

# **SIR and CIRSE Joint Medical Simulation Task Force Strategic Plan**

## **Introduction: The 2010 Vision of the Societies**

By 2010 a growing number of validated IR simulation training modules will: 1) have been shown to transfer skills and reduce procedural error, 2) be delivering clinical benefit to patients, 3) have been integrated into a standardized IR training curriculum and certifying examinations: the newly formed American Board of Radiology (ABR) Foundation is planning on a major role for simulation in its early initiatives.

## **Strategic Mission**

The Executive Councils of SIR and CIRSE have charged their Medical Simulation Task Forces to work together to achieve excellence and safety in interventional radiology patient care by recommending and guiding implementation of a robust infrastructure and process to support IR simulation development, assessment, validation, application, and dissemination.

## **Preamble**

**The goal of medical training** is to create practitioners who demonstrate mastery of the professionalism (skills, knowledge, attitudes, behavior) required for the successful delivery of medical therapy (1). A well-designed and fully integrated curriculum is the essential mechanism by which this mastery is achieved. Since ancient times, medical education has followed a master-apprentice model (MAM), with clinical, cognitive, psychomotor and attitudinal skills being offered and demonstrated by the ‘master’ and incorporated by the ‘apprentice’. Today, as part of an approved curriculum, the apprentice learns these skills under supervision to achieve mastery of the subject, initially by observing the instructor and in time, he/she is allowed “hands on” experience under supervision. Since at least the time of Galen, this training has, in various eras, been supplemented with additional skills training on physical models, animal models and cadavers. In addition, the role of analog and digital simulation, for medical education, has been explored for the past twenty years (2).

**The traditional MAM** has many limitations. Although the “master” should be present throughout the critical portions of a procedure this is not always achievable. Because training requires actual patients, inexperienced operators can produce suboptimal results or even cause patient harm. Time constraints, rising costs, stress, ethical considerations, and an adversarial medicolegal milieu adversely impact the learning environment. Diagnostic imaging advances have all but eliminated the need for the straightforward invasive diagnostic procedures, which form the foundations for acquiring and mastering interventional radiology skills. This reduces exposure to case material during service rotations. The latter is too often uneven or random, and certainly far from standardized. This is compounded by the decrease in resident work hours. At a time when there is increasing public demand for patient safety, it is easy to understand the attractions of adopting novel teaching methods.

**Teaching models and tools** must be cost effective, adaptable to change, and proven to develop skills that transfer to clinical circumstances. Medical simulation, using a combination of physical models and computer simulations, holds considerable promise. Governmental standards exist to govern aviation simulation but no such regulation exists for medical simulator models. The incorporation of simulations into training in medicine requires adherence to principles of educational methodology and validation of training efficacy. Paramount, however, is the practical imperative that procedural skill is meaningless without comprehension of the underlying condition and risks/benefits of various therapies.

**Validation.** For public and professional acceptance, the use of simulation as a component of training in high stakes IR procedures will require proof (validation) of effectiveness. Validation of ‘*testing*’ requires an ability to accurately assess knowledge and performance as they relate to learning objectives. The requirements for validating a *training* device will depend on considerations such as a need:

1. to claim that participating in a particular training program is an accurate indicator of a level of competence or proficiency in the clinical environment.

2. to claim that the use of a particular training device will consistently provide particular results (e.g. proficiency, decreased training cost or time to proficiency, decrease in errors over time), when used by different individuals in different training programs.
3. to standardize a range of training programs to ensure each predictably delivers a certain percentage of learners attaining pre-defined standards within a set period of time.
4. for acceptance by users, experts, or other third parties (e.g. the public), that is generally more likely where training is performed with validated tools.

For these reasons, **validation** and **defined standards** (including those specified within a curriculum) underpin this entire document and its strategy.

**A strategy for implementation.** For expediency in covering a range of topic areas and accomplishing all of the development and validation tasks, safe and clinically relevant implementation of simulation-based training in IR will require a process, which can evolve in response to advances in technology, metrics and validation. Technological developments and validation will occur at different rates and times and it would be impractical for one to rely exclusively on the other. Hence the recommendation is to adopt new technology within its known limitations (3) as determined by its development history, validation studies, and the standards that are to be set in consequence of this strategy. Adoption of *appropriately developed* technologies will allow and even hasten their validation. With appropriate instructional design and validation, innovation in medical simulation has the potential to produce a new era in procedural training in medical education.

