Patient Education in Nuclear Medicine Technology Practice

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Objective: This is the second article of a two-part series on patient education. This article builds on the first one by discussing some of the unique considerations in providing patient education in the nuclear medicine department. Concrete strategies for nuclear medicine technology practice are discussed here. After reading this article, the technologist should be able to: (a) describe the affective and technical aspects of the nuclear medicine technologist's role as a patient educator; (b) identify some strategies that nuclear medicine technologists can use to become better teachers; and (c) describe factors that affect patient learning in the nuclear medicine department and some approaches to overcome or minimize learning barriers.

Key Words: patient education; professional practice; radiation risk; risk perception

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Patient education has gained increasing importance over the last few years. Requirements have been incorporated into JCAHO standards and NRC regulations (*1*,*2*). The Patient's Bill of Rights and some professional codes of ethics acknowledge the relevance of patient education as part of overall patient care (*3*,*4*). Moreover, today's patients are better educated and better informed or desire to be better informed. Medical information is readily available on the Internet and in popular magazines. Certain prescription medications are marketed to consumers on television and in magazines as well. Consumers are urged to discuss this procedure or that medication with their doctors.

All of these factors have created an environment in which patients may expect more from health care professionals, particularly in the area of providing information. From a health care deliverer's point of view, a better informed patient may be a more cooperative and compliant patient.

The previous article in this series begins with the statement: ''Patient education is well accepted as an essential component of clinical practice for health care professionals who work with patients'' (*5*). Certainly nuclear medicine technologists (NMTs) would not deny that much of their communication with patients involves informing patients about the requirements of a procedure. Patient education, however, goes beyond merely telling patients what they may eat or what positions they must assume for particular procedures. In this article a more comprehensive view of patient education in nuclear medicine will be explored, one that addresses both the affective and technical dimensions of the technologist's role.

THE TECHNOLOGIST AS TEACHER

If technologists were asked to describe their role as patient educators, many might claim that patient education is not really a part of their responsibilities, rather their role is ''to do the nuclear medicine tests.'' But if NMTs view patient education as assisting patients to complete tasks or to fulfill roles to the patient's perceived satisfaction (*6*), then technologists are indeed patient educators. A health care professional who provides patients with the means to reach a goal by listening, giving information, using a technical skill to help, and respecting the patient's autonomy is engaged in patient-centered education (*6*).

Why might NMTs not consider themselves to be teachers? First, technologists have the dual responsibilities of serving as the patient's advocate while at the same time providing the physician with necessary clinical data. While these two obligations may appear on the surface to mesh, in certain instances they are in conflict with one another. An example of this type of conflict occurs when a patient refuses a particular examination, but the physician finds this decision unacceptable. The technologist may be placed in the middle of this conflict, wanting to respect the patient's autonomy to decide on his care, while understanding the relevance of the information to the physician and the patient's treatment plan. To avoid conflict with the physician, the NMT may be reluctant to provide information to the patient that could strengthen the patient's decision to forego the procedure. Unfortunately, the technologist's reticence also may withhold information that could persuade the patient to consent to the procedure.

Time constraints are another reason that patient education may not receive the necessary emphasis from NMTs. Productiv-

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ity, measured in the number of examinations performed in a day, makes the practice of nuclear medicine technology rather task oriented. That is, completion of the work (product) becomes more important than the way in which the work is accomplished (process). When time is limited and the work load is high, technologists set priorities that may emphasize the more visible aspects of their role, such as number of studies produced, while downplaying other less noticeable, though no less important, facets such as patient education.

Third, while successful completion of a large work load requires a task-oriented approach to some extent, it also may heighten the technologist's need to control situations in which the technologist should perhaps be a facilitator rather than a decision maker. Situations in which the patient asks difficult questions or appears to be uncooperative can generate feelings of anxiety in the technologist. If the technologist is fearful that productivity will suffer and reflect on performance, the need to control such situations may become a coping mechanism that prevails over the patient's need for information or recognition of the patient's feelings.

Fourth, technologists may perceive that they are not well prepared with certain technical knowledge or with the ability to deal with the emotional involvement that comes from addressing patients' concerns that go beyond the technical completion of an examination.

What makes NMTs the most likely choice as patient educators in the nuclear medicine department? First and foremost, NMTs are the most knowledgeable about the procedures. Patients are typically concerned with ''what will happen to me'' and ''how will I feel'' during the test. Clark suggests giving patients ''concrete objective information messages'' to prepare them for a health care procedure (*7*). Such messages are intended to minimize patients' distress by diminishing the differences between patients' expectations and their actual experiences. The messages include descriptions of the steps in the procedure, the sensations a patient may experience and why they occur, the setting where the procedure will be performed, and how long the procedure will take.

Many technologists already may be using this technique as it includes many of the technical specifics that are conveyed to patients. Information about sensations that may be experienced can be collected by asking a few questions at the completion of any examination. Technologists may then use these descriptions with future patients. For example, a technologist may tell a patient that ''other patients have said that persantine leaves a faint metallic taste in the mouth.'' Thus, a patient will be prepared for that sensation and not become worried that it signals something of concern.

