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An Investigation of
Mental Readiness and its Links to
Performance Excellence in Surgery

MASTERS THESIS

Presented to the Faculty of Education
in Partial Fulfillment of the Requirements for the
Degree of Master of Arts

by

Judy M. McDonald

Faculty of Education
University of Ottawa

 Judy M. McDonald, Ottawa, Canada, 1992



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My sincere thanks to
the surgeons of this study,
who shared intimate details
in areas not normally revealed to
someone outside the profession.

The interviews also acted as a catharsis for many.

Feelings were unleashed in a profession
that depends on emotional control.

I feel privileged in being exposed to this
human side of medicine.

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TABLE OF CONTENTS

	Page
Abstract	1
Introduction	2
Review of Literature	3
Excellence and Surgery	3
Excellence in the Workplace	3
Mental Readiness in Sport	4
Conceptual Model: Orlick's "Theory of Human Excellence"	6
Mental Readiness in the Workplace	7
Mental Readiness in Medicine	10
Procedural Model	11
Methodology	13
Purpose	13
Subjects	14
Instrument	15
Procedure	16
Data Analysis	17
Attempts at Control for Investigator Bias	18
Operational Definitions	19
Results and Discussion	22
Overview of Mental Readiness	23
Overall Importance of Mental Readiness	23
Differences in Readiness Between Performances	25
Differences in Readiness Within Subjects	26
Success Elements: Orlick's "Theory of Human Excellence"	28
Commitment	28
Belief	32
Positive Images	36
Mental Readiness	42
Full Focus	52
Distraction Control	56
Constructive Evaluation	71
Performance Blocks	78
Special Profiles of Excellence	89

Elite Surgeons	89
High-Mortality-Risk Surgery	90
Best Performances	90
Gender Differences	91
Different Criteria for Success and Disappointment	91
Other Mental Practices	94
Post-Operative Coping Strategies	94
Training and Experience	102
Analogies — Sports, Flying ... the Arts	104
Conclusions and Recommendations	109
Conclusions	109
Recommendations	112
Contributions to Education	113
Bibliography	114
Appendices	
Appendix A Success Elements within Orlick's "Theory of Human Excellence"	117
Appendix B Surgeon Interview Guide	119
Appendix C Athlete Interview Guide	122
Appendix D Relationship Between Surgeon and Athlete Interview Guides	124
Appendix E Definitions for Challenging Elective Surgery	125
Appendix F Differences Within Readiness Factors Between Subject Groups	128
Appendix G Practical Considerations for Mental Readiness Training in Surgery	129

LIST OF TABLES

	Page
Table 1 Ranking of Challenging Elective Surgery	20
Table 2 Overall Importance of Readiness to Performance Excellence in Surgery	25
Table 3 Means and Standard Deviations for Readiness Factors in Successful and Disappointing Challenging Surgery	26
Table 4 Differences in Readiness Between Successful and Disappointing Surgery Within Subject Groups	27
Table 5 Indicators of Surgeons' Commitment	29
Table 6 Contributors to Surgeons' Self-Belief	33
Table 7 Positive Imagery and Positive Thinking Strategies Used for Challenging Surgery	37
Table 8 Planned Preparation Activities for Mental Readiness Before Successful, Challenging Surgery	43
Table 9 Unplanned Positive Influences to Mental Readiness	49
Table 10 Full Focus Experiences During Successful, Challenging Surgery	52
Table 11 Distraction Control Before and During Surgery	56
Table 12 Distraction Control in a Crisis During Surgery	58
Table 13 Distraction Control During Lulls	68
Table 14 Constructive Methods of Evaluation in Surgery	72
Table 15 Attributed Sources to the Success and Disappointment of Challenging Surgery	76
Table 16 Performance Blocks Before and During Surgery	79
Table 17 Criteria for Success or Disappointment in Challenging Surgery	92
Table 18 Coping Skills for Morbidity and Mortality	98

LIST OF FIGURES

Page

Figure 1	Wheel of Human Excellence	7
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ABSTRACT

The purpose of this study was to assess factors that are related to excellence among surgeons. The sample included 33 highly proficient surgeons involved in high- and low-mortality-risk surgery, seven of whom were known by reputation as "elite". A framework developed by researchers in athletics was used to examine how surgeons perform their best in challenging elective procedures. Individual in-depth interviews were carried out to determine their mental readiness before, during and after surgery. This provided a quantitative and qualitative analysis of mental readiness. These findings were compared with Orlick's "Theory of Human Excellence" which is based on results from world-class athletics and other high-performance domains. Common elements of success were found which included: commitment, belief, positive images, mental readiness, full focus, distraction control, and constructive evaluation. Major performance blocks were identified which interfered with optimal performance. Characteristics which distinguished certain groups of surgeons were identified. This investigation confirmed that there were many similarities in mental preparation procedures and perspectives engaged in by top surgeons and top athletes. Practical recommendations for mental training were provided relevant to excellence in the surgical arena.

INTRODUCTION

The operating room — a theatre for doctors carrying enormous responsibility in pursuit of flawless results. The Olympics — an international arena for athletes honed to compete at the peak of their abilities in pursuit of the ultimate recognition in sports. Both areas in which an *individual*, backed by support teams and years of training must perform exceptionally at a critical juncture.

While mental readiness training has been widely credited for the winning performances of the sports elite, its application in other areas remains largely unstudied. This investigation uses a framework developed by researchers in athletics to examine how surgeons perform their best in challenging elective procedures. Although medicine and sports are quite distinct fields, surgeons and world-class athletes share many important performance traits. Like the athlete, the surgeon

- must be at his/her peak in specific periods demanding high performance.
- is directly responsible for his/her performance at those times.
- has a finite time in which to execute his/her specialty (minutes or hours).
- generally is scheduled to perform in advance.
- is highly skilled in unique ways.
- needs steady nerves.
- has performed thousands of hours of practice/training.

While athletes and surgeons have similarities in their pursuit of excellence, the difference in surgery is the underlying risk of losing life itself. Cooperative research between the sports world and the workplace has, in the past, produced a better understanding of how to achieve excellence under demanding conditions (Davis, Drucker, Foster, Gamelli, Gann, Pruitt & Sheldon, 1984; Loehr & McLaughlin, 1986; Rigauer, 1981). This study is directed at benefiting practicing surgeons, as well as residents and interns.

REVIEW OF LITERATURE

EXCELLENCE AND SURGERY

In the medical profession, performing with excellence is a fundamental expectation. In high-risk surgery, a doctor's diligence is essential because the patient rarely gets a second chance. Where lives are at stake and insurance rates are high, knowing how to operate under extremely stressful conditions and consistently perform with excellence is crucial.

Indeed, surgery exemplifies a high-performance workplace. Competition, training, success and reward were factors considered in Callan's (1983) and Copeland's (1983) analyses of stresses in medicine. Comparisons of complex surgery to sport and the arts were present in Csikszentmihaly's work (1975) which examined the "flow" in various high-performance disciplines. Similarly, Kuehn (1989), Spencer (1990), and Wright (1984) reported parallels between surgery, and the creation of music and art. Even the collaborative analogy of aircrafts to operating rooms has been made between disciplines (Murray, 1988).

EXCELLENCE IN THE WORKPLACE

Definitions of excellence have recently been evolving, from Maslow's theory of innate need for self-actualization and self-esteem (Maslow, 1970, pp. 367), to the internal responsibility expected in Glasser's "success and failure identity" (1976), and the social learning described in Bandura's "modeling" for achieving success (1977). Peters and Waterman (1982) were innovators in defining a standard for excellence based on leading companies that had gained a reputation for exceptional products and quality of workplace.

Some researchers are worried that efforts to be prepared, self-directed, and innovative are declining. Proper insurance coverage often seems to be the only consideration when someone prepares for a risky undertaking (Boodman, 1987; Clutterbuck, 1982a; Coombs, 1981). Sixteen-hour workdays are common in some professions. Yet workers are expected to show "individual" readiness before, during, and after tasks requiring high levels of ability and skill. Efficiency and endurance are more essential than ever, and delivery of consistent performances at critical points is often of primary importance (Boodman, 1987; Clutterbuck, 1982b; Corsini and contributors, 1986; Dickinson, Ferguson & Sincar, 1984; Janis, 1989; Roach, 1982). Boodman (1987) advises that "a new view is needed". Maddox, Anthony & Wheatley (1987) and Carney (1981) suggest it is time for an interdisciplinary approach.