**The role of simulation.** For simulators to play an increasingly important role in the training of interventional radiologists, they must be thoughtfully developed and carefully, yet expeditiously, incorporated into official training curricula. This is essential to ensure correct learning of the cognitive and clinical knowledge necessary for the practice of medicine. This requirement has been identified by the Society of Interventional Radiology (SIR) Executive Council, the Cardiovascular and Interventional Radiological Society of Europe (CIRSE), and the Board of Directors of the Radiological Society of North America (RSNA) (4). The SIR-CIRSE Joint Simulation Task Force has been charged with recommending to their Executive Councils a plan to integrate throughout their divisional structures, the analysis, development, assessment, application, and dissemination of medical simulation in interventional radiology. This includes professional education, standards, research (principally: direction, advice and support), economics, practice building, and public information. The Joint Simulation Task Force is not a credentialing body. Its recommendations will include professional education, standards, research, economics, practice building and public information. They will be derived from evidence based expert advice. The RSNA continues to work with SIR and CIRSE on the vision, mission, and goals for simulation in IR and beyond, as well as an implementation plan.

*The remainder of this document defines a strategy for development of a robust role for simulation in interventional radiology training and assessment.*

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## **Specific Goals to attain the mission of the Joint Simulation Task Force**

1. To foster international relationships between societies and physicians in recognition of an increasingly global radiology community.
2. To help the IR profession meet the anticipated growth in demand for IRs by conducting activities which, through introducing simulation into curricula, will help to:
  - a. continuously improve education and training to reflect the current and evolving specialty of IR.
  - b. encourage and educate students at undergraduate level.
  - c. meet the educational and continuing professional development needs of societies' members.
3. To become stronger and more inclusive Societies by demonstrating leadership in key clinical and technology areas affecting the future of IR.
4. To advocate successfully on behalf of patients to:
  - a. ensure that they have access to optimal care.
  - b. Provide excellence in that care by:
    - i. recommending standards in education.
    - ii. using medical simulation optimally to improve patient safety.

5. To support and disseminate high quality research in simulation relevant to radiologic science, and pursue excellence in publications and communications of this research.

## **Strategy Outline**

The strategy to achieve the stated goals for medical simulation is set out as two stages, which will develop in parallel. Attention is paid to financial implications and to the timeframes over which these developments might be expected to occur. The strategy may require update and modification as trends, technology and the political arena evolve. While not intended to be prescriptive, the strategy will demonstrate the societies' leadership in the field of medical simulation in interventional radiology. The Joint Simulation Task Force will work to develop the strategy objectives, and to disseminate findings, in partnership or in parallel with others, and to meet the societies' mission of excellence in IR patient care.

**STAGE 1 (Appendix 1):** Comprises two parallel strands, curriculum development and organizational objectives.

*A. Curriculum development:* Defines the role of simulation within a structured, training program including how, where and when simulator training takes place. It will also review assessment methodologies for establishing competence including traditional techniques, novel automatic assessment based on simulator derived performance data and observer based methods. Finally, it outlines the role of credentialing organizations to oversee accreditation and revalidation

*B. Organizational objectives and goals met by the strategy:* Considers how utilizing simulator models could improve performance of IR training and of health care institutions. Human factors for the adoption of medical simulation standards will be determined, including identification of metrics and agreement on standards for the validity and efficacy of simulator models. Criteria for evaluating simulators will be developed with respect to learning, training, and the nature of performance feedback provided. Support for the task force will be enlisted from industry, funding organizations, politicians. A program will be formulated for implementation of simulator-based training in interventional radiology curricula. Finally, recommendations will be made regarding the use of simulation by simulator and medical device companies for education, when operating outside curricula (4).

**STAGE II (Appendix 2):** *Research methodology (ie. milestones, Gantt charts, specifications, costings, personnel, etc) are expected to be generated and implemented by various other groups. It is intended that this strategy will provide guidance.* Development, including meeting the requirements of Stage 1 A and B, to include:

**A. Standards (Training)**

**B. Professional Education**

**C. Practice Building**

**D. Research** *(This part of the strategy aims to provide direction, advice and support to researchers from within and outside the collaborative, academic and industrial partners of the Joint Task Force)*

**E. Economics**

**F. Public Information**

## **References\***

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2. Dawson S. Procedural simulation: a primer. *Journal of Vascular & Interventional Radiology*. 17(2 Pt 1):205-13, 2006 Feb.
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*\*Other sources of information used:* Strategic Vision (Medical Simulation in Radiology Strategic Planning Meeting – October 2005) – Improved health care delivery and patient safety through the application of medical simulation to radiologic education, training, and assessment

# Appendix 1

## STAGE I

**Sections A and B** are parallel strategic developments to support the Task Forces' Mission and Vision. [Development partners in brackets], (Timelines in brackets).

