altered manner.

C. MR SAFE PRACTICE GUIDELINES: MR TECHNOLOGIST

1. MR Technologists should be ARRT Registered Technologists (RT). Furthermore, all MR Technologists must be trained as Level Two MR Personnel during their orientation, prior to being permitted free access to Zone III.
2. All MR Technologists will maintain current certification in American Heart Association Basic Life Support at the Health Care Provider level.
3. Except for emergent coverage, there will be a minimum of two MR technologists or one MR Technologist and one other individual with the designation of MR Personnel in the immediate Zone II through Zone IV MR environment. For emergent coverage, the MR Technologist can scan with no other individuals in their Zone II through Zone IV MR environment as long as there is in-house ready emergent coverage by designated Department of Radiology MR Personnel (e.g., radiology house staff, radiology attendings, etc.).

D. PREGNANCY-RELATED ISSUES

1. Health care practitioner pregnancies

   Pregnant health care practitioners are permitted to work in and around the MR environment throughout all stages of their pregnancy [10]. This includes but is not limited to positioning patients, scanning, archiving, injecting contrast, entering the MR scan room in response to an emergency, etc. Although permitted to work in and around the MR environment, pregnant health care practitioners are requested not to remain within the MR scanner bore or Zone IV during actual data acquisition/scanning itself.

2. Patient pregnancies

   a. Pregnant patients can be accepted to undergo MR scans at any stage of pregnancy if, in the determination of a Level Two MR Personnel–designated attending radiologist, the risk–benefit ratio to the patient warrants that the study be performed. The radiologist should confer with the referring physician and document this in the radiology report or the patient's medical record that:
      1. The information requested from the MR study cannot be acquired via non-ionizing means (e.g., ultrasonography), and
      2. The data is needed to potentially affect the care of that patient and/or fetus DURING the pregnancy, and
      3. The referring physician does not feel that it is prudent to wait to obtain this data until after the patient is no longer pregnant.

   b. MR contrast agent(s) should NOT be routinely provided to pregnant patients. This, too, is a decision that must be made on a case-by-case basis by the covering Level Two MR Personnel–designated attending radiologist who will assess the risk–benefit ratio for that particular patient.

   c. It is recommended that pregnant patients undergoing an MR examination provide written informed consent to document that they understand the risks/benefits of the MR procedure to be performed, the alternative diagnostic options available to them (if any), and that they wish to proceed.

E. TIME VARYING GRADIENT MAGNETIC FIELD–RELATED ISSUES: INDUCED VOLTAGES

Types of patients needing extra caution: Patients with implanted or retained wires in anatomically and/or functionally sensitive areas (e.g., myocardium or epicardium, implanted electrodes in the brain) should be considered at higher risk especially from faster MR imaging sequences, such as echoplanar imaging (which may be used in such sequences as diffusion weighted imag-

ing, functional imaging, perfusion weighted imaging, MR angiographic imaging, etc.). The decision to limit the dB/dt (rate of magnetic field change) and maximum strength of the magnetic field of the gradient subsystems during imaging of such patients should be reviewed by the Level Two MR Personnel–designated attending radiologist supervising the case/patient.

F. TIME VARYING GRADIENT MAGNETIC FIELD–RELATED ISSUES: AUDITORY CONSIDERATIONS

1. All patients/volunteers should be offered and encouraged to use hearing protection prior to their undergoing any imaging in the MR scanners.
2. All patients/volunteers in whom research sequences are to be performed (i.e., MR scan sequences that have not yet been approved by the Food and Drug Administration [FDA]) are to have hearing protective devices IN PLACE prior to initiating any such research MR sequences on these patient/volunteers. Without hearing protection in place, MR imaging sequences that are not FDA approved should not be performed on patients/volunteers.