Superior performance is a given on the international sports scene. Recently, intense mental readying techniques have been shown statistically to be the most significant factor determining excellence at the elite level (Orlick & Partington, 1988). Extrapolating on these new findings in studies of the workplace is timely. Encouraging mental readiness among surgeons, for example, is one approach to promoting excellence in the operating room.

MENTAL READINESS IN SPORT

"Sport psychology is the positive body of knowledge which provides athletes the means by which they can ready themselves to meet their goals" (Orlick, 1989). This school of thought "promotes the joy of play, the pursuit of personal goals, the extending of limits, the ability to focus on the moment, seeing opportunities within difficulties, learning from setbacks, dealing positively with distractions, and communicating effectively with oneself, one's body, and other people" (Orlick, 1989, pp. 1, 2).

Mental readying techniques have evolved as a sports science for eliciting ready-on-demand superior performances in competition. However, current advances reflect the groundwork of

various education researchers. For instance, the connection between mental ability and performance first received attention as a result of Thurstone's spatial orientation and visualization (1938, cited in Guilford, 1968), and Guilford's intelligence theory identifying the ability to anticipate (1968).

In the 1970s the link between imagery and performance gained acceptance with Piaget's exploration of mental imagery (Battro, 1973; Piaget, 1971), Glasser's use of "perceived picture album" in reality therapy (1976, 1984), Lozanov's "suggestology" (Bancroft, 1976, cited in Ostrander, 1979, pp.141-143), Nideffer's profile of the "inner athlete" (1976), and Ostrander's "superlearning" (1979). American golf star Jack Nicklaus claimed that his success was owed entirely to practicing concentration and visualization. "Precision in the game, he said, is 50% mental picture, 40% set-up, and only 10% actual swing" (cited in Ostrander, 1979, p. 147).

In the 1980s, five separate researchers found that performance results in elite sports were clearly associated with factors relating to the athlete level of mental readiness (Davis, 1984; Foster-Glore, 1981, cited in Loehr & McLaughlin, 1986; Loehr, 1982; McCaffrey, 1989 as cited in Orlick, 1989; Orlick & Partington, 1988).

Orlick and Partington produced an unprecedented account of mental readiness involving the entire 1984 Canadian Olympic team (1988). Their study detailed common factors among top 1984 Olympians before, during, and after their experiences of peak performance. The predictors included a variety of readiness factors, the helpfulness of others, the amount and quality of imagery, and attentional focus. Statistics on three readiness variables — physical, technical, and mental readiness — indicated that the highest and only significant predictor of final Olympic achievements was the mental readiness variable ($r = .41$, $p < .0001$).

Their study, which includes a collection of seasoned strategies from these gifted athletes (Orlick & Partington, 1986, 1988; Orlick, 1986) has had immense impact on both Olympians and less-experienced competitors in clearly defining concrete links between mental readiness and consistent, excellent performance.

Orlick (1989, 1991, 1992) has since formulated the conceptual framework for a "Theory of Human Excellence." It is based heavily on the results of in-depth interviews with world-class athletes (Orlick & Partington, 1988), as well as work with other high-performance domains (Orlick, 1991, p.3).

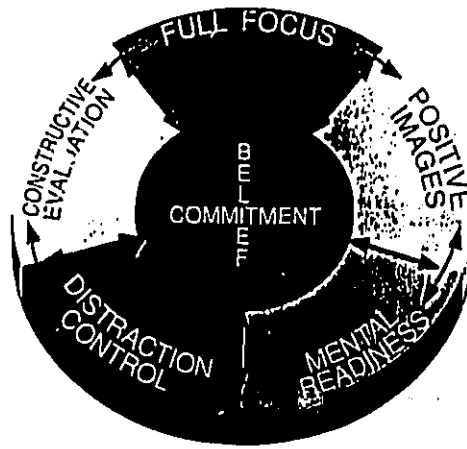
CONCEPTUAL MODEL: ORLICK'S "THEORY OF HUMAN EXCELLENCE"

Orlick's "Theory of Human Excellence" outlines important elements for success — still to be fully developed into a conventional theory (Hesse, 1967) — and introduces a conceptual model for achieving excellence at critical moments. The "Theory of Human Excellence" (Orlick, 1989, 1991, 1992; see Figure 1) states the following:

There are seven basic elements of excellence that allow human beings to excel, or to become the best that they can possibly be in a chosen pursuit. The first two elements of excellence are commitment and belief. Together they represent the dedication and perspective an individual carries to a given endeavour, the extent to which one believes in oneself and one's pursuit, and one's willingness to persist in the face of challenges and obstacles. As such, commitment and belief form the heart of human excellence. The remaining five elements of excellence are essential to achieving the highest level of human pursuits, and are comprised of the following mental readying skills:

- *Positive Images*
- *Mental Readiness*
- *Full Focus*
- *Distraction Control*
- *Constructive Evaluation*

Figure 1
Wheel of Human Excellence



(See Appendix A for description of each success element)

MENTAL READINESS IN THE WORKPLACE

A review of the workplace literature establishes a similar respect for the importance of mental readiness relative to achieving excellence.

Futurists recognize that a winning edge in the workplace will soon depend on accompanying the advancements of computer technology with the instinctive creative processes of the human mind (Maddox et al., 1987, p.118). Adopting and generating more visual, open, and intuitive approaches have been recommended to prepare individuals for uncertainties (Maddox et al., 1987).

Imagery and other creative, cognitive strategies have been tried in certain high-performance disciplines. Prominent users include the U.S. Apollo moon flight program (Clutterbuck, 1982b) and a growing number of executives (Maddox et al., 1987; Ray & Myers, 1986). The importance of deliberate exercises of the mind is now being taken more seriously for maintaining creativity and overcoming "mental constipation" (Clutterbuck, 1982b). Channon (1982) agreed that by

envisioning forthcoming events one is doing more than just talking about the future, one is actually making clear pictures of how one wants the future to be.

Developing a positive attitude gained credence through Pines's (1980) study of 400 successful and 400 unsuccessful executives. She found differences not in their education or experience, but rather in the way they handled stress. Successful executives looked at difficult situations as a challenge or a problem to solve rather than as a deadly stress to be avoided. Similarly, Boodman (1987) found in business that poor attitude and poor preparation know-how restricted efforts to be innovative.

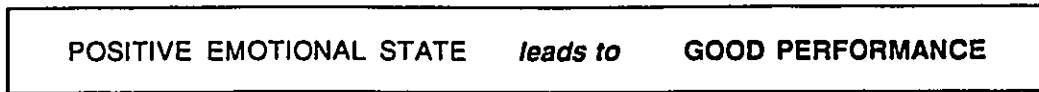
Personal vitality was also linked to high-level performance in the workplace. Maddi and Kobasa (1984), in studying executives and managers, found that executives who could keep themselves together and continue to perform at their optimum through extreme stress were people who had a "zest for life." In fact, these "hardy" executives shared three qualities not present in those who suffered from stress-related health problems: commitment instead of alienation, control instead of powerlessness, and challenge instead of fear.

Further to this, Maddi and Kobasa identified that relative to one's ability to fight stress, poor physical conditioning was not always a detriment; however, a close and supportive network of family and friends did seem to help. Helpfulness of others was later substantiated as a success variable by Orlick and Partington (1988). Even humor became a consideration when Kiechel (1983) concluded that "executives ought to be funnier."

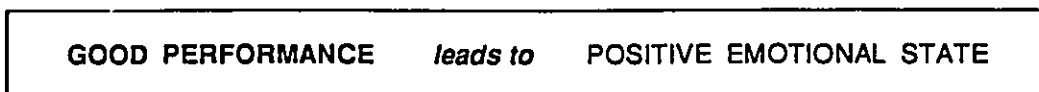
By the 1980s, researchers became interested in applying knowledge coming out of studies of world-class athletics to the workplace. Several researchers adapted sports principles for use in the business world, showing that parallels did exist between sport and work processes (Rigauer, 1981). Davis (1984) concluded that an individual using mental training skills on the job has an advantage.

Along these lines is Loehr and McLaughlin's work with executives, entrepreneurs, and athletes (1986) in creating the term "mentally tough." Like Orlick, these researchers established

their own conceptual model pertaining to performance excellence — "Ideal Performance State" — based on their workshop and consulting experience. Their findings support the paradigm:



not to be confused with the traditional understanding that



The former is neurologically explained by the configuration of the human nervous system, which actually requires the emotions to be in place first (Loehr & McLaughlin, 1986, pp.16-19).