Second, technologists have the opportunity. They can address patients' concerns or misinformation on the spot when the patient expresses them. These are referred to in education as ''teachable moments.'' For example, a patient arrives in the nuclear medicine department and laughingly asks, ''Nuclear medicine? Is this where they blow you up?'' While the remark may be construed as the use of humor to defuse anxiety about an upcoming event, it also reflects the general public's lack of information about nuclear medicine and the beneficial uses of radioactivity. An astute technologist can use this opportunity to explain nuclear medicine, how it is different from nuclear weapons, and how it will benefit this particular patient, thus educating the patient, establishing a rapport with him, and perhaps alleviating his anxiety somewhat.

Finally, caring is a primary role of the professional nuclear medicine technologist (*8*,*9*). As part of that role, technologists are in a unique position to encourage and empower their patients by acting as an enabler, someone who ''[facilitates another's] passage through life transitions and unfamiliar events'' (*10*). Patients are often referred to nuclear medicine as part of the diagnostic process to rule out a serious disease or after having been diagnosed with a life-altering condition. Encouraging patients, listening to their concerns, and allowing them to participate in their care may help them feel less like victims.

For example, how does an NMT function as an enabler for a woman newly diagnosed with breast cancer who is referred to nuclear medicine for bone imaging? This patient will need information about nuclear medicine and the bone imaging procedure. She also should know that bone imaging is a commonly performed test in breast cancer patients before and after therapy, so she may visit nuclear medicine more than once. Since this patient is new to the health care environment, she probably is trying to learn and organize a great deal of information about her disease and an array of diagnostic tests in a short period of time. She needs encouragement to help cope with this dramatic change in her life as well as acknowledgment of her anxiety about test results and the course of her disease.

The technologist may be able to answer certain questions the patient has about other tests. For instance, ''Shouldn't I be having bone x-rays instead of a nuclear medicine scan?'' If the NMT cannot or should not answer a particular question, the technologist can suggest the appropriate person to ask and explain why that person is a better source of certain information. The patient may ask the technologist for the results of her imaging test. An ''I just do'em, I don't read'em'' response ignores the patient's anxiety about the test outcome and presents the technologist as an uncaring, button pushing collector of data. A professional NMT may respond to the obvious concern that underlies this question, acknowledging the patient's anxiety and explaining when the results will be available, and that the patient's physician can best address what the results mean in terms of her treatment. At such an early stage, it will be important to distract the patient from dwelling on morbid outcomes without giving false reassurance that everything will be all right.

Patiently answering questions in a way that suggests the NMT is not giving pat or routine answers to difficult questions demonstrates that the NMT views the patient as an individual, respects her right to know, and is not attempting to hide some unpleasant news. The interaction is patient-centered and encourages the patient to be an active participant in her care. Thus, the NMT has assisted this patient in achieving the goals of enabling: understanding new information, negotiating transition or change, and participating in one's own health care (*6*).

What are some strategies that NMTs can use to become better teachers? Relationships with patients begin when technologists introduce themselves. The tone of those relationships is set within the first few minutes of this interaction. Nurses commonly refer to themselves as registered nurses when asked their profession or when introducing themselves to patients. Perhaps NMTs should adopt a similar approach and state that they are certified technologists. While this statement by itself is insufficient to gain patients' trust and establish rapport, it does indicate that the individuals have had some preparation leading to a credential that qualifies them to function as NMTs. It also may serve as a reminder to technologists that, as professionals, their role includes two equally important aspects—the technical and the affective.

Katz provides some suggestions for becoming a more effective teacher, as summarized in Table 1 (*11*). To get a patient's attention, technologists should state the purpose of the information they are about to convey. An important principle of adult education is that adults learn best when the information is relevant to their immediate situation (*12*). Therefore, giving information that the patient not only needs to know but also wants to know makes for patient-centered and patient-driven education. Obviously, there are details that the patient must hear, but technologists also should make an effort to discern patients' concerns as well. These concerns may or may not be directly related to the completion of an examination, however, that does not make them any less important to the patient.

NMTs can get and hold their patients' attention by varying their tone of voice and acting interested in what is being conveyed. An unfortunate habit that NMTs fall into is reciting information in a rote, monotone fashion. Although technologists may have explained and performed a procedure hundreds of times, it is important to remember that no procedure is ever routine to a patient. Using a conversational tone may encourage patients to participate as if they were in a more ordinary type of discussion. The payoff for technologists is that this exchange also may enhance their work experience by adding a new dimension to even the most routine procedures.

Patients have much to learn, absorb, and think about at a time when they are very ill or have recently received unwelcome news about their condition. Since the average adult can manage to think about only five to seven points at one time (*11*), explanations need to be short, simple, and specific. The most important elements—what the patient really needs to know—should be presented first because these points are more likely to be remembered. Everyday language, not medical jargon, should be used. If a medical term must be used, explain what it means because patients will be too embarrassed or overwhelmed to ask. For instance, the description ''radioactive drug'' may be more understandable than the term ''radiopharmaceutical.''