G. TIME VARYING RADIOFREQUENCY MAGNETIC FIELD–RELATED ISSUES: THERMAL

1. All unnecessary and/or unused electrically conductive materials should be removed from the MR system before the onset of imaging. It is not sufficient to merely "unplug" or disconnect unused unnecessary electrically conductive material and leave it within the MR scanner with the patient during imaging. All electrical connections such as on surface coil leads, monitoring devices, etc., must be visually checked by the scanning MR Technologist prior to each scan to ensure the integrity of the thermal and electrical insulation.
2. For electrically conductive material, wires, leads, implants, etc., that are required to remain within the bore of the MR scanner with the patient during imaging, care should be taken to ensure that no large caliber electrically conducting loops (including patient tissue; see section g, 5, below) are permitted to be formed within the MR scanner.
3. For electrically conductive material, wires, leads, implants, etc., that are required to be within the bore of the MR scanner with the patient during imaging, care should be taken to place thermal insulation (including air, pads, etc.) between the patient and the electrically conductive material during imaging, while simultaneously attempting to (as much as feasible) keep the electrical conductor from directly contacting the patient during imaging. It is also appropriate to try to position the leads/wires as far as possible from the inner walls of the MR scanner if the body coil is being used for radiofrequency transmission. When it is necessary that such electrically conductive leads directly contact the patient during imaging, consideration should be given to prophylactic application of cold compresses or ice packs to such areas.
4. Depending on specific magnet designs, care may be needed to ensure that the patient's tissue(s) do not directly come into contact with the inner bore of the MR imager during the MR imaging process. This care is especially important for several higher field MR scanners. The manufacturers of these devices provide pads and other such insulating devices for this purpose, and manufacturer guidelines should be strictly adhered to for these units.
5. It is also important to ensure that the patient's own tissues do not form large conductive loops. Therefore, care should be taken to ensure that the patient's arms/legs not be positioned in such a way as to form a large-caliber loop within the bore of the MR imager during the imaging process. For this reason, it is preferable that patients be instructed not to cross their arms or legs in the MR scanner.
6. Skin Staples/Superficial Metallic Sutures: Patients requested to undergo MR studies in whom there are skin staples or superficial metallic sutures (SMS) may be permitted to undergo the MR examination if the skin staples/SMS are not ferromagnetic and are not in the anatomic volume of RF power deposition for the study to be performed. If the nonferromagnetic skin staples/SMS are within the volume to be RF irradiated for the requested MR study several precautions are recommended, as follows:
   a. Warn the patient and make sure that they are especially aware of the possibility that they may experience warmth or even burning along the skin staple/SMS distribution. The patient should be instructed to report immediately if they experience a warmth or burning sensations during the study (and not, for example, wait until the "end of the knocking noise").
   b. It is recommended that a cold compress/ice pack be placed along the skin staples/SMS if this can be safely clinically accomplished during the MR imaging examination. This will help to serve as a heat sink for any focal power deposition that may occur, thus decreasing the likelihood of a clinically significant thermal injury/burn to adjacent tissue.
7. For patients with extensive and/or dark tattoos including tattooed eyeliner, in order to decrease the potential for radiofrequency heating of the tattooed tissue it is recommended that cold compresses or ice packs be placed onto the tattooed area(s) and kept in place throughout the MR imaging process if these tattoos are within the volume in which the body coil is being used for RF transmission. This approach is especially appropriate if fast spin-echo (or other high RF duty cycle) MR imaging sequences are anticipated to be used in the study. If another coil is being used for RF transmission, a decision must be made if high RF transmitted power is to be anticipated by the study protocol design. If so then the above precautions should be followed in that case as well. Additionally, patients with tattoos that had been placed within 48 hours prior to the pending MR examination should be advised of the potential for smearing or smudging of the edges of the freshly placed tattoo.
8. The unconscious/unresponsive patient should have any/all attached leads covered with a cold compress/ice pack at the lead attachment site for the duration of the MR study prior to the initiation of scanning.
9. Patients in whom there are long electrically conductive leads such as Swan-Ganz thermodilution cardiac output capable catheters, Foley catheters with electrically conductive leads, etc., should be considered at risk for MR studies if the body coil is to be used for RF transmission over the region of the electrically conductive lead. This is especially true for higher field systems and for imaging protocols utilizing fast spin echo or other high RF duty cycle MR imaging sequences. Each such patient should be reviewed and cleared by an attending Level Two radiologist and a risk benefit ratio assessment performed prior to permitting them access to the MR scanner.