Loehr and McLaughlin's conceptual model resembles that of Orlick's with respect to identifying positive attitude, focusing, distraction control, motivation, visualization, breathing control, rituals, and attention to stress. However, Loehr and McLaughlin embrace exercise, diet, problem-solving, and humor, which Orlick ignores. On the other hand, Loehr and McLaughlin's results omit Orlick's elements of pre-event plans for mental readiness, and constructive evaluation.

Businesses have independently ventured into more intuitive approaches to excellence. As the notion of success continually takes on new meaning, it has become important to learn how to perform one's best at crucial times. If inadequately prepared —if not "at the ready" — work may dissolve into distress, a constriction of innovative efforts, and the eventual loss of what is at stake (Boodman, 1987).

Researchers familiar with both sports and work have agreed that overcoming mental blocks and correctly preparing oneself mentally is critical for excellence in the workplace (Davis, 1984; Loehr & McLaughlin, 1986).

MENTAL READINESS IN MEDICINE

An extensive biographical search on medical practice was conducted using numerous categories related to excellence, performance, mental preparation, rehearsal, and stress management, extending over the past 30 years of research. This search resulted in literature which predominantly emphasized technical skillfulness, doctor-patient relationships, and controversies pertaining to sleep deprivation, malpractice claims, and ethical concerns.

Research relating to mental readiness strategies in surgery is lacking. More common was the agreement that the *patient's* emotional and psychological preparation is important in determining the outcome of procedures (Holzer, 1989; Korn, 1983; Walt, 1989; Wertheimer, 1985).

Assumption of responsibility is held as a key ingredient to success in surgery (Barker, 1971; Holden, 1985; Najorian, 1989; Spencer, 1983, 1990). The combination of competence, confidence and knowledge results in technical excellence and good surgical judgement (Holden, 1985). Wind & Rich (1983) highlighted behaviour patterns and personality traits of "good surgeons". This included attention to details, calm logical thought under stress, and effective leadership. Some studies in personal development of health care professionals have explored coping with failure (Applebaum, 1981; Bosk, 1979; Hayward, 1987; Wright, 1984) and developing of role models (Chapman, 1981; Davis et al, 1987; Dawson, 1990).

The greatest support for the value of mental training principles among medical professionals has emerged from the exploration of visual memory images for learning anatomy (Gibbons, Baker & Skinner, 1986; Horowitz, 1983; Korn, 1983; Najarian, 1989). Acute observation, visualization in three-dimensions (Najorian, 1989), and constructing both visual and kinesthetic images (Korn, 1983) were identified as critical for learning surgical procedures and performing appropriate motor skills.

The limited amount of medical literature related to mental preparation for surgery, suggests the need for further research in the area of mental readiness and excellence.

PROCEDURAL MODEL

Orlick's key elements in his "Theory of Human Excellence" provide a foundation for performing optimally. From a theoretical perspective, these success elements should apply in any demanding high-performance domain, including medicine. This investigation will ascertain the extent to which this proposition is valid.

The procedural model to be followed is taken from Orlick and Partington's 1988 study, which involved individual interviews with Canadian Olympic athletes who participated in the 1984 Olympic Games in Sarajevo and Los Angeles. The study's aim was to learn about athletes' personal states of "mental readiness". It explored what was necessary for the athletes before, during, and after Olympic competition to create consistent, ready-on-demand superior performances of excellence.

The 75 Olympians interviewed represented a range of sports grouped under seven competitive categories, and included both highly successful performers and athletes who had been identified as either inconsistent or as failing to achieve the level expected of them at the Olympics.

An "Athlete Interview Guide" was developed to conduct intensive interviews with the participants. Intensive interviews were considered appropriate for the following reasons:

- *Interviews provide an opportunity for the open searching and probing necessary to explore new topics, such as elite athletes' personal mental preparation strategies.*
- *Interviews enable the investigators to learn and understand the terms athletes use to discuss mental preparation topics.*
- *Interviews scheduled at the athletes' convenience increase the likelihood they will participate in the study.*

Qualitative data collected allowed for within-subject and between-subject comparisons. The within-subject options came from looking at Olympic, previous best, and previous worst

performances. The between-subject option was provided by sampling the athletes representing different levels of performance.

Interviews were arranged through a combination of a preceding letter, and follow-up telephone call. They were conducted one-on-one, face-to-face, one time only, and arranged at the athlete's convenience. Each interview was tape-recorded, and detailed notes were made throughout, with permission of the respondent. Interview time ranged from 45 minutes to two hours. Typed verbatim interview transcripts, reviewed by the athlete, were qualitatively analyzed.

Through descriptive analysis, common success elements and performance blocks were identified. Success elements were related to either the quality of training or the mental preparation for competition, as previously described under *Conceptual Model: Orlick's Theory of Human Excellence*". Major performance blocks that interfered with doing well at the Olympics included changing pre-performance patterns that had been effective, being selected late or dealing with last-minute changes, and being overcome by distractions.

This study was accompanied by a second investigation, in which an additional 120 athletes from the 1984 Olympic Games completed a questionnaire. Not only were the elements for success found to be the same, but Olympic performance correlated statistically with certain variables. First, mental readiness was the only significant predictor of Olympic percentile ranking ($r=.40$, $p = .0001$) relative to physical and technical readiness. Mental constructs, such as attentional focus (males: $r = .28$, $p = .005$; females: $r = .38$, $p = .01$) and imagery (males: $r = .41$, $p = .005$; females: $r = .72$, $p = .005$), were identified and operationalized as a result of the earlier interviews. Helpfulness of others was also found to be a significant predictor of Olympic percentile ranking (males: $r = .57$, $p = .001$).

METHODOLOGY

THE PURPOSE

The major purpose of this investigation was to assess factors related to mental readiness for performance excellence in surgery. In parallel with Orlick and Partington's study (1988), this investigation was designed to:

- explore the "readiness" of surgeons, from their own perspective
- probe into the factors associated with surgeons' mental, physical and technical readiness
- assess the level of mental preparation in best and less-than-best performances
- document the role others play in surgeons' mental readiness
- invite recommendations to improve mental preparation in the medical environment

This study includes two primary components: one confirmatory and the other practical.

Confirmatory Component

The purpose of the confirmatory component of this study was to examine the transferability of Orlick's "Theory of Human Excellence" (1989, 1991, 1992) and of the performance blocks from the Orlick and Partington study (1988), from excellence in sport to excellence in surgery.

Hypothesis: The success elements proposed in the Orlick's "Theory of Human Excellence" (1989, 1991, 1992) exist in whole or in part in the context of the surgical environment.

Practical Component

A secondary purpose of the study was to obtain practical information for surgeon's to improve their mental readiness for the challenges they face. This practical component was aimed at providing a list of effective mental training techniques relevant to excellence in the surgical arena.

SUBJECTS

The interview sample included 33 currently active surgeons, 26 men and seven women predominantly from the National Capital Region. The Heads of Surgery at five Ottawa hospitals identified those surgeons as being highly proficient in their specialty.

Six surgical specialties were represented. They were grouped as either high mortality (51% — neuro, cardio, and vascular surgery) or low mortality risk (49% — orthopedic, general, and plastic surgery).

Years of experience ranged from one to 30, with a mean of 11 years; 49% had over 10 years, 36% four to nine years, and 15% with one to three years. Fifty-five percent operated on adults, 30% were pediatric, and 15% did both. Seven surgeons had a reputation, among peers, the medical community, and the media, as being "elite" or "super-stars."

INSTRUMENTS

The "Athlete Interview Guide" (see Appendix C) from the Orlick and Partington study (1988) was adapted with pilot input from four leading surgeons (Dover et al., 1990; Keon, 1990) to create a "Surgeon Interview Guide" (see Appendix B). It relates specifically to surgeons' concentration, mental rehearsal, crisis management, and development of specialized thinking patterns. Although some changes were made to the questions, the body of the instrument remained the same.