Since time is a rationed commodity for many technologists, making the most of it becomes part of the art of practicing nuclear medicine technology. Patient education can occur during a procedure if technologists continue the communication process that they began when first meeting the patient. This spreads out the delivery of information over a longer period of time and may give opportunities to present information at the time when it is most relevant to what is occurring in the procedure.

Most patients are anxious to cooperate with technologists since test outcomes affect their care. This offers another opportunity for technologists to focus the nuclear medicine experience on the patient rather than on the needs of the technologist. Everyone appreciates feedback to gauge their progress and to ascertain that their actions are helpful to the process. Throughout an examination, NMTs should offer encouragement that patients are following directions correctly and that their cooperation is making the technologist's job easier. At the end of the examination, thanking patients for their cooperation again emphasizes that the patient is at the center of a process that technologists facilitate rather than control.

Since the information or instructions given to patients in nuclear medicine can be unfamiliar or overwhelming, technologists need to review what is required. During the review, technologists should attempt to draw out patients about aspects that they may not understand by asking open-ended questions. Asking a patient, ''Do you understand the instructions?'' is most likely to elicit a positive response, which may reassure the technologist without truly determining the patient's confusion or uncertainty. A better question might be ''What questions do you have?'' indicating that asking a question for clarification is accepted and expected. Technologists also can ask patients to restate instructions, although patients should not be made to feel that they are being quizzed.

Technologists should be mindful of barriers to learning that may be present and attempt to work around or overcome them. Common barriers are described in the first article of this patient education series (*5*) and will be discussed in the next section about the patient as learner.

As in any relationship, some assessment during the course of interaction needs to occur. All of the strategies discussed above may not work with all patients or in all situations. Technologists should look for clues, such as a patient's body language, attention span, or degree of participation and interest, that may direct technologists to seek other communication and instructional methods (*13*).

TABLE 1
Recommendations for Effective Patient Teaching

Get the patient's attention.
Keep explanations short, simple, and specific.
Use allotted time effectively.
Verbally reward and reinforce the patient.
Review important information.
Test the patient's understanding.
Recognize and manage barriers to learning.

THE PATIENT AS LEARNER

For learning to take place, the individual must be open to receiving and processing information. Readiness to learn may be affected by a variety of factors. Wesson looked at stressors that patients experience when they are admitted to an intensive care unit (*14*). In many ways, patients coming to the nuclear medicine department experience anxiety for similar reasons: an uncertain diagnosis; an unfamiliar and/or intimidating environment; invasive procedures; the inability to communicate effectively or control events; and unmet needs for information and/or emotional support. Therefore, coming to the nuclear medicine department may be an anxiety-producing event for many people that affects their ability to learn about what is to take place and how they will participate in the process.

Davidhizar and Dowd (*15*) also noted a ''diagnostic divide'' which they described as the period of time when the patient does not know the outcome of tests. This period may be among the most stressful for patients. As research in the area of grief and of death and dying has shown (*16*), not knowing whether one is dying may be more stressful than receiving a diagnosis of terminal illness.

Anxiety affects individuals differently and can manifest itself in a variety of ways. One example of how anxiety is revealed in patients' learning readiness is how they express their need to know about the nuclear medicine examination. At one extreme, patients may state that they ''do not need to know the details, just do what you need to do.'' While this statement may be a reflection of the confidence patients have in their doctors and other hospital staff, it also may be a way to avoid dealing with the realities of their condition. It also may affect a patient's ability to give informed consent if the patient lacks certain essential information about a procedure. If patient cooperation is essential, as in the case of an exercise myocardial perfusion study, these patients may not grasp the necessity of their actively contributing to the examination process. Attempting to draw these patients out with open-ended questions or observations may be helpful in securing their full participation.

At the other extreme, patients may express anxiety by demanding to know even the smallest technical details or by requesting repeated reassurances about certain aspects of the examination. These patients should receive honest, focused responses to their questions.

Learning styles are another factor affecting the delivery of patient education. Just as individuals express their anxiety in different ways, people also learn in different ways. For example, some people may learn best by hearing a short talk, reading printed material, or by actually performing a skill. This is why a variety of teaching methods may be useful. One method may match the learning style while the other methods reinforce the material to be learned.

In nuclear medicine a lung ventilation study is a complicated procedure requiring significant patient participation. Typically technologists explain the procedure while showing the equipment to the patient. However, one study showed that the amount of area contamination resulting from an aerosol lung ventilation decreased when the patients were permitted to practice the breathing technique before aerosol administration (*17*). Thus, reinforcing the spoken word with a dress rehearsal resulted in a safer study for both the patient and the technologist.

This same study also demonstrated the importance of reiterating key information. During the aerosol administration, patients were coached by the technologist about the breathing technique they had practiced. This type of reinforcement resulted in significantly less surface and air contamination than when patients were not coached (*17*).