H. CRYOGEN-RELATED ISSUES

1. For superconducting systems, in the event of a system quench it is imperative that all personnel/patients be evacuated from the MR scan room as quickly as safely feasible and the site access be immediately restricted to all individuals until the arrival of the MR equipment

service personnel. This is especially so if cryogenic gases are observed to have vented partially or completely into the scan room itself, as evidenced in part by the sudden appearance of white "clouds" or "fog" around or above the MR scanner. As noted in section B.2.m above, it is especially important to ensure that all police/fire response personnel are restricted from entering the MR scan room with their equipment (axes, air canisters, guns, etc.) until it can be confirmed that the magnetic field has been successfully dissipated, as there may still be considerable static magnetic field present despite a quench or partial quench of the magnetic field.

2. It should be pointed out that room oxygen monitoring was discussed by the MR Blue Ribbon Panel and rejected at this time because the present oxygen monitoring technology was considered by industry experts to not be sufficiently reliable to allow for continued operation during situations of power outages, etc.

I. CLAUSTROPHOBIA/ANXIETY/SEDATION–ANALGESIA/ANESTHESIA MR SAFE PRACTICE GUIDELINES

Adult and pediatric patient anxiolysis, sedation, analgesia, and anesthesia for any reason should follow established American College of Radiology (ACR) [11, 12], American Society of Anesthesiologists (ASA) [13–16], and JCAHO standards [17].

J. CONTRAST AGENT SAFETY MR SAFE PRACTICES

1. Contrast agent administration issues

   No patient is to be administered prescription MR contrast agents without orders from a duly licensed physician. Intravenous injection-qualified MR technologists may start and attend to peripheral intravenous access/lines if they have undergone the requisite site-specified training in peripheral IV access and have demonstrated and documented appropriate proficiency in this area. IV-qualified MR technologists may administer FDA-approved gadolinium-based MR contrast agents via peripheral intravenous routes as a bolus or slow or continuous injection, as directed by the orders of a duly licensed site physician.

   a. Administration of these agents is to be performed as per the ACR policy (Res.1-H, 1987, 1997):

      > The ACR approves of the injection of contrast material and diagnostic levels of radiopharmaceuticals by certified and/or licensed radiologic technologists and radiologic nurses under the direction of a radiologist or his or her physician designee who is personally and immediately available, if the practice is in compliance with institutional and state regulations. There must also be prior written approval by the medical director of the radiology department /service of such individuals; such approval process having followed established policies and procedures, and the radiologic technologists and nurses who have been so approved maintain documentation of continuing medical education related to materials injected and to the procedures being performed.

2. Prior contrast agent reaction issues [18]:
   a. Adverse events after intravenous injection of gadolinium seem to be more common in patients who had previous reactions to an MR contrast agent. In one study, 16 (21%) of 75 patients who had previous adverse reactions to MR contrast agents reacted to subsequent injections of gadolinium. Patients with asthma also seem to be more likely to have an adverse reaction to gadolinium. Patients with allergies also seemed to be at increased risk (~2.0–3.7 times, compared with patients without allergies). Patients who have had adverse reactions to iodinated contrast media are more than twice as likely to have an adverse reaction to gadolinium (6.3% of 857 patients).
   b. At present there are no well-defined policies for patients who are considered to be at increased risk for having adverse reaction to MR contrast agents; however, the following recommendations are suggested: patients who have previously reacted to one MR agent can be injected with another agent, if they are restudied, and at-risk patients can be pre-medicated with corticosteroids and, occasionally, antihistamines [18].
   c. All patients with asthma, allergic respiratory histories, prior iodinated and/or gadolinium-based contrast reactions, etc., be followed more closely as they are at a demonstrably higher risk of adverse reaction.