In adapting the "Athlete Interview Guide" to surgeons, the following changes were made:

1. The interview questions were operationally adjusted, through the vocabulary and examples, to reflect the surgical environment. For example, "unusually challenging surgical procedure" and "immediately before beginning the operation" replaced "the Olympic Games" and "at the startline." Biweekly "Morbidity and Mortality Rounds" with peers were identified as being as much an opportunity to succeed or fail as the actual surgery itself, and was therefore incorporated into the questions.
2. **Managing crisis situations** during surgery was clearly critical to success. Consequently, preparation for crises, on-site crisis management, and distraction control in a crisis were given more attention than what existed in the "Athlete Interview Guide."
3. To assess the **differences in readiness between successful and less-successful performances**, the "Athlete Interview Guide" allowed for within- and between-subject comparisons based on performance scores. In the "Surgeon Interview Guide," performance readiness centered on comparing best and less-than-best performances of the highly proficient surgeons. Comparisons between subjects were based on elite reputation, years of

experience, surgical risk of mortality, achievements through different performance expectations, and gender.

4. Several **open-ended questions** in the "Athlete Interview Guide" enabled subjects to report **mental**, as well as **physical or technical factors** that influenced their performance. Since these questions were also part of the "Surgeon Interview Guide", the possibility of Loehr and McLaughlin's findings (exercise, diet, problem-solving, and humor), which were not examined in Orlick and Partington's work, could be explored.
5. An in-depth question on Sports Consultants was omitted in the "Surgeon Interview Guide," since it was premature to know if a comparable individual existed in the surgical environment. However, a question on the **roles of others** identified any significant others with respect to mental preparation.

PROCEDURES

This investigation was a qualitative and quantitative collection of data through in-depth interviews with highly proficient surgeons. The study design and procedures paralleled those used in the 1988 Orlick and Partington study, which examined "readiness" of 235 athletes for the 1984 Winter and Summer Olympic Games. Seventy-five of these athletes were taken through an interview process.

This study of surgeons included two stages. In the first stage, a pilot set of meetings were held with four leading surgeons (Keon, 1990; Letts, Dover, & Drzewiecki, 1990). The second stage involved 33 full-scale interviews.

The aim of the first stage was threefold: first, to gain approval for surgeons' participation in this proposed study; second, to ensure that the questions had been accurately adapted to reflect the

appropriate vocabulary and examples; and third, to develop the most feasible procedure for in-depth interviews in terms of scheduling, recording, and facilitating open communication. These pilot meetings helped to further refine the "Surgeon Interview Guide."

The second stage of the study followed Orlick and Partington's procedure of arranging interviews through a letter, and a follow-up telephone call. The letter explained the purpose of the interview, introduced the investigator, and provided assurances of confidentiality within the framework of the proposed design.

The interviews were one-on-one, face-to-face, one time only, and arranged at the surgeon's convenience. The interviews were held in the doctors' office or in a spare office at the hospital. All surgeons received a thank you note for their participation, and a copy of their interview transcript to approve its authenticity.

DATA ANALYSIS

Each interview was tape-recorded, with the permission of the respondent. Following completion of all the interviews, typed verbatim interview transcripts were prepared for descriptive analysis, as in the procedures used by Orlick and Partington.

To compare the transferability of Orlick's "Theory of Human Excellence" between athletics and surgery, the success elements were used as the basic framework for qualitatively analyzing the transcripts.

From 10 sample written transcripts (representing differences in gender, specialty, level of experience), the investigator and advisor extracted representative quotes. They agreed which quotes demonstrated the existence of each of the seven elements of excellence. A description of each success element along with representative quotes were then given to four reviewers. They independently went through all 33 transcripts to determine whether or not each success element was evident for each subject. There was full agreement between the reviewers with respect to

whether or not a particular surgeon's transcript warranted assignment to major success elements (i.e., commitment, self-belief, positive images, mental readiness, full focus, distraction control, and constructive evaluation). One major success element (i.e., positive images) required further clarification to attain complete agreement. For example the final criteria for evidence of positive images had to include statements about visualizing, imagining, seeing mental pictures, running a movie, feeling the tissue in their mind's eye, as opposed to just positive thinking or planning.

Performance blocks were also identified by the independent reviewers in a similar fashion and presented in a descriptive (frequency count) manner.

The quantitative section of the interview generated numerical ratings, which allowed for calculations of means, standard deviation, Mann-Whitney testing, and Wilcoxon Match Pairs testing.

ATTEMPTS AT CONTROLLING INVESTIGATOR BIAS

Many precautions were built into the procedure in an attempt to control for bias including:

1. The **pilot phase** assessed the relevance of questions and established appropriate, reliable vocabulary and examples. It also allowed for feedback on possible bias by the investigator.
2. **Subjects were not known** well by the investigator, nor was there any **conflict of interest** with this examined field.
3. All interview questions were treated in a **standard way** and in a **particular order**. Given the retrospective nature of the questions, the timeframe for subjects' recall was kept to a minimum (within the last few months). Questions divided the event into segments so details could be easily retraced.
4. The investigator **clarified or paraphrased** when necessary to check the clarity and understanding of the subjects' experience or perspective. Checks to monitor investigator bias

were also made early in the study (i.e. feedback from advisor after listening to initial interviews).

5. All subjects reviewed a copy of their interview transcript to ensure that it authentically represented their accounts and perceptions of what had actually transpired.
6. Data were categorized by independent reviewers and not the investigator. A cross-checking procedure was used by the assistants who independently assessed the data.
7. Concurrent with the Orlick and Partington study (1998, p.108), it was concluded that manipulating the responses of high-level achievers would be extremely difficult, if not impossible since these performers tend to be self-directed and act according to their own principles.

OPERATIONAL DEFINITIONS

Mental Readiness: Being "psyched", "totally ready", totally prepared". A high degree of mental readiness revolve around problem prevention and mental excellence (Orlick, 1989).

Challenging Surgical Procedures: Surgeons sometimes perform what they consider to be "routine" surgery but sometimes must also perform under difficult and exceptional circumstances.

Definitely there are some cases I'm much more up for than others. In fact, when I'm more up for it, it's probably more of a help because I have talked about, thought about, and discussed the case. (orthopedic surgeon)

The surgeons interviewed were asked to list examples of high-performance conditions in surgery, like the challenge facing an athlete at an Olympic competition. Challenging surgical procedures refers to elective surgery within the past month or two that was looked upon as

complicated, stressful or high-risk. Furthermore, the surgeon would have to have been active in performing the surgery and have known in advance that it was scheduled.

Seven circumstances were identified where an elective surgical procedure was judged to be complicated, stressful and/or high-risk. These challenging surgical procedures in rank order are listed in Table 1.

Table 1
Ranking of Challenging Elective Surgery

Challenging Elective Cases*	Total Responses (ranked percent)
High-risk procedure	66
Complex procedure	57
High-risk patient	27
Teaching others	27
First-of-its-kind procedure	21
Unfamiliar procedure	21
Special patient relationship pressure	12

* See Appendix E: Definitions for Challenging Elective Surgery

Successful performance: Surgery that the surgeon judges to be one of his or her best efforts in a challenging surgical procedure.

Disappointing performance: Surgery that the surgeon judges to be less than his or her best efforts in a challenging surgical procedure.

Surgery: Six surgical specialties were represented: cardiac, neuro, vascular, orthopedic, general, and plastic surgery (based on meetings with Howe (1989) and Keon (1989)).

Surgeons: Surgeons must perform through adverse conditions and multiple demands. Judgement, technical expertise, medical ethics, and stamina are vital. The following quotes illustrate the stresses inherent in surgery:

We're attempting to overcome something nature has put into the patient. Surgeons are basically aggressive. If they're not, and they're very timid, then they won't succeed. (elite neurosurgeon)

If you don't do any harm in surgery, then you've done some good. Our prime motive is "first to do no harm." Sometimes you do your best and still you do harm. (elite neurosurgeon)

We don't like to work with unpredictability. We like to have it all down pat. That's why a big part of the preparation is to try to reduce the unpredictability and keep surprises to a minimum. (general surgeon)

There are times when everything goes right. When I went home that night I knew that I had done something that was almost impossible in that case. Nothing else that I've done can compare with it. (elite cardiac surgeon)

There have been many, many, many times in my life where I've come out and wished I'd have done something different. There's the old scenario of doing too little or too much. (elite cardiac surgeon)

We have contact with life and death all the time. That's very hard to understand. Why do little children die of brain tumors? That is a big tragedy. These things are very hard to understand. In my view, if there is nothing "above," then how do things work? I think these are "mysteries of faith. (elite neurosurgeon)

Surgeons are good or bad mostly because of two things: judgement and preparation. ... Most surgeons with experience are technically competent. I don't feel that I can tie my knots better one day than other days. Usually it's all in the background preparation. (elite neurosurgeon)

Understanding the magnitude of responsibility for a surgeon serves to emphasize the importance of being able to consistently perform at optimal levels in their high-risk workplace.