**A. Curriculum development** [led by the certifying organizations] (12 months). **Attains goals 1-5 (listed above)**: simulation designed into IR curricula as a specific component of skills training and assessment. The task forces, societies, educators contribute relevant curriculum structure requirements.

1. **Planning** (4 months) [by statutory training authorities, with advice from societies, higher education institutions, educators].
  - *Determine overall goal(s)* for a given training and/or testing program ('... to achieve excellence and safety in interventional radiologic patient care'). A core set of knowledge (cognitive, clinical) and skill sets is to be outlined in respect of level of experience, e.g. 2<sup>nd</sup> year resident, 3<sup>rd</sup> year resident, consultant / attending etc.
    - Curricula may differ between countries, though the commercial benefits of uniformity are recognized.
  - *Costing / resource implications* for startup and long term maintenance.
2. **Simulation for a structured, comprehensive training program** (6 months). How and where does simulator training take place (insertion sites)?
  - *Assimilation of simulation* (including non-haptics, other simulations) and E-learning into curricula for training and assessment purposes.
    - Knowledge and clinical base
    - Provide mentored proficiency training using simulators in modified apprenticeship for core and complex skills.
      - Core skills, low fidelity
      - Complex skills, high fidelity
    - Determine
      - What are the gaps in simulation?
      - The role for simulation in certification / revalidation (see 3 and 4 below).
      - Relationship to, and requirements for, patient based training.
    - Location and implementation: e.g. web based.
  - *Operational requirements*
  - *Maintenance*
3. **Objective assessment methodologies** (12 months). This covers traditional, automatic and observer based assessment.
  - *Feedback mechanisms*: organizational, trainer, trainee.
  - *Ongoing validation*.
  - Have *societal objectives* been met?
4. **Credentialing organization to oversee / provide** (12 months).
  - *Certification*.
  - *Revalidation*.

**B. Organizational objectives and goals met by the strategy.** (Iterative {..} timeline for some deliverables: 4..24 months).

**1. Define how simulator models could improve performance of IR training and health care institutions.** (4 months) **Attains goals 2-5.**

- *To train core and complex skills* as a part of a curriculum, together with knowledge and attitudes. [Instructional designers, clinical educators]
- *To improve performance* in patients as evidenced by safety (reduction of error), efficacy (improved outcomes) and efficiency (reduction of cost). [Human factors / psychologists, clinical researchers].

**2. Validity and efficacy standards** (6..24 months): lead established by Joint Simulation Task Force \*. **Attains goals 1-5.**

- *Agree on standards* for the validity and efficacy of simulator models (6 months) \* [human factors / psychologists, clinical researchers]. These requirements will be based on:
  - The overall goals for the training and testing program to be established in Section A, above.
  - The claims it is proposed to make for training within that program (e.g. it will produce excellent and safe IRs, working to the highest standards).
  - The level of acceptance to be achieved for those claims (e.g. acceptance of the training programme, its methodology and resulting certification by trainers, trainees, the credentialing organisations and the public).
- *Identification of metrics* (6..18 months). [human factors / psychologists, clinical researchers].
- *Instrument and device specification\** (12..24 months) standards to facilitate simulation

{\*Once standards have been set, this work might, equally, be performed by other groups with an appropriate track record.}

**3. Define selection criteria for simulators and the criteria for evaluating their impact on training, learning, and providing performance feedback.** (8 months). **Attains goals 2 and 3.**

- *Define IR curricular requirements* for simulation. [Educators, instructional design specialists, human factors / psychologists, computer scientists].
- *Develop / adopt protocols for creation of relevant metrics.* [human factors / psychologists, subject matter experts, research associates, industry].
- *Develop / adopt validation standards / standards for efficacy.* [human factors / psychologists].
  - Validation/verification of procedure, to include standards for the ability of simulation to accurately reproduce physical and functional characteristics of the procedure.
  - Efficacy of training, design appropriate training transfer paradigms
  - Validation of assessment, to include standards for the ability of simulator models to test specific performance metrics.

**4. Enlist support.** (12-24 months). **Attains goals 1 and 5.** [Task forces, industry, funding organizations, politicians].

- *Establish an ongoing dialogue with companies* involved or interested (education/certification) in medical simulation (in the beginning phases)
  - Identify and consult with simulator manufacturers.