K. MR SAFE PRACTICE GUIDELINES REGARDING MR SCANNING OF PATIENTS IN WHOM THERE ARE/MAY BE INTRACRANIAL ANEURYSM CLIPS

1. In the event that it is unclear whether a patient does or does not have an aneurysm clip in place, plain films should be obtained. Alternatively, if available, any cranial plain films, CT or MR examination that may have already been taken in the recent past (i.e., subsequent to the suspected surgical date) should be reviewed to assess for a possible intracranial aneurysm clip.
2. In the event that a patient is identified to have an intracranial aneurysm clip in place, the magnetic resonance examination should not be performed until it can be documented that the type of aneurysm clip within that patient is MR safe/compatible. All documentation of types of implanted clips, dates, etc., MUST be in writing and signed by a licensed physician. Phone or verbal histories and histories provided by a non-physician are not acceptable. Fax copies of operative reports, physician statements, etc., are acceptable as long as a legible physician signature accompanies the requisite documentation. A written history of the clip itself having been appropriately tested for ferromagnetic properties (and description of the testing methodology used) prior to implantation by the operating surgeon is also considered acceptable if the testing follows the ASTM (American Society of Testing and Materials) established Deflection Test methodology.
3. All implanted intracranial aneurysm clips that are documented in writing to be composed of titanium (either the commercially pure and/or the titanium alloy types) can be accepted for scanning without any other testing necessary.
4. All non-titanium intracranial aneurysm clips manufactured 1995 or later for which the manufacturer's product labeling continues to claim MR compatibility may be accepted for MR scanning without further testing.
5. Clips manufactured prior to 1995 require either pre-testing (as per the ASTM Deflection Test methodology) prior to implantation or individual review of previous MR imaging of the clip/brain in that particular case, if available. By assessing the size of the artifact associated with the clip relative to the static field strength on which it was studied, the sequence type, and the MR imaging parameters selected, an opinion may be issued by one of the site's Level Two MR attending radiologists as to whether the clip(s) demonstrate significant ferromagnetic properties or not. Access to the MR scanner would then be based on that opinion.
6. HAVING SAFELY UNDERGONE A PRIOR MR EXAMINATION (WITH AN ANEURYSM CLIP—OR OTHER IM-

PLANT—IN PLACE) AT ANY GIVEN STATIC MAGNETIC FIELD STRENGTH IS NOT IN AND OF ITSELF SUFFICIENT EVIDENCE OF ITS MR SAFETY OR COMPATIBILITY, AND SHOULD NOT BE SOLELY RELIED UPON TO DETERMINE THE MR SAFETY OR COMPATIBILITY STATUS OF THAT ANEURYSM CLIP (OR OTHER IMPLANT). Variations in static magnetic field strength, static magnetic field spatial gradient, orientation of the aneurysm clip (or other implant) to the static magnetic field and/or static field gradient, rate of motion through the spatial static field gradient, etc., are all variables that are virtually impossible to control/reproduce. These variables may well have not resulted in adverse event in one circumstance but may result in significant injury or death on a subsequent exposure. Case in point: A patient who went blind from interactions between the metallic foreign body in the retina and the spatial static fields of the MR scanner entered the magnet and underwent the entire MR examination without difficulty. He only went blind on the way out of the MR scanner at the completion of the examination.

7. Barring availability of either pre-testing or prior MR imaging data of the clip in question, a risk/benefit assessment and review must be performed in each case individually. Further, for patients with intracranial clips with no available ferromagnetic and/or imaging data, should the risk/benefit ratio favor the performance of the MR study, the patient/guardian should provide written informed consent that includes death as a potential risk of the MR imaging procedure prior to permitting that patient to undergo an MR examination.