Can reinforcement have a negative effect on patient compliance? An apocryphal sounding, but true, story involves a man who was counseled repeatedly to collect ''every possible drop of urine'' for 24 h as part of a Schilling test. When the man returned the next day, he brought several additional containers other than what he had been given. To comply with the request for ''every possible drop of urine,'' he enlisted the aid of family and friends to supply what had been requested. Unfortunately, the donations had been pooled and the study had to be repeated. Perhaps the moral to this story is that technologists should be careful what they ask for. In this instance, the technologist reinforced what was important to the success of the test, but failed to assess the patient's level of general understanding and the interpretation of the instructions.

At different stages of life, patients have unique age-related physical, motor, sensory, cognitive, and psychosocial characteristics. These characteristics affect the way a patient learns and his need for certain information as well as his ability to understand. The JCAHO standards require age-specific care for patients, which includes patient and family education (*1*). While a detailed discussion of how learning occurs at various ages is beyond the scope of this article, a few examples may illustrate some key points (*18*).

For infants and toddlers, technologists will need to explain the procedure to the parents. While toddlers and younger children can understand simple directions, they have short attention spans and function in the present. Therefore, a review of the entire procedure before it occurs is best discussed with the parents. The patient should be given one direction at a time as the study progresses. As children approach adolescence, they should receive more detailed explanations and be involved in any pre- or postprocedure instructions. It is sometimes assumed that elderly patients cannot understand the details of an examination. This false assumption may stem from an observed decline in certain motor, sensory and cognitive functions. Deficits in these functions may make it more difficult or time consuming for technologists to communicate with patients. Nevertheless, while slower mental functions result in slower learning, the elderly are able to absorb new information given additional time. If a family member is present, it may be reassuring to the patient (and to the technologist) if that person is included in the discussion.

Table 2 identifies barriers to learning that frequently arise in the health care setting. These have been discussed in some depth in the first article of this series and in other sections of this article. Several will be addressed here again.

TABLE 2
Barriers to Learning

Physical impairments (e.g., hearing loss, pain, visual acuity)
Emotional state
Language
Cultural differences
Literacy
Numeracy
Environment

Literacy is an important life skill. When individuals are confronted with making crucial decisions that affect their lifestyle and, perhaps, their life span, as in the case of health care decisions, their reading level affects their ability to obtain the information that may affect those decisions. Consent forms, instructions for medical examinations and medications, and insurance forms are just a few examples of the written materials that patients receive. While the average American adult reads at the eighth or ninth grade level, one of five adults reads at only the fifth grade level or below (*11*). Some individuals may be only functionally literate, that is their reading skills are adequate to perform in a particular setting, such as shopping for groceries, but are inadequate to comprehend the written procedures for a medical examination.

What implications does this information hold for designing and using written materials for patient education? Technologists may be asked to develop or review printed materials for use in the nuclear medicine department. Some criteria for assessing written patient education materials are outlined in the subsequent discussion (*19*). Content is typically the first concern in developing material for patient use. The content should include what is important for the patient to know from the patient's perspective, that is, make the material patient-centered. Too much detail may be confusing or frightening.

Answers to the following pertinent questions should be included: Why is the test being done? What is it for? How is it done? What will it tell me/my doctor? Will there be any pain or side effects? and How long will the test take? One suggestion is to interview patients and ask them about their perceptions so these may be incorporated into the material. ''What is the one thing that you wish you had known about this test?'' may produce key points that need to be included.

Dividing the material into short sections that are organized in a logical sequence will help make the material more manageable to the reader. It may be most appropriate to discuss the information in the actual sequence that the procedure is performed. As alternatives, the most important information may be presented first or more general information followed by more specific information. Short sentences of 10 to 12 words using the second person ''you'' to personalize the information produces a conversational style.

The reading level for patient education materials should be at the sixth to eighth grade level, the same level as newspapers and magazines, unless the target audience is known to have a different reading ability. There are a variety of formulas to evaluate the reading level of a document (*20–22*). Some computer word processing programs have a feature that can assess a document's reading level. It is best to use simple, everyday words and avoid medical terms unless they are absolutely necessary. For example, stating that an IV or intravenous line will be started as part of a stress test may not be as meaningful as saying that a needle will be placed in the patient's arm.

Depending on population demographics, it may be appropriate to offer educational materials in other languages. Even though individuals may speak English fluently as a second language, their reading abilities may be inadequate to understand written materials. Likewise, patients who function well on a day-to-day basis in English may better understand discussions of their health care in their native language.

The old adage that a picture is worth a thousand words may not always hold true when using illustrations or photographs in patient education materials. On one hand, graphics can add interest, highlight important points, and help poorer readers understand the material. On the other hand, the ability to understand pictures is related to whether the viewer has experience with photos and illustrations as well as some reference point for what is being depicted. Someone who is unfamiliar with internal human anatomy and has never seen such a photograph or illustration may not be able to understand a nuclear medicine image. Even individuals with some anatomical knowledge require an orientation to the image as it looks different from the actual organs. Once a document has been produced, pilot testing it with a small, representative group of patients can help evaluate the suitability of the piece as an educational resource for patients.