RESULTS AND DISCUSSION

The material presented in the following chapter is based upon qualitative and quantitative analyses of the surgeons' interview transcripts.

In the first section, surgeons' views of mental readiness are quantitatively profiled. This included an overall perspective of readiness, followed by an analysis of readiness factors between successful and disappointing performances, and within subjects. In the second section, factors related to success are examined. A detailed analysis of interview transcripts is presented using the framework of established success elements from Orlick's "Theory of Human Excellence". This is followed by a section on the performance blocks experienced before and during surgery. In the next section, characteristics which distinguished elite surgeons, high-mortality-risk surgeons, best performances, gender, and those with different views on success are presented. The final section identifies other mental practices in surgery. Coping strategies are analyzed, perspectives on training and experience are given, followed by a list of helpful external analogies.

Representative interview quotes are presented throughout the results to illustrate the basis upon which statements or categories were formulated. The surgeons were free to respond to each question in an open-ended way, and often mentioned more than one factor as influencing mental readiness.

OVERVIEW OF MENTAL READINESS

To surgeons, mental readiness means being confident, and in control. It also means having the facility to access knowledge, make the best use of experience, concentrate totally, and make constructive, accurate decisions at all times.

These quantitative results demonstrate strong links between mental readiness and surgical performance outcomes. Each battery of variables (dependent variables) is considered separately, starting with the importance of the state of mental readiness relative to technical and physical readiness, then the differences between successful and disappointing performances, followed by differences found between the five subject groups (independent variables); i.e., gender, years of experience, mortality risk of surgery performed, age of patient, and elite reputation.

Overall Importance of Mental Readiness

Surgeons are taught that their first duty is "to do no harm." They all want to do the best possible for every patient. They speak often of the seriousness, challenges, and the possible consequences of error in day-to-day dealings. The demands are unique. Surgeons know that the patient has entrusted them with everything, including life itself. These quotes help to qualify the value placed on mental readiness.

You can overcome just about anything if you're properly prepared for it mentally. When the operation starts, you can shut everything out of your life if you're ready for it. When people come apart (mentally) it's because they haven't taken enough time to prepare for when they're in there. Then they realize that they're into something they don't completely understand. That's when it comes apart. (elite cardiac surgeon)

The mental preparation is as important as physically being there. In other words, if you're not with your case, if you're not positive about it, and if you have not convinced yourself that you can do this and give the patient a reasonable chance of improvement, then I don't think you should be doing the surgery. This comes from

mental preparation, training, and attention to detail for every case. It's not hit-and-miss. You have to produce it every time. (orthopedic surgeon)

If you're mentally ready, it will work. Mental preparation is very important. ... A lot depends upon you as an individual — your orientation, your knowledge, your mental frame, and how you put things into perspective in your own mind. (elite neurosurgeon)

I would give a very, very high priority to mental readiness as it applies to your overall knowledge, experience, and overall preparation for this given event ... It would probably be higher than the technical preparation because mental readiness involves the technical preparation. It's everything. It's the confidence of knowing that you have done everything that can be done before you go in there, that you have prepared yourself as well as you possibly can, and that you know you can do it. (elite cardiac surgeon)

Mental readiness is very important because if you're ready that means your stress is none or very little. If you don't have mental readiness, you have to push to do it. When you're stressed, your concentration is less. A surgeon should not do surgery while under a lot of stress. Concentration becomes too difficult. ... If you're stressed, that means that your mental preparation is wrong. You have to have really prepared yourself well to go into surgery. (elite cardiac surgeon)

Your mental preparation is probably even more important than your actual technical skill. ... Mental preparation is at least 70% of every operation. Technical would be about 25. Physical about 5. There's no doubt about it, in my particular field, stamina is very important. The field is not for everyone, but you train yourself to accommodate that. (elite neurosurgeon)

Sometimes, even though you know it's a bad case, in the back of your mind you know you're going to get him through. You have to have good odds to go into some place like that, unless there is a very pressing reason. You have to convince yourself that you are doing the right thing before you go in. Also, that there is a good chance that you will succeed even though the odds are against you. (elite cardiac surgeon)

Mental readiness is the main feature in our specialty. With technical readiness, you are always technically ready unless you've had an injury. ... A surgeon will rarely have something the matter with the mechanics of doing the operation, but he can often have something wrong with the central computer, if he has his own mind-set. You have to be 100% mentally ready for a serious operation but not so much for minor, routine things. (elite neurosurgeon)

The mental part of preparation is far greater than the technical skill. You can't have a klutz operating, but at the same time you can have a well-prepared klutz do a far better operation than somebody who has a very steady hand who really hasn't thought a great deal about the operation. ... He can perhaps circumvent the technical handicap he may have, be it a physical handicap or an instrument that isn't working right, by a contingency plan. That is a mental thing. (elite cardiac surgeon)

Given two guys who have the same technical ability and given the same set of conditions, if one guy's mentally prepared and the other isn't, that can have a great affect on the outcome (cardiac surgeon)

When asked about the relative importance of mental, technical, and physical preparation for excellence in surgery, mental readiness was said to contribute 49%, technical 41%, and physical 10% (see Table 2).

Table 2
**Overall Importance of Readiness
to Performance Excellence in Surgery**

Readiness Factor	Mean Percentage	Standard Deviation
Mental Readiness	49	20.8
Technical Readiness	41	19.1
Physical Readiness	10	8.9
<i>Total Readiness</i>	<i>100*</i>	

*Note: On a scale where readiness factors total 100%.

From the perception of highly proficient surgeons, mental readiness clearly plays a major role in the success of surgery. This result supports that found in Orlick and Partington's study (1988) with high-achievers in sport. Even with the most modest of interpretations, given the standard deviation sizes, mental readiness must be judged, if not more important, at least equal to technical readiness.

Differences in Readiness Between Performances

Surgeons were asked to think back as to how they felt just before both a successful and a disappointing challenging surgical procedure. They were asked to rate their degree of technical, physical and mental readiness at that moment on a scale from 0 to 10, with 10 representing 100% ready and 0 representing 0% ready (see Table 3).

Mental readiness ratings during successful performances had the least amount of variance, while physical readiness had the greatest, as shown by the size of the standard deviation. Conversely, mental readiness had the greatest variance during disappointing performances.

Table 3
Means and Standard Deviations for Readiness Factors
in Successful and Disappointing Challenging Surgery

Readiness factors	<i>Successful Procedures</i>		<i>Disappointing Procedures</i>	
	Mean	Standard Dev.	Mean	Standard Dev.
Technical	9.27	0.91	8.81	1.36
Physical	9.27	1.15	8.81	1.39
Mental	9.44	0.69	8.22	1.95

Note. On a scale of 0 to 10, where 10=100%

Non-parametric Mann-Whitney tests (two groups with one score each) were used to measure differences within the readiness factor scores (dependent variables) between the various subject groups (independent variables).

Scoring was consistent within all three factors for both successful and disappointing performances, with one exception. The only significant fluctuation in the scoring occurred between surgeons having one to three years experience. They rated themselves lower in technical readiness in their disappointing performance ($p = .044$) than surgeons with over ten years experience (See Appendix F).

Differences in Readiness Within Subjects

Wilcoxon Match Pairs tests (i.e., two scores with one group) were used to measure differences in readiness between successful and disappointing performances (dependent variables) within the various subject groups (independent variables) (see Table 4).

The greatest change in readiness was in mental readiness ($p = .003$), as compared to technical and physical readiness. This difference between subject groups was most prominent in males ($p = .005$), those without an elite reputation, and to a lesser degree in pediatric surgery ($p = .012$), and in those with ten years or more experience ($p = .028$).

Table 4
Differences in Readiness Between
Successful and Disappointing Surgery
Within Subject Groups
(Wilcoxon Match Pairs tests)

Group	Percent of Surgeons	<i>Differences in Readiness Between Successful and Disappointing Performances</i>		
		Mental	Technical	Physical
All subjects	100	.003***	.039*	.032*
Males	79	.005**	.010*	.250
Females	21	.465	.787	.068
High-Mortality-Risk Surgery	51	.043*	.028*	.285
Low-Mortality Risk Surgery	49	.033*	.343	.063
Surgery on Adults only	55	.075	.205	.655
Pediatric Surgery only	30	.012*	.205	.075
10 yrs or more experience	49	.028*	.225	.178
1-6 yrs experience	36	.050	.091	.144
1-3 yrs experience	15	.423	.109	.317
Elite Reputation	21	.180	.655	.317
All Others	79	.008*	.056	.058

* sign. $p < .05$
 ** sign. $p < .01$
 *** sign. $p < .005$

SUCCESS ELEMENTS: ORLICK'S "THEORY OF HUMAN EXCELLENCE"

This section compliments the previous quantitative data as a qualitative analysis of the surgeons' interview transcripts.