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References

1. Chaljub G, Kramer LA, Johnson RF III, Singh H, Crow WN. Projectile cylinder accidents resulting from the presence of ferromagnetic nitrous oxide or oxygen tanks in the MR suite. *AJR* **2001**; 177:27–30
2. ECRI hazard report: patient death illustrates the importance of adhering to safety precautions in magnetic resonance environments. *Health Devices* **2001**;30:311–314
3. Shellock FG, Kanal E, SMRI Safety Committee. Policies, guidelines, and recommendations for MR imaging safety and patient management. *J Magn Reson Imaging* **1991**;1:97–101
4. Kanal E, Shellock FG, SMRI Safety Committee. Policies, guidelines, and recommendations for MR imaging safety and patient management. *J Magn Reson Imaging* **1992**;2:247–248
5. Shellock FG, Kanal E, SMRI Safety Committee. Guidelines and recommendations for MR imaging safety and patient management. III. Questionnaire for screening patients before MR procedures. *J Magn Reson Imaging* **1994**;4:749–751
6. American College of Radiology. *MRI monograph: safety and sedation*. Reston, VA: American College of Radiology, **1996**
7. American College of Radiology. *American College of Radiology standard for performing and interpreting magnetic resonance imaging (MRI)*. Reston, VA: American College of Radiology, **2000**
8. Jarvik JG, Ramsey S. Radiographic screening for orbital foreign bodies prior to MR imaging: is it worth it? (editorial) *Am J Neuroradiol* **2000**;21:245–247
9. Seidenwurm DJ, McDonnell CH III, Raghaven N, Breslau J. Cost utility analysis of radiographic screening for an orbital foreign body before MR imaging. *Am J Neuroradiol* **2000**;21:426–433
10. Kanal E, Gillen J, Evans JA, Savitz DA, Shellock FG. Survey of reproductive health among female MR workers. *Radiology* **1993**;187:395–399
11. American College of Radiology. *American College of Radiology standard for adult sedation/analgesia*. Reston, VA: American College of Radiology, **2000**:res. 17
12. American College of Radiology. *American College of Radiology standard for pediatric sedation/analgesia*. Reston, VA: American College of Radiology, **1998**:res. 36
13. American Society of Anesthesiologists. *Updated practice guidelines for sedation and analgesia by non-anesthesiologists*. Park Ridge, IL: American Society of Anesthesiologists, August **2001**
14. American Society of Anesthesiologists. *Guidelines for non-operating room anesthetizing locations*. Park Ridge, IL: American Society of Anesthesiologists, **1994**
15. American Society of Anesthesiologists. *Standards for basic anesthetic monitoring*. Park Ridge, IL: American Society of Anesthesiologists, **1998**
16. American Society of Anesthesiologists. *Standards for post anesthesia care*. Park Ridge, IL: American Society of Anesthesiologists, **1994**
17. Joint Commission on Accreditation of Health Care Organizations. *Standards and intents for sedation and anesthesia care: comprehensive accreditation manual for hospitals*. Chicago: Joint Commission on Accreditation of Health Care Organizations, **2001**:report no. TX. 2-2.4.1
18. American College of Radiology Committee on Drugs and Contrast Media. *Manual on contrast media*, 4.1 ed. Reston, VA: American College of Radiology, **1998**

The reader's attention is directed to the commentary on this article, which appears on page 1349.

APPENDIX 1: Personnel and Zone Definitions

Personnel

Non–MR Personnel: Patients, visitors, or facility staff who do not meet the criteria of Level One or Level Two MR Personnel.

Level One MR Personnel:

Individuals who have passed minimal safety educational efforts to ensure their own safety as they work within Zone III regions will be referred to as Level One MR Personnel (e.g., M.R.I. department office staff, patient aides).

Level Two MR Personnel:

Individuals who have been more extensively trained and educated in the broader aspects of MR safety issues including issues related to the potential for thermal loading/burns, direct neuromuscular excitation from rapidly changing gradients, etc., will be referred to as Level Two MR Personnel (e.g., M.R.I. Technologists, Radiologists, Radiology Department nursing staff).

Zones

Zone I: This includes all areas that are freely accessible to the general public. This area is typically outside of the MR environment itself, and is the area through which patients, health care personnel, and other employees of the MR site access the MR environment.

Zone II: This area is the interface between the publicly accessible uncontrolled Zone I and the strictly controlled Zone III (see below). Typically the patients are greeted in Zone II and are not free to move throughout Zone II at will, but are rather under the supervision of MR Personnel. It is in Zone II that the answers to MR screening questions, patient histories, medical insurance questions, etc., are typically obtained.

Zone III:

This area is the region in which free access by unscreened Non–MR Personnel and/or ferromagnetic objects and equipment can result in serious injury or death as a result of interactions between the individuals/equipment and the MR scanner's particular environment. These interactions include but not limited to those with the MR scanner's static and time varying magnetic fields. All access to at least Zone III is to be strictly restricted, with access to regions within it (including Zone IV) controlled by, and entirely under the supervision of, MR Personnel.

Zone IV:

This area is synonymous with the MR scanner magnet room itself; Zone IV, by definition, will always be located within Zone III as it is the MR magnet and its associated magnetic field, which generates the existence of Zone III itself.

Non–MR Personnel should be accompanied under the immediate supervision and visual contact with one specifically identified Level Two MR Person for the entirety of their duration within Zone III or Zone IV restricted regions.

Level One and Two MR Personnel may move freely about all zones.