Other design considerations that affect readability include print size, type of paper, paper and ink color combinations, and spacing. The print size should be large enough for individuals with some visual acuity impairment. Glossy paper tends to produce glare that can affect readability in some types of light. Black ink on light colored paper offers the best contrast. Spacing should be great enough to provide definite separation between letters and lines of type. Readability is improved if the text is broken up into smaller blocks of information with space separating one segment of information from the next.

The JCAHO standards for patient and family education have prompted the publication of a myriad of patient education materials. For several reasons, however, written materials and videos are best used as supplements to instruction from and discussion with a health care professional. In nuclear medicine, a technologist's time with patients is relatively brief. Direct patient contact gives NMTs an opportunity to establish a rapport with their patients. During this time technologists can address the questions and concerns of the patients that may not be explored in written material. Perhaps a patient has a unique situation that requires some adjustment in the examination preparation or procedure. Technologists also can use this time to establish their role as a facilitator and assess other patient needs that cannot be supplied with written educational materials.

WHAT TO TELL THE PATIENT

The term ''patient education'' most often brings to mind extended interaction between a health care professional and a patient to teach the patient about a chronic condition that requires lifestyle changes. Cardiac rehabilitation after coronary artery bypass surgery or dietary counseling for diabetes are two examples. Nuclear medicine technologists, however, most often have only single, brief encounters with their patients during which they must establish rapport to gain the patient's trust, perform the examination, and provide patient education. These encounters can be divided into three segments: preprocedure preparation, performing the examination, and postprocedure instructions. Table 3 summarizes the information that technolo-

TABLE 3
Patient–Technologist Interactions

Stage in the examination process	Routinely conveyed information	Patient education opportunities
Preprocedure	Exam preparation instructions (dietary restrictions, medications to be discontinued or started, etc.)	Explain nuclear medicine
		Radiation risk/benefits of the procedure
	Steps in the procedure	Safe use of radiation
	Time commitment	Other risks
	Sensations	Qualifications of NMT
		Other based on patient's questions*
During the procedure	Exam requirements (positions, time)	Explain equipment
	Sensations	Explain NMT's activities necessary to complete test, but unfamiliar to patient
		Inform patient about exam's progress and his role in its successful completion
Postprocedure	Resume normal diet and medications	Direct patient to appropriate source of information*
	Availability of results	

*These patient education opportunities may occur at any time during an examination.

gists typically convey to patients and the opportunities for patient education during the three stages of an encounter.

Explaining routine procedural requirements and how the examination will be performed is a straightforward task for technologists. Other topics, however, may cause technologists uneasiness or frustration. Radiation risk is one of the most difficult subjects to discuss with patients. There is no one correct or best way to describe radiation risk. Moreover, it is difficult to express radiation risk in terms that the average person understands. Much of what patients may have learned about radiation in the media or elsewhere is in a negative context. Furthermore, many people tend to categorize activities as either ''risky'' or ''safe.'' Hence, patients may assume automatically that a medical examination using radiation is unsafe without considering the benefits that offset the small amount of risk.

Two approaches that may be useful in describing radiation risks to patients are risk comparisons and the risk-benefit continuum (*23*). Risk comparisons contrast two or more activities in relation to possible consequences. For example, a familiar activity known to have risk associated with it, such as driving on a freeway, is compared to a less familiar activity, such as exposure to radiation. The risk of 1 rad (0.01 Gy) of radiation is equivalent to driving 220 miles on a freeway. This means that an equal number of people are thought to die from cancer due to exposure to that amount of radiation as those driving 220 miles on a freeway (*24*). A weakness in such comparisons is that there are other variables that affect the amount of risk. In this instance, weather conditions, the driver's health, and the type of automobile also affect the amount of risk associated with driving on a freeway. When comparing radiation exposures, the type of radiation used as well as other variables must be considered. Table 4 lists some risk comparisons based on reduced life expectancy as a consequence of an activity (*25*).

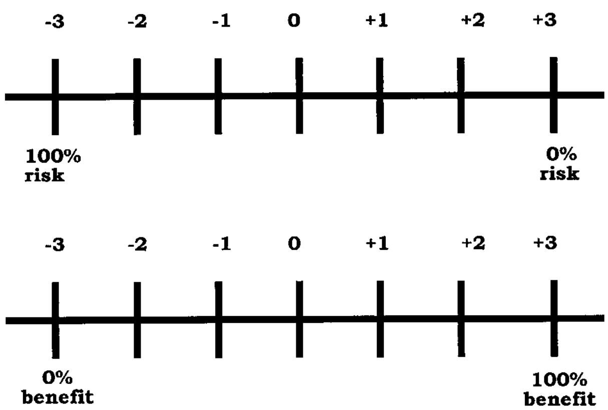
The risk-benefit continuum (Fig. 1) is a way to demonstrate the strength or weakness of the value of an activity in question (*26*). Having an examination that uses ionizing radiation is one example of such an activity. The conservative assumption is that there is no ''risk-free'' level of radiation. However, the risk or probability that an individual will develop a radiation-induced effect as a result of low-level radiation exposure is very small. Nevertheless, radiation is not used for diagnostic or therapeutic purposes unless the patient receives some medical benefit from its application. The question then becomes ''How much benefit will the patient derive from the examination?''