Orlick's "Theory of Human Excellence" provides psychological attributes that allow one to excel, or to become the best that they can possibly be in a chosen pursuit. It identifies seven basic success elements: commitment, belief, positive images, mental readiness, full focus, distraction control, constructive evaluation.

Surgeons were asked a series of questions about their mental preparation and focus in a recent challenging surgical procedure that went very well — a best performance. (See interview questions in Appendix B: Surgeon Interview Guide). The seven success elements of Orlick's "Theory of Human Excellence" were used as a framework to assess their responses.

The success elements are presented below. Each success element is reported in three ways. First, the success element is discussed and subdivided into its profiling characteristics and percentage frequency counts. Second, representative interview quotes are provided to highlight details of the most interesting character traits. And finally, relationships found through chi-square analysis regarding mental readiness traits, which could be valuable in further understanding the success elements, are discussed as points of interest. (Note: As an adjunct to the qualitative analysis of transcripts, chi-square testing was performed on various mental readiness characteristics to help determine the relationship between certain variables.)

Commitment

All of the surgeons interview transcripts reflected a high level of commitment. This commitment was evidenced by giving extra time, being dedicated to their profession, being persistent and meticulous in setting high standards, and staying open-minded and compassionate.

For 72% of surgeons, commitment was also a result of feeling personally responsible and fearful of errors. (See Table 5)

Table 5
Indicators of Surgeons' Commitment

Commitment Indicators*	Total Responses (ranked percent)
Dedicated lifestyle, giving extra time	79
Setting high standards, persisting in being best	76
Feeling responsible and fearful of errors	72
Having compassion	46

* All respondents had at least one indicator of commitment

Dedicated Lifestyle

Experienced surgeons saw commitment as a full-time job with a dedication to give more when needed.

dedicated lifestyle — You can't be a part-time surgeon. To do surgery well, you have to be full-time and you have to be totally devoted to it. That has to be your main thing. If you take it as a hobby or a part-time thing, I don't think you do it as well. ... Of course it makes your life really narrow, but that's what you've chosen to do. ... You do only one thing; you're not into a lot of diversion. Some people are trying to be administrators and other things, and doing surgery part-time. I don't really think that works out too well. ... You really have to be totally dedicated. I think it's just like training for any sport. It's a full-time training thing. It's a regimented routine. You're doing a lot of surgery and you're doing the same thing. You're not out messing around. (elite orthopedic surgeon)

dedicated lifestyle — You can't prepare yourself, either technically or mentally, if at some point you can't dedicate yourself at a certain specific time wholly to that. You've got to have a real switch that says, "Well, I've got an emergency coming in and I've got tickets to the theatre — tough luck theatre, I'm taking the case." ... Unless you have that, I don't know how you can do a proper job. (cardiac surgeon)

extra time, personally responsible, compassion — Always, always, the bottom line is the patient. You need to keep that focus in mind. ... I have a supportive family, so if I'm late for an engagement in the evening, that really doesn't make a difference. My wife understands and all my friends understand. ... You've got to realize and keep your priority there. Everyone else will actually

understand. Those that don't understand, you don't have to worry about. You have to take that attitude, the patient comes first. ... I get called all the time when I'm not on call. I come in because that's the bottom line. Everybody around who deals with me knows that I will go. There are no ifs or buts. That's how I handle distractions.
(elite neurosurgeon)

Several surgeons were of the opinion that the coming generation of doctors are shifting from a lifestyle of absolute dedication to a way of life that distributes time more evenly with personal priorities.

We (those of us who have already graduated) still have one foot in the old era, where mental readiness also demands dedication. It's not uncommon for a lot of the old-time surgeons to say, "Surgery comes first, and my family comes second." ... We are at the threshold of a new era, where the newer residents believe, whether right or wrong, that lifestyle and family is first and surgery comes second.
(cardiac surgeon)

Dawson (1990) reflected this new view in suggesting that with a demanding surgical life, all surgeons need to establish a pattern of time away as "expansion gaps" for other interests. Professional commitment is then put second to family, wider education, and relaxation.

High Standards

Striving for perfection, attending to details, and careful planning characterized the high standards these proficient surgeons set for themselves.

high standards — *I believe in perfection. Everything you do, you have to do it as close to perfection as possible. You can't afford mistakes. I always feel that the moment you put your guard down, you get a punch in the nose. You always have to be on your toes. You can't relax, you can't let go, you cannot say, "Ah this is crooked but it's okay." No, it's not okay. You have to be compulsive. I believe that. I am compulsive, with every detail.* (elite neurosurgeon)

high standards, personally responsible, compassion — *This is the most important thing that I do. It's my biggest responsibility, other than to my family. Once in the operating room, the biggest responsibility that you have is to that patient, to do that procedure as well as you possibly can. ... I place certain demands upon myself. I want every operation to be what I think is perfect.* (cardiac surgeon)

high standards, personally responsible, compassion— You've got to be very demanding right at the very beginning. You can't make most of your bridges safe, every single bridge has to be safe. It's the same thing with the work that I do. You can't just have some of your operations go okay; every one has to go okay. That starts right from the beginning. It's a preparedness of what goes on throughout your life. It isn't something that you can just turn on or turn off. You have to really strive, and work at trying to be the best. It isn't just something that you come by naturally. It's something that you do have to work at. It's a matter of not accepting 90% or 95%. You have to go for 110%. (cardiac surgeon)

high standards — They say I'm too demanding. But you know what? I say, "I'm not sacrificing any of this quality or what we do for the sake of convenience. That's too bad if they don't want to work here." I am very meticulous and careful in these procedures because these people can either be made worse or be disabled for life for some silly little mishap or something that hasn't been properly corrected. (neurosurgeon)

high standards — You have to be right on. You have to be exactly sure of what you're doing for each patient. (general surgeon)

Personal Responsibility and Compassion

Through chi-square analysis, it was found that having compassion, together with giving extra time and dedication, was reported more often by experienced surgeons (more than 10 years experience) as compared with those with less experience (less than six years' experience; $p = .002$ and $.024^{**}$ respectively). The literature cites commitment to responsibility, high standards, and compassion as forming the "soul" (Najorian, 1989) and "intellectual energies" (Spencer, 1990) of a surgeon.

personally responsible, high standards — When I'm in surgery, essentially I put 100%, if not 105%, of myself into it. I forget other problems. You've got a life in your hands and you want to keep that life going in the best condition possible. This is our goal. ... we're dealing with a disease that kills. (cardiac surgeon)

personally responsible, extra time — You just put everything else out of your life. Nothing else matters. That can be a problem in your own personal life, where you'll frequently come under a great deal of social criticisms. People are sometimes unfair in their criticisms. Personally, I have frequently been in the position where I've been committed to a dinner engagement of a very high social order, which you just don't miss according to social protocol. However, I just wasn't able to go because I just couldn't walk out of the operating room. That's very difficult to deal with because you get tremendous criticism for that. The other people around the room frequently feel that they're more important than you are.