APPENDIX 2: Safety Screening Form for MR Procedures

Date_____ Name_(first middle last) _____
Female [ ] Male [ ] Age_____ Date of Birth_____ Height_____ Weight_____

	YES	NO
1. Why are you having this examination (medical problem)?_____		
2. Have you ever had an MRI examination before and had a problem?----------	____	____
If yes, please describe_____		
3. Have you ever had a surgical operation or procedure of any kind?----------	____	____
If YES, list all prior surgeries and approximate dates: _____		
_____		
4. Have you ever been injured by a metal object/foreign body (e.g., bullet, BB, shrapnel)?----------	____	____
If YES, please describe_____		
_____		
5. Have you ever had an injury from a metal object in your eye		
(metal slivers, metal shavings, other metal object)?----------	____	____
If YES, did you seek medical attention? ----------	____	____
Describe what was found _____		
6. Do you have a history of kidney disease, asthma, or other allergic respiratory disease?----------	____	____
7. Do you have any drug allergies?----------	____	____
If Yes, please list drugs _____		
8. Have you ever received a contrast agent/x-ray dye used for MRI, CT, or other x-ray or study?----------	____	____
9. Have you ever had an x-ray dye or magnetic resonance imaging (MRI) contrast agent allergic reaction?----------	____	____
If YES, please describe_____		
_____		
10. Are you pregnant or suspect you may be pregnant?----------	____	____
11. Are you breast feeding?----------	____	____
12. Date of last menstrual period_____ Post-menopausal?----------	____	____

APPENDIX 3: MR Hazard Checklist

THE FOLLOWING ITEMS MAY BE HARMFUL TO YOU DURING YOUR MR SCAN OR MAY INTERFERE WITH THE MR EXAMINATION.

Please mark on the drawings provided the location of any metal inside your body or site of surgical operation.

You must provide a Yes or No for every item. Please indicate if you have or have had any of the following:

YES NO

____ ____ Any type of electronic, mechanical, or magnetic implant. (Type_____)
____ ____ Cardiac pacemaker
____ ____ Aneurysm clip(s)
____ ____ Implanted cardiac defibrillator
____ ____ Neurostimulator
____ ____ Biostimulator (Type _____)
____ ____ Any type of internal electrode(s) or wire(s)
____ ____ Cochlear implant
____ ____ Hearing aid
____ ____ Implanted drug pump (e.g., insulin, Baclofen, chemotherapy, pain medicine)
____ ____ Halo vest
____ ____ Spinal fixation device
____ ____ Spinal fusion procedure
____ ____ Any type of coil, filter, or stent (Type_____)
____ ____ Any type of metal object (e.g., shrapnel, bullet, BB)
____ ____ Artificial heart valve
____ ____ Any type of ear implant
____ ____ Penile implant
____ ____ Artificial eye
____ ____ Eyelid spring
____ ____ Any type of implant held in place by a magnet (Type_____)
____ ____ Any type of surgical clip or staple
____ ____ Any I.V. access port (e.g., Broviac, Port-a-Cath, Hickman, Picc line)
____ ____ Medication patch (e.g., Nitroglycerine, nicotine)
____ ____ Shunt
____ ____ Artificial limb or joint (What and where_____)
____ ____ Tissue expander (e.g., breast)
____ ____ Removable dentures, false teeth or partial plate
____ ____ Diaphragm, IUD, Pessary (Type_____)
____ ____ Surgical mesh (Location_____)
____ ____ Body piercing (Location_____)
____ ____ Wig, hair implants
____ ____ Tattoos or tattooed eyeliner
____ ____ Radiation seeds (e.g., cancer treatment)
____ ____ Any implanted items (e.g., pins, rods, screws, nails, plates, wires)
____ ____ Any hair accessories (e.g., bobby pins, barrettes, clips)
____ ____ Jewelry
____ ____ Any other type of implanted item (Type_____)

I attest that the above information is correct to the best of my knowledge. I have read and understand the entire contents of this form and I have had the opportunity to ask questions regarding the information on this form.