- *Identify stakeholders:* societies, simulator companies, funding organizations / sources (ERC, F6, NIH, DTI, medical device companies), Government departments (e.g. PMETB, US and EU equivalents?), educators.
  - Initial discussions with the ABR, EAR, RCR etc to integrate medical simulation into the initial, and maintenance of, certification processes.
- *Establish lines and protocol of communication.*
- *Develop funding strategies.*

**5. Construct an implementation plan / program** for simulator based training in interventional radiology curricula (e.g. training, examinations). (8 months). **Attains goals 2-4.** [statutory bodies, instructional design specialists, educators].

- *Recommendations for integrating* simulation into curriculum based training programmes.
- *Define the role* of today's simulators in IR curricula.
- *Define development needs.*

**6. Develop recommendations for the use of simulation by simulator and medical device companies** for education, when operating outside curricula (3). (6 months). **Goals 3 and 4.** [educators, statutory organizations / societies / education boards, instructional design specialists].

## Appendix 2

### STAGE II

**Development.** Note that research methodologies (milestones, Gantt charts, specifications, costings, personnel, etc) are expected to be generated and implemented by various other groups. It is intended that this strategy will provide guidance.

#### **A. Standards (Training)**

##### One-Year Plan –

- *Determine the capabilities* of current simulators (physical, computer based and hybrids; vascular and non vascular).
- *Broad strokes IR curriculum* identified (Section 1A, above).
- *Identify and prioritize IR modules* that need to be developed by simulation companies.
- *Determine potential downsides/pitfalls* of simulators to effective training (if any; if present, options needed to solve them).
- *Maintain awareness* of ongoing medical simulation work by other organizations and specialties; collaborate where appropriate.

##### Three-Year Plan –

- *Validation of some* simulators (vascular and nonvascular) in IR - partially established.
- *Prove that proficiency* on a medical simulator translates to proficiency in clinical situations.
- Complete the first iteration in development of a lexicon for medical simulation.

##### Five to Ten Year Plan –

- *Simulation incorporated* into the residency and fellowship programs.
- *Improved IR outcomes* and patient care through medical simulation.
- *Reduced errors* in IR patient care through medical simulation.
- *Medical simulation used* for new procedure training and maintenance of skills training in IR.
- Update standard documents/ incorporate simulation based training (evidence based).
- *Simulation is a part of the IR certification* processes of statutory radiological training organisations.

#### **B. Professional Education:**

##### One-Year Plan –

- *Strategy for incorporating simulation* into the (establishing: see Section 1A above) IR curriculum for education
  - Identify the various potential models and opportunities for facilitating simulation training for SIR, CIRSE and other IR society and training organization members. Assess training / simulation needs and goals of specific target groups (see Section 1A, above).
  - Identify the specific functionalities of existing simulators, which are applicable to meeting training goals of the curriculum.
  - What has been learnt of simulation used in other fields to support training goals?
- *Explore the role of simulation* to
  - address gaps in existing fellowship training, including procedures where there are diminishing case loads, restrictions on work hours, and reduced exposure to

- invasive procedures due to advances in non-invasive imaging – use established (SIR, BSIR etc) IR syllabus (not the syllabi books) or curriculum
- train experienced, actively practicing IRs on new technology or procedures and for credentialing
- maintain skill in low volume procedures for experienced active IR practitioners

#### Three-Year Plan –

- *A comprehensive set of procedures, skill sets, and specialty metrics* has been defined and provided as open source for incorporation into academic and commercial simulator models.
  - Specialty led development of metrics for all interventional radiology procedures would be an ongoing, constantly updated process.
  - The methodologies and recommendations of CIRSE / SIR for creation and maintenance of metrics have been defined and may require further revision.
  - The data (e.g. curricula, training objectives, metrics, skills sets) produced will be made available as open source to academic, educational, commercial and academic developers alike.
- *An enduring model* of procedural education has been developed that will sustain IR's commitment to safety, quality, and innovation. Simulation is incorporated into or as a prerequisite for certification exams in IR.
  - Develop organizational objectives to support and inform simulator selection and funding.
- *Medical simulation* will be used:
  - to provide fellow level training on cases where there is diminished case load or reduced exposure
  - for maintenance of skill in low volume procedures for experienced active IR practitioners
  - to train actively practicing members on new technology/procedures
  - to recertify actively practicing members
- *Endorsements.* Credentialing and training organizations that hold statutory responsibilities would endorse / approve training as appropriate.

#### Five to Ten Year Plan –

- *Simulation as established technology in IR training.* Medical simulation is a validated recognized and approved method for training and objective assessment of technical competence in the performance of interventional radiology procedures. Educators with experience and expertise in use of medical simulation are essential partners and will have much to offer in this process.
- Predict future requirements.
- Medical simulation will provide the 'whole team' experience for training on IR procedures.
- *Capabilities and limitations of transfer* of simulation training to clinical situations has been determined.