TABLE 4
Reduced Life Expectancy Associated with Risk

	Reduced life expectancy
Familiar risks	
Smoking a cigarette	10 min
Construction employment from age 20 y	94 days
Home accidents	95 days
Coal mining from age 20 y	155 days
Overweight by 20%	2.7 y
Ionizing radiation risks	
1 mrad radiation	1.5 min
1 rem occupational exposure	1 day
Medical radiographs (U.S. average)	6 days
Radiation work at 500 mrem/y from age 20 y	7 days
Radiation work at 5 rem/y from age 20 y	68 days

mrem = 0.001 rem; mrad = 0.001 rad; rem = roentgen equivalent man (equivalent of 1 rad × relative biological effectiveness).

Table reprinted from reference *25* with permission of the author.



Total	
-6	Patient should not undergo examination
-3	Patient and physician may decide that patient should not undergo examination because of high risk-benefit ratio
0	Difficult decision for patient and physician; risk and benefit equal
+3	Good risk-benefit ratio: patient probably should undergo examination
+6	Patient should undergo examination

FIGURE 1. Risk-benefit continuum. (Figure reprinted from reference *26* with permission of the author.)

Using the risk-benefit continuum, an examination is evaluated on the two dimensions of risk and benefit, using a scale ranging from −3 (100% risk) to +3 (0% risk) and −3 (0% benefit) to +3 (100% benefit). The value for each dimension is derived separately and then added together to arrive at a decision about whether the patient should undergo the procedure.

At the extreme end of the continuum is the case of a patient who is likely to die if an examination using radiation is not performed. The examination can be assigned a +3 in terms of risk because without it the patient will die In this case, the potential risk of cancer induction in the future is minimal given that the patient's illness is terminal. If the examination will, with an almost 100% probability, find a curable cause of the disease, the examination is assigned a +3 in terms of benefit. The total of +6 indicates that the examination should be performed. Even if the examination has only a weak chance of finding the cause of a disease, the benefit still may outweigh the risk (e.g., +0.5 benefit and +3 risk for a total of +3.5).

More often cases are not at the extremes of the continuum. In the case of coronary artery disease (CAD), myocardial perfusion imaging and coronary arteriography are important diagnostic tools for determining appropriate therapy as well as evaluating the patient's prognosis. Although CAD is incurable, the use of radiation for diagnosis and follow-up can significantly improve the patient's survival rate and quality of life. The risk-benefit continuum cannot precisely quantify the relationship between risk and benefit. As with every value decision, this relationship is not easily translated into a number. Rather this is a tool that can be used to initiate discussion of benefits and risks. In the final analysis the patient must decide what the risks and benefits mean to him.

A negative total indicates that the risk outweighs the benefit of an examination, or that there is no benefit, only a risk. As the total of the risk and benefit values approaches 0, the question becomes whether the examination should be performed. Again, this number is not an absolute. The physician may have reasons for ordering an examination that are unknown to the technologist.

A problem in explaining radiation risk is numeracy, the ability to understand numbers. First, words such as rarely, frequently, occasionally and usually hold different meanings for different individuals. In one study, 100 cancer patients were asked for their interpretations of these commonly used words (*27*). There was little agreement among the patients about the numerical meaning of these words.

Second, abstractions such as ''a one in a million chance'' have little meaning for patients. When a group of people were asked to judge the frequency of death due to several causes, the estimates of the common causes of death (e.g., accidents) were underestimated, and the rarer, more dramatic causes of death (e.g., lightening) were overestimated (*28*). One explanation for these findings is that the interpretation of events is colored by individuals' previous experiences rather than an understanding of numbers associated with the frequency of occurrence. If people engage in an activity with some risk attached to it and have a positive or ''safe'' experience, individuals tend to consider that activity to be safe. The risk has not changed, but the perception has. Most people know that riding in a car carries a risk of accident; however, because they have returned home safely many times, the perceived risk is considered to be low or acceptable. Radiation exposure from a diagnostic examination is for many people an unfamiliar event. While people receive radiation exposure from natural sources in the environment daily, it is estimated that only about 1% of them knows that radiation is naturally occurring (*29*).

Other factors in addition to risk perception influence patients' decisions (*30*) about whether to have an examination using radiation. Emotions, which have been mentioned as a barrier to learning, play an important role in decision making. Patients are more likely to perceive a risk as being higher than it actually is when they are anxious (*31, 32*). For this reason, technologists need to acknowledge the emotional side of the decision-making process with empathy and understanding while providing the facts to help patients make informed decisions. If technologists reinforce by words and demeanor that it is acceptable for patients to ask questions about the safety of a procedure, any risk associated with the examination is a ''voluntary'' risk rather than an ''imposed'' one. Studies show that accepting a voluntary risk is more satisfactory to individuals than an externally imposed one (*33*). One of the worst things a technologist can do is to discount or belittle a patient's concerns about radiation.