Patient signature_____
MD/RN/RT signature_____ Date_____
Print name of MD, RN, RT_____

APPENDIX 4: Instructions for the Patients

1. You are urged to use the ear plugs or headphones that we supply for use during your MRI examination since some patients may find the noise levels unacceptable and the noise levels may affect your hearing.
2. Remove all jewelry (e.g., necklaces, pins, rings).
3. Remove all hair pins, bobby pins, barrettes, clips, etc.
4. Remove all dentures, false teeth, partial dental plates.
5. Remove hearing aids.
6. Remove eyeglasses.
7. Remove your watch, pager, cell phone, credit and bank cards, and all other cards with a magnetic strip.
8. Remove body piercing objects.
9. Use gown, if provided, or remove all clothing with metal fasteners, zippers.

APPENDIX 5: Hazard Checklist for MRI Personnel

For MRI Office Use Only
Patient Name_____
Patient ID Number_____ Referring Physician_____
Procedure_____ Diagnosis_____
Clinical History_____

Hazard Checklist for MRI Personnel

YES	NO	
____	____	Endotracheal tube
____	____	Swan-Ganz catheter
____	____	Extraventricular device
____	____	Arterial line transducer
____	____	Foley catheter with temperature sensor and/or metal clamp
____	____	Rectal probe
____	____	Esophageal probe
____	____	Tracheotomy tube
____	____	Guidewires

X-RAY VISION

A LOOK INSIDE MEDICAL IMAGING AND RADIATION THERAPY

Radiologic Technologist

ra·di·o·log·ic tech·nol·o·gist (rā'dē-ō-loj'ik tek-nol'ŏ-jist)
the medical personnel who perform diagnostic imaging examinations and administer radiation therapy treatments

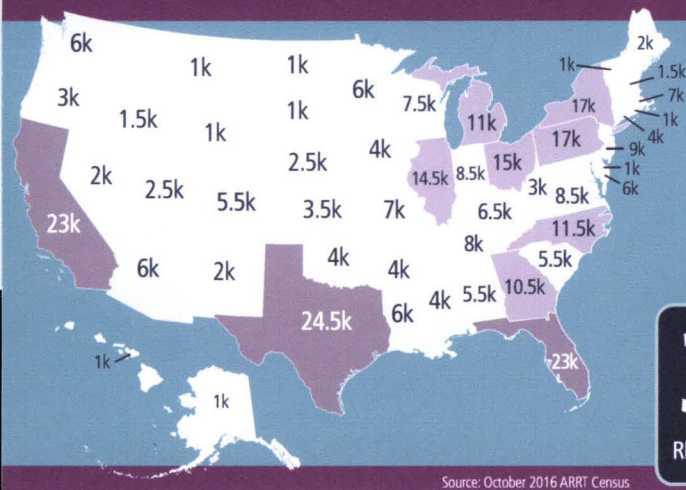
EDUCATION

2 YEARS
Combination Certificate/Associate Degree Program

4 YEARS
Bachelor's Degree Program

PASS National Certification Exam

+ EARN 24 CONTINUING EDUCATION CREDITS EVERY 2 YEARS



WHO'S TAKING MY X-RAY?

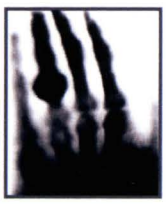
When you're scheduled for a medical imaging examination or radiation therapy treatment, the person who performs your exam or delivers your treatment is called a radiologic technologist. Registered radiologic technologists, R.T.s, are educated in anatomy, patient positioning, examination techniques, equipment protocols, radiation safety, radiation protection and patient care.

332,755
REGISTERED RADIOLOGIC TECHNOLOGISTS

Source: October 2016 ARRT Census

1900 1950 2000

1895
The x-ray was discovered by German physicist Wilhelm Conrad Roentgen on Nov. 8.



FIRST X-RAY IMAGE
X-ray of Roentgen's wife's hand and wedding ring.

1977
FIRST MR SCAN

1971
FIRST CT SCAN

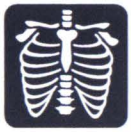
ANNUALLY

78.7M CT procedures

37.8M MR procedures

14.5M Nuclear medicine scans

1.2M Radiation therapy treatments initiated



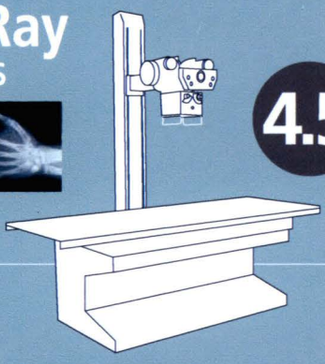
159.7M x-ray procedures performed in the United States.