### C. Practice Building

#### One-Year Plan –

- *Make SIR / CIRSE members aware* of the importance that medical simulation will have in building their practice and why IR must take a leadership role (2)

#### Three-Year Plan –

- *Medical simulation will be a tool* to safely and effectively introduce new procedures into existing practices
  - Clinical audit will continue to ascertain outcomes.

Five to Ten Year Plan –

- *Practitioners trained and re-certified* on simulators for rare or complex procedures will be differentiated in the medical market place as more facile and desirable on these procedures (on audited clinical outcomes).
- More practitioners will become trained and eligible to do rare and complex procedures on simulators, making the procedures more widely available to patients

**D. Research** (*this part of the strategy aims to provide direction, advice and support to researchers from within and outside the collaborative, academic and industrial partners of the Joint Task Force*).

One-Year Plan –

- *Identify current status of research* on medical simulation
- *Define / initiate* (if / where practicable) *validation* efforts: pilot study, measure proficiency, learn about how to conduct studies at large meetings
  - Identify requirements for further validation based on the standards proposed in Stage I (Section B.3.).
  - Identify the various potential models and opportunities for facilitating validation studies of simulation for IR procedures.
- *Perform validation* studies of existing simulators using taskforce members and other groups, and the CIRSE / SIR meeting simulator workshops. Further studies involving radiology trainees.
  - Demonstrate effective and acceptable transfer of training obtained on a simulator to “in vivo” environment
  - *Further guidelines* / recommendations regarding simulator training based on this work.
- *Funding*. Surmount funding hurdles to attain the longer-term vision of fully integrated, relevant, validated skills training and certification using virtual environments.
  - As at least some projects will be long term (>5 yrs), funding would need to be substantial and identified / competed for / secured from: foundations, grants, government agencies, societies, corporations (e.g. industry).
  - Research would be conducted by parties within and outside the task force societies.

Three to 10 -Year Plan –

- *SIR / CIRSE and others are actively involved in research* that moves the field of simulation forward for interventional radiology.
- Encourage industry/academia/NIH/EU/ERC partnership for the advancement of simulation (plans under way – Gary Becker effort).

Five to Ten Year Plan –

- *Validation* provided in well-designed, objective studies, led by specialties(s) providing certification (see recommendations of Task Forces<sup>1</sup>). Mechanisms must be robust as validation is the necessary basis for assimilating simulation into a training program that provides a certification.
  - Project costing / funding (e.g. industry funding, with free use of simulators: ideal is non-commercial funding).
  - Protocols based on validation standards
    - Content, construct validation: e.g. at SIR/CIRSE annual meeting
    - Transfer of training studies, conducted at educational institutions, might not be of great value prior to instructional improvements in the medium term. Such preliminary studies would however provide a valuable baseline.
  - Ethical approvals and governance will need to be applied across borders.

- *Medical simulation is used for the innovative development* of new devices and procedures, e.g. software will have been developed to model and test new devices “in vitro” on simulators to study deployment instructions in non-lethal environment through multiple insertion cycles.

## **E. Economics**

### One-Year Plan –

- *Identify areas* where medical simulation may impact economics and reimbursement in the future.

### Three-Year Plan –

- *Encourage payers* to acknowledge Continued Medical Education training on simulators to enable practitioners to stay current and facile on rarely occurring procedures for payment determinations (if Pay-for-Performance happens).

### Five to Ten Year Plan –

- *Accrual of case experience* will have been shown to be more cost-effective on simulators than acquiring preliminary credentialing experience on humans or in animal labs.

## **F. Public Information**

### One-Year Plan –

- *Illustrate SIR, RSNA and CIRSE’s leadership role* in patient safety and how our leadership role in the validation of medical simulation and collaboration with industry and academia in its research and development contributes to safe, effective, quality patient care.

### Three-Year Plan –

- Low cost / No cost public information campaign.
- *SIR / CIRSE are recognized leaders* in medical simulation development and assessment.
- Dovetail onto the simulation training successes and PR of the aviation industry, aerospace industry, and the computer (gaming) industry.
- *Make case to health care advocacy groups*, medical payer groups, and retiree groups (AARP, etc.).

### Five to Ten Year Plan –

- *Promote how medical simulation* has been shown to reduce medical errors in IR and how SIR and CIRSE’s leadership role in patient safety led to this reduction.

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