They say, "If I can arrange my agenda to be here, this guy could have arranged his. How did he ever get into this kind of fix in the first place?" From that point of view, life can be difficult. All you can do is not be concerned about any of that stuff during the course of the operation. You stay there until it's finished, or until the situation is under control. (elite cardiac surgeon)

personally responsible — I have a mental mechanism of just putting all the rest out of my mind. I just say, "Those other things just aren't important. What's most important is that patient, who is now unconscious, asleep on the O.R. table, whose life is in my hands. He is totally dependent upon me." ... I say, "I've got to do my best for this patient, who is now completely in my hands." (elite neurosurgeon)

personally responsible — You are responsible for the patient you admit, operate on, write notes on. Through medical school, this responsibility to the patient is our main driving force. (general surgeon)

compassion, extra time — Her son, who was an extremely nice man, came in with her and talked to me. I initially said, "I don't think that it can be done." She was sitting there agonizing. As I talked to the two of them, I decided, "Well what the hell, the lady's going to die in a month anyway." So I said, "Okay, fine, I'll do it. I'm going to have to do it on off time, but I'm going to do it." I did it, she came out and she's all right. (elite cardiac surgeon)

compassion — I knew from day one I was going to be a neurosurgeon. ... I didn't want to be anything else. ... At the age of 17, I knew exactly what I wanted. ... Most people try to frustrate you and say, "Look, you're not going to be able to do that because of this, because of that" or "How do you know that you're going to want that, it's too early in your career." This even came from doctors. When I was a second- or third-year medical student, I went to speak to a neurosurgeon. I said, "Look, I want to come and get involved." The guy sent me back and said, "It's too early in your career. Go back and once you pass these subjects, you come back and see me." So fine, I did that. I went back home, studied, and a couple of years later I went back to the neurosurgeon. He gave me all the cons that you could imagine. Nothing positive about it. This is the guy that tries to make sure that you're on the right track. But he didn't turn me around with his stories. I said, "Yes, I still want to be a neurosurgeon. It's fine, I'll accept what you tell me, but I still want to work with you." Then he took me under his wing. (elite neurosurgeon)

Belief

All surgeons interviewed projected a strong belief in themselves and their ability to carry out surgery. However, their level of confidence was generally qualified with acknowledgment that it was relative to their number of years in practice. The contributors to the surgeons' belief in themselves are as follow in Table 6.

Table 6
Contributors to Surgeons' Self-Belief

Contributors to Self-Belief*	Total Responses (ranked percent)
Acquired self-confidence	100
Control of the work environment	70
Mentor support	61
Natural self-confidence, other previous successes	42
Strong religious or spiritual belief**	12
Kinship of a close "buddy"	12

* All respondents had at least one strong contributor to self-belief

** See also *Positive Images* section

Acquired versus Natural Self-Confidence

Although 42% of surgeons felt that they began with some natural self-confidence, all agreed that it is fundamentally something learned over the years through experience. Experience brings a better working knowledge of responsibility to the patient, contingency planning, and how to decrease stress.

The majority of surgeons enhanced their self-belief by seeking ways to set controls on their environment. For example, they developed rituals, used positive thinking, picked their own team, and derived ways to postpone or cancel other surgery when more preparation time was needed (See *Positive Images* and *Mental Readiness* sections for more details).

acquired confidence — Every step that goes well is a building process. Every small successful step builds me up for the next step. Once I arrive to the area of the tumor, I say, "Gee, it's in my view." Something that has been successful to that point should be successful to the end. It's a build up of confidence. It's not just there. (neurosurgeon)

acquired confidence — I'm not the best surgeon in the world, ... but I feel competent. I know I've done my homework. Hence, I'm surgically and mentally prepared. It's not easy. The stress is still there, but not the anxiety of not being capable of performing. The stress of doing something difficult will pass. I'm prepared and I know I'm capable. Otherwise, I would not be able to function. If I

had no confidence in myself, what would I be doing in the operating room? (cardiac surgeon)

acquired confidence — If a person knows that he's a good surgeon in the real sense (I don't mean that you just make yourself believe that you're good when you're not), your peers feel that you're good, and you're doing the surgery well, then every time you have a case you say, "I'm a good surgeon. Whatever may come I will do it". ... But you have to be good in order to say that. It can't be false. (elite cardiac surgeon)

acquired confidence, natural confidence — My team is as experienced as I am. They've seen it all. ... If I'm not good enough then I shouldn't be here. I'm here because I'm good enough. There is only one person who says, "I'm the best surgeon" It's myself. If I know that I've done my best, what else can I do?. (cardiac surgeon)

previous successes, natural confidence — I believe that the same thing that gave me success in swimming brought me success as a surgeon. (orthopedic surgeon)

previous successes — It starts much, much earlier than when people are in training. It starts when you're growing up. When my daughter was in public school, she was going through spelling and somebody said, "It's really not important that she learn how to spell properly. She has to be able to express herself." I bought that a little bit, but I don't think that's all true. You've got to be very demanding right at the very beginning. (cardiac surgeon)

Good preparation habits and positive thinking may be major contributors to enhancement of confidence. It was found that those who reported a natural self-confidence, versus those who did not, rated higher in both their use of books as study aids (chi-square testing; $p = .004^*$) and positive thinking ($p = .038^*$) in preparation for surgery.

Mentors

It's possible that role models play a significant part in nurturing dedication to excellence. Surgeons who reported that having mentors was an important factor in their self-confidence, also exhibited commitment through having compassion (chi-square testing; $p = .037$), and feeling

personally responsible and fearful for errors ($p = .006^*$)¹. Role modeling was depicted as an important influence on student decisions to become surgeons (Davis et al, 1987, p. 21), on bedside manner (Chapman, 1981, p. 14), and on technical skills (Dawson, 1990, p. 22).

mentor — It's a matter of emulating your masters. If you respect a man's judgement and skill, then you try to be like him. You develop confidence when you know you're learning from the best. (elite neurosurgeon)

Religion and Kinship

Religion and the kinship of fellow surgeons were reported by 12% of surgeons as strong factors in enhancing self-confidence. Strong religious or spiritual beliefs were an important influence in the confidence of elite surgeons (chi-square testing; $p = .005^{**}$). This belief provided a necessary psychological foundation to prepare and cope with the stresses ahead. To others, intimate bonds with colleagues gave inner strength.

religion — I'm not a strongly religious person, but I believe in God. Every surgery I go to, I pray to God. This is the psychological thing that gives me strength. There are no written books or anything, just God, your God, my God, everyone's God. I pray to God to make me successful and grant that the patient will be okay. I psychologically prepare myself because sometimes you go in and you come close to surprises. (elite cardiac surgeon)

religion — I'm a believer. I get a lot of help from "up there." When I'm in times of trouble, sometimes I say, "God help me." I say it to myself during surgery. For me it helps because I strongly believe. To be in this type of job, it helps to be strong in spiritual preparation. I couldn't do it otherwise. Medicine is an imperfect thing. We are human beings and we're technicians, period. There is something else in control. There is someone up there that guides you. Mind you, that's not all. You have to do your homework, but there is a factor there. In my way, I strongly believe in that and it helps. Maybe others say, "No, I don't believe in that nonsense." Your belief is another factor that plays in your mental preparation and your spiritual preparation. (elite neurosurgeon)

¹ Note: When a chi-square result was significant and of particular interest, but showed a warning that one or two cells had a count less than five, the figure is identified with "*" or "***" respectively.

spiritual — The spiritual side is important. My father was a minister. There are certain guidelines that you have to follow. It's part of being disciplined. You have to follow those guidelines as much as anything else. (elite orthopedic surgeon)

kinship — You have to have "a brother." ... Our first ten years of practice we almost lived together. We just talked about everything, every case. Every time we'd have a disaster, we'd be on the phone to each other. You dump your soul, then you feel better and you do it again. Otherwise you might be shy to get back on. (neurosurgeon)

Positive Images

Positive imagery was a common practice in psyching before surgery, and performing through difficult phases. Mental imagery was reported by 79% of surgeons either before or after surgery. It was used by 73% of surgeons for rehearsing in preparation, and by 27% for recalling and evaluating performance details. Imagery was also used in coping with negative consequences (see *Coping Strategies*). Medical researchers have agreed that visual memory is an asset in recalling anatomy and surgical procedures (Gibbons, 1986; Horowitz, 1983; Korn, 1983; Najorian, 1989).

Positive-image strategies were identified and rated as shown in Table 7.