Another factor affecting patients' decision-making styles is how they cope with what is perceived to be an intimidating event (*34*). One style is called ''vigilance'' in which the individual seeks information to predict what will occur. In the ''avoidance'' style, the individual prefers to refrain from gaining too much information. Thus, each of these types requires different amounts of information. The vigilance group requires maximal information, while the avoidance group prefers minimal information.

While it is important for technologists to communicate radiation risk to patients, it may be more useful to first establish the competence of the technologist and the relative safety and benefits of the procedure. If the patient asks for more specific information, the NMT can provide it at that time.

Many patients may want to be reassured that there is no risk associated with a nuclear medicine examination. This is an opportunity for the NMT to explain that although the risk cannot be eliminated, it can be minimized by using certain techniques (*35*). These activities ensure that the minimum amount of radioactivity necessary to complete a test is used to derive the maximum benefit from the small amount of radiation received. Instructing the patient to drink fluids and void frequently in preparation for bone imaging is one illustration. Another is routinely performing quality control tests on imaging equipment to increase the likelihood that diagnostically accurate images will be produced and eliminate the need for repeat examinations.

As an example, a technologist routinely explains radiation risk to patients by stating that they are receiving no more radiation from a nuclear medicine examination than they would from an average chest radiograph. How meaningful is this information to a patient? An ''average'' chest radiograph, or any other radiographic exam, and the amount of radiation received from those procedures is probably as unfamiliar to patients as the nuclear medicine examination. Table 5 compares the effective radiation doses received from various medical imaging procedures (*36*). Effective dose is a concept that compares radiation doses received from various sources, both natural and artificial. The effective dose takes into account the sensitivity of different body tissues to radiation, as well as the effect of the various types of radiation on these tissues. According to Table 5, the effective radiation dose from a plain film chest radiograph is the lowest of all the effective doses listed and is much lower than the effective doses of all the nuclear medicine examinations listed. Another consideration is a patient's prior experience. If a patient had an unsatisfactory experience during a radiographic procedure, this dissatisfaction may carry over to the nuclear medicine procedure if the two procedures are compared. The technologist may want to relate the risk of a nuclear medicine test to an activity that is more familiar to patients. If driving 220 miles on a freeway carries the same risk as 1 rad of radiation, then a bone imaging procedure, based on Table 5, has a lower risk. This assumes that in this instance 1 rem is approximately the same as 1 rad. This is an imperfect comparison, but one that patients may more readily understand because it is a familiar activity. The technologist also should stress the benefits of the nuclear medicine examination to the patient.

Patients frequently ask technologists questions related to their condition, but not directly related to the nuclear medicine examination. This is another area that causes technologists concern but that supplies opportunities for education. Davidhizar and Dowd (*37*), looking at the history of patient education in the radiologic sciences, have postulated three types of health care professionals in regards to providing patient information: hiders, revealers and experts. Hiders are individuals who tell patients little about the examination or anything surrounding their care. Such individuals often were brought up in environments that encouraged technologists to think of themselves as ''just technologists'' who are given to the ''I just do'em, I don't read'em'' response. In some cases, hiders were trained to withhold information (e.g., to indicate that ''nuclear medicine didn't use radiation like x-ray'' or a similar misleading response).

Unfortunately, as the current pendulum has swung to a more professional attitude regarding technologists along with patient

TABLE 5
Effective Doses from Selected Medical Imaging Procedures

Radiopharmaceutical (activity)	Effective dose (mSv)
^{99m}Tc-pertechnetate (80 MBq/2.2 mCi)	1.0
^{99m}Tc-IDA derivatives (150 MBq/4.0 mCi)	2.3
^{99m}Tc erythrocytes (800 MBq/21.6 mCi)	5.3
^{99m}Tc-phosphate (600 MBq/16.2 mCi)	3.5
^{99m}Tc-DTPA (300 MBq/8.1 mCi)	1.6
^{99m}Tc-DMSA (80 MBq/2.2 mCi)	0.7
^{99m}Tc-leukocytes (200 MBq/5.4 mCi)	2.2
^{99m}Tc-MAA (100 MBq/2.7 mCi)	1.1
^{99m}Tc-MAG3 (100 MBq/2.7 mCi)	0.7
^{99m}Tc-HMPAO (500 MBq/13.5 mCi)	4.7
^{99m}Tc-MIBI (400 MBq/10.8 mCi), resting	3.4
^{111}In leukocytes (20 MBq/0.54 mCi)	7.2
^{123}I-MIBG (400 MBq/10.8 mCi)	5.6
^{131}I-iodide (400 MBq/10.8 mCi), 0% thyroid uptake	24.0
^{201}Tl-chloride (80 MBq/2.2 mCi)	18.0
Computed tomography	
Head	1.8
Chest	8.3
Cervical spine	2.9
Thoracic spine	5.8
Abdomen	7.2
Pelvis	7.3
Plain film radiograph	
Skull	0.1
Chest	0.04
Thoracic spine	1.1
Lumbar spine	2.2
Abdomen	1.4
Pelvis	1.0
Intravenous urogram	4.6
Barium meal	4.6
Barium enema	8.7

Table reprinted from reference *36* with permission of the authors.

demands for more information, some technologists have adopted the approach of a revealer, one who tends to tell the patient everything they know. Such an approach is not appropriate either. Some things need to be revealed by the physician or may produce unnecessary anxiety in the patient. Thus, a revealer technologist might respond to a patient's request for information about ''What does this myocardial imaging show?'' by revealing too much information about cardiac pathology.