Source: Statistics obtained from IMV 2013 and 2015 reports

EQUIPMENT

● = avg # of units per facility

X-Ray units

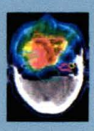


4.5

CT scanners

2

Radiation Therapy treatment units

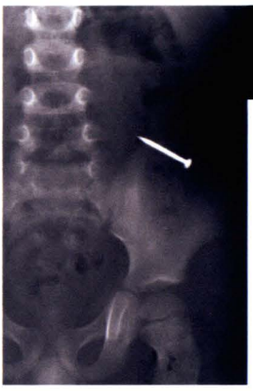


2

Source: ASRT Radiation Therapy Staffing and Workplace Survey 2016 and ASRT Radiologic Sciences Staffing and Workplace Survey 2015

Radiologist Assistant

Radiologist assistants are experienced R.T.s who have obtained additional education and certification that qualifies them to serve as radiologist extenders. They work under the supervision of a radiologist to help improve productivity and efficiency.



Strange Appearances...

Foreign bodies are frequently encountered in medical imaging and can range from intentionally placed objects, such as medical devices and surgical hardware, to debris from accidents and injuries and a wide variety of swallowed items.

TECHNOLOGY

(R) Radiography
(X-ray) Produces images of anatomy to detect bone fractures, find foreign objects and show the relationship between bone and soft tissue.

Computed Tomography
(CT scan) Obtains "slices" of anatomy at different levels of the body so physicians can view what's happening inside organs.

(T) Radiation Therapy
Administration of targeted doses of radiation to the patient's body to treat cancer or other diseases.

(N) Nuclear Medicine
Radiopharmaceuticals in body emit gamma rays that provide functional information about organs, tissues and bone.

(CI) Cardiac-Interventional Radiography
Fluoroscopic procedures specifically targeted for diagnosis and treatment of cardiac diseases.

(VI) Vascular-Interventional Radiography
Fluoroscopic procedures specifically targeted for catheter placement and the diagnosis and treatment of vascular diseases.

(M) Mammography
Produces images of breast tissue to diagnose and rule out breast disease.

(MR) Magnetic Resonance
(MRI) Creates detailed images of anatomy by exposing atoms in the patient's body to a strong magnetic field.

(QM) Quality Management
Monitors the quality of processes and systems in the radiology department.

(S) Sonography
(Ultrasound) Uses sound waves to obtain images of organs and tissues in the body.

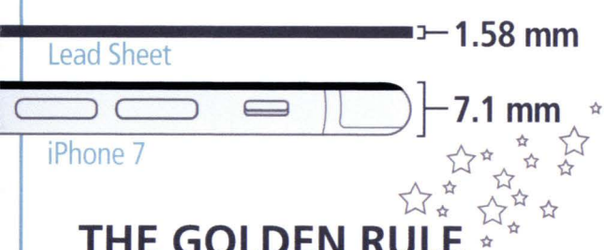
(BD) Bone Densitometry
Measures bone mineral density to diagnose and rule out osteoporosis.

(CMD) Medical Dosimetry
Radiation dose is calculated and generated for distribution treatment plans, determined by the patient's oncologist.

207.2
Pb
82 lead

A LITTLE LEAD GOES A LONG WAY...

On average, x-ray room walls have lead lining that is 1/16 inch-thick. That's 4.5 times thinner than the new iPhone 7. The lead-plate walls stop radiation in its tracks.



DOSIMETRY BADGE

Contains storage phosphors that are sensitive to ionizing radiation and are used for monitoring radiation exposure to R.T.s.

THE GOLDEN RULE

ALARA

As Low As Reasonably Achievable

The practice to make every reasonable effort to minimize patient and personal radiation exposure by adjusting time, distance and shielding during a procedure.

The ASRT is the largest radiologic science association in the world. Its mission is to advance and elevate the medical imaging and radiation therapy profession and to enhance the quality and safety of patient care.

asrt
American Society of Radiologic Technologists
www.asrt.org