Table 7

**Positive Imagery and Positive Thinking Strategies
Used for Challenging Surgery**

Positive-Image Strategies	Total Responses (percent)
<i>Imagery*</i>	
• Imagery in preparation	73
• Imagery after surgery	27
<i>Positive thinking**</i>	
• Psyching, positive in preparation	70
• Enjoyment experience during surgery	46
• Crisis control: positive thinking	49
• Lull control: positive thinking	15
• Praying before or during surgery	12
* 79% of respondents used some type of imagery.	
** 97% of respondents used positive thinking. Additional quoted positive thinking are in the following sections:	
• Psyching in preparation	<i>Mental Readiness</i>
• Enjoyment experience	<i>Full Focus</i>
• Crisis control: positive thinking	<i>Distraction Control</i>
• Lull control: positive thinking	<i>Distraction Control</i>
• Praying before or during surgery	<i>Belief</i>

Imagery

Surgery lends itself well to creating and rehearsing visual and tactile experiences. The picture images were of varying degrees of vividness and quite often replete with other sensory experiences. These mental pictures appeared to be of special value to surgeons in rehearsing for:

- transforming two-dimensional textbook drawings into three-dimensional images of reality
- rotating a surgical procedure to suit various angles of entry
- sensitizing themselves to the feel of the tissue to recognize when they're reached the right area
- rehearsing the procedural steps to develop a more fluid movement

- anticipating potential hazards and corresponding courses of action
- memorizing the "perfect" result

imagery — I have an idea as to what the perfect inside should look like. Each time you're trying to reproduce that as close to that as you can. With orthopedics, it's never perfect. It's a little like carpentry: You shave a little off, put it together, and match it. We use saws, drills, and all that kind of stuff, so it can never actually be perfect. Some of the residents use that word. They say, "Oh, that's perfect." It's pretty good, but it's not perfect. There's that idea of perfect and then there's what you can actually achieve with whatever tissue you are working on. (elite orthopedic surgeon)

imagery — A surgeon needs to be able to see in three-dimensions. This skill is underestimated and not taught. First, you have to be able to transfer two dimensions to three dimensions. Secondly, you have to be able to rotate and tilt the position. You lose perspective with changes in the body position. (general surgeon)

imagery, plan steps — My motto is to visualize. For instance, I visualize myself cutting the skin and the fat, seeing what muscles are underneath, knowing what instrument I'll use to cut with. Then I'll think, "Oh yes, remember to get your cautery out, to burn the muscle instead of cutting it so you don't get complications afterwards with your blood clotting (the hematoma)." I just visualize what I'm doing. ... When I was first starting out and doing a cleft lip, where I was operating on a baby's head upside down, I'd do my drawings upside down. I always have a visual picture in my head when I'm doing something as to how I'm going to do it. It's like seeing all the tissues in three dimensions A lot of the time I'll actually remember how it felt, how much I had to press, and how much I had to handle the tissue to get to the right spot. If you're in the right spot, often it is very easy to do what you want it to do. If you're not in the right spot, it's hard. ... The "feel" of it is part of it. (general surgeon)

imagery, anticipate complications, plan steps — It's all planning. Usually everything goes very well but sometimes it doesn't. Before the surgery, you have to know what you are going to do. ... In the planning stage, you're visualizing what you're going to do. Sometimes when you look at the patient's angiogram, you know that case is going to be very difficult. Your mind is working on how you can overcome this difficulty. In one way it creates stress, but in another way it helps you solve the problem. ... I'm meticulous so that is reflected in how I see and visualize surgery. For example, I say to myself, "This patient is going to have beautiful grafts; everything will be just perfect," and I visualize it. (elite cardiac surgeon)

imagery, anticipate complications, plan steps, subconscious — When we make a decision to operate, it's sometimes months ahead of time. At that time, I would make the decision to do this type of procedure and read about it, and then forget about it until the week before. The week before I know I'm operating, I get the abstracts I have copied on the procedure and the techniques, and read about it. The night before going to bed, I rehearse the operation in my head, then sleep on it. It's very visual, step by step. I see myself doing it. I go through the different steps. What's important in surgery is to be one step ahead of the problems. You think of the problems that can occur and what would be the solution. You cannot always

think of all the complications, but you have to be ready if they come up. If something you haven't thought of comes up, you can take care of it with the years of experience you've built up. (cardiac surgeon)

imagery, anticipate complications, plan steps — I've rehearsed all the potential scenarios that I'm familiar with given my experience and based on the communication with others. I've also worked through contingency plans in my mind. If it's a planned elective procedure, my most intense period is the night before at home, and then often the half hour or the hour that the patient is actually being prepared for surgery and anesthetised. I do most of it on my own and then I tend to review my options again in the operating room, with the x-rays right there in front of me, in case I've overlooked or forgotten some simple little detail. ... I'd say my visualization is 80% visual and 10% motor, and other sensory parameters. ... It's 3-D imagery. "Where is everything going to be? What am I going to encounter?" I can sit right here in the office, or I can be driving the car or be anywhere at all. I can just turn on the cameras and I can do 3-D imagery. I rotate it around in different planes almost like a hologram because that's what surgery's all about. You don't necessarily just go in on one trajectory. The trajectory may change according to how you move your instruments around. So I do an awful lot of imagery before surgery. ... It comes so natural to me, I assume that many others use it. ... I've always been a 3-D person. It's just a very natural process for me. (elite neurosurgeon)

imagery, anticipate complications, plan steps — Usually at night lying in bed, I think, "Okay, tomorrow I will do this, and then control at this level and then the next step will be to go down and expose this vessel, and the next thing would be this." I would rehearse the operation step by step, like rehearsing a play. I think about the potential problems. I think, "Okay, if I get faced with this, I would do it this way." So you have all the scenarios laid out. ... You have an algorithm in the way you want to proceed. I see it in pictures. (cardiac surgeon)

imagery, plan steps — You review the operation. You read over the standard technique for doing it. You have that in your "eye," memorized. You have a visual image of what you want to do, and you go and do it. (elite orthopedic surgeon)

imagery, plan steps — You definitely visualize. You go look at the book, and you have an idea of what you think is the perfect way to do it. You have that idea. I generally do it the night before, because I get up early in the morning and usually run first. I have a couple of text books in my locker at the hospital. I may just take a brief look at it, but usually it's the night before that I look at it. You rehearse, memorize that pattern, and know the steps that you are going to do, because the nurse is not sure what you're going to do next. You run through all the steps. You have all the steps that you plan in your mind just like somebody who's doing any kind of complex diving skill. They would say, "I'm going to do this, this, twist and bang!" You go through it all in your mind. (elite orthopedic surgeon)

post-imagery — You always do a post-mortem in your own mind on your performance. ... Not in any particular setting. You don't go back to your office and deliberately think about it but it's on your mind for a little while afterwards. Sometimes you actually replay the whole operation in your mind. You replay it just like a video and say, "Did I really do it the way I should have done it? Could I have done it differently?" There's a lot of replay that goes on. ... You actually see yourself. You almost feel it as you're doing it. (general surgeon)

Careful analysis of the surgeons' transcripts revealed that the preferred place for mental rehearsal was at home. It was most often practiced at home by 49% of the surgeons, in the operating room by 24%, at the scrub sink by 24%, in the lab by 6%, and in their office by 3%.

Surgeons who used imagery in preparation for surgery, compared with those who did not, reported taking time in a crisis to assess backup options prepared and rehearsed (chi-square testing; $p = .005^*$). They also reported doing self-evaluation by assessing the result ($p = .026^*$). Perhaps imagery practice is a particularly effective aid when trying to recall action plans in high pressure situations and after surgery for self-evaluation purposes.

The most consistent users of imagery, both in preparation for surgery (chi-square testing; $p = .025^*$), and in self-evaluation after surgery ($p = .031^*$), were those who saw their successes as based on personal performance. It's possible that rehearsal with imagery enhances self-confidence.

Positive Thinking

Mental imagery was viewed by some of the exceptional surgeons as an advanced skill that develops with practice and experience.

imagery, experience — When I first began, I was less into mental imagery. Of course, then my contingency plan preparation was far less elaborate than it is now. I think you build upon every case. (elite neurosurgeon)

While 79% reported using positive imagery, almost all surgeons (97%) utilized or experienced positive thinking and/or positive feelings about their capacity to perform, and about sensations associated with "perfect" execution of the procedure.

psyching — You have to think positively that you're going to do it. You are prepared, you are trained, and you are a good surgeon. No matter what happens you'll go over it, even if something that you've never seen before. You're technically good. You tell yourself positive things: "You're good and you're going to do it." But you have to be good in order to say that. It can't be false. (elite cardiac surgeon)

psyching — You have to be both disciplined and sympathetic when thinking about the patient. The night before, you have to remember that somebody's in the hospital waiting to see "you". They are not waiting for the intern, or the nurse, or the anesthetist or anybody else. They're waiting to see you. If you don't have that in the back of your mind then you'll go home, show up the next morning after the patient is asleep, do the operation, and go back home again. You might as well be a ghost. If you behave like that, you're not ready to do this operation. You have to have a lot more things in your mind than just sewing A to B. If you don't have that, then you're not mentally ready for it. (cardiac surgeon)

positive — Sometimes I don't want to see anybody before surgery. I prefer not to see the parents. ... Sometimes I don't even want to see the patient. I want to go into the O.R. when the patient is already anesthetised, and then I