Both hiders and revealers are more concerned with their own anxiety than that of the patient, and use their strategies to alleviate that personal anxiety. For a hider, it is easy to adopt the mantra of ''that's not my job.'' Davidhizar and Dowd (*37*) postulate that there are more young professionals in the category of revealer and that they feel they have ''done what is best for the patient'' by revealing all they know.

The final type is the expert who assesses the patient and the situation and knows the limitations of the professional environment. The expert reveals only what is useful to the patient and what is anxiety reducing, rather than anxiety producing. Davidhizar and Dowd (*37*) propose that the development of expertise probably takes several years of clinical experience to develop effectively, and that students should be encouraged to role model experts and disregard the tactics of hiders and revealers.

It bears repeating that what is routine for technologists is definitely not routine for patients. Therefore, patient education tailored to the needs of the individual patient is integral to every nuclear medicine examination. One of the challenges to technologists is to keep their explanations sounding fresh and individualized for each patient.

THE ENVIRONMENT

Environment refers to the physical surroundings and general atmosphere of an area where teaching and learning take place. The influence of the nuclear medicine environment on the patient needs to be considered because environment affects the learning experience.

Patients who are sent to the nuclear medicine department for the first time are confronting many unknowns. Foremost in their minds is the uncertainty about what the examination will entail and how the results will affect their prognosis and treatment, but other factors in the environment can add to that stress. Throughout the nuclear medicine examination, patients and technologists share confidential information. Patients may be more forthright in their responses and in asking pertinent questions if this exchange takes place in private. Feelings of embarrassment may prevent patients from asking pertinent questions if they know that the questions and answers will be overheard by others. Likewise, a relatively quiet area enhances the exchange of information. Patients who are weak, have a hearing loss, or have problems maintaining their concentration may have difficulty understanding what is being said and in making themselves heard above the noise of computers, paging systems, radios, and the general buzz of a busy work area. If patients must ask for information to be repeated multiple times, they may become frustrated or embarrassed and miss key information.

Technologists may forget how intimidating a nuclear medicine department can be for the uninitiated because they work in that environment on a daily basis and are in control of the equipment and the work flow. Technologists should anticipate the patients' anxiety by briefly explaining the equipment and its purpose. Technologists also need to be aware that certain practices that are benign and necessary may be perceived by patients as mysterious and even threatening. Even turning the lights off in an imaging room to view a computer monitor may be intimidating. When a patient observed an NMT processing a study on a computer in a darkened imaging room, he solemnly asked, ''Will my test be done in that cave?'' Also, physical comfort factors such as room temperature can distract the patient from learning important information.

The general impression a patient receives on entering the department may set the tone for the entire nuclear medicine experience. Taking a look at pediatric nuclear medicine facilities may give some hints as to what other departments that care primarily for adults may do to become a more welcoming place. Obviously, age-appropriate materials need to be substituted. A nicely appointed waiting area that is a pleasant place in which to spend a short period of time creates the first impression.

More important is the reception patients receive. Someone needs to greet patients immediately on their entrance into the department and indicate how long it will be before their test begins. The same person should assess the patient's needs. These may be readily observed, but patients should be asked about them as well. If the introduction to the nuclear medicine department is pleasant, professional and caring, it will facilitate the patient education that occurs later on in the process.

CONCLUSION

This short series presented some foundations on which patient education is based and applied them to patient education in the nuclear medicine department. What implications does the move towards more patient education hold for nuclear medicine technology practice and the individual NMT? While patient education always has been a part of NMT practice, it is becoming increasingly important. This less technical aspect of an NMT's role will expand and become a more integral part of clinical practice. NMTs will become more holistic caregivers and will be as concerned with the patient's emotional and psychological well-being as with the technical performance of examinations. The distinction among practitioners in various disciplines already is becoming blurred as their duties expand beyond what had been considered the traditional scope of practice, sometimes overlapping with other disciplines. While some of the impetus for these changes can be viewed as a way of controlling costs, providing a continuum of care for better patient outcomes also is a motivating force.

As the profession changes, its practitioners must adapt and change too. NMTs always have been an adaptable lot, learning new skills as the face of nuclear medicine changed. Professional NMTs must involve themselves in all aspects of patient care. They must go beyond being merely pleasant to patients and adopt more therapeutic approaches to patient, questions and concerns.

There is little written about the best strategies for patient education where the encounters between practitioners and patients are as brief as they are in nuclear medicine. Perhaps this series of articles will prompt NMTs to reflect about their own practice and to devise personal strategies for gaining additional skills that will facilitate patient education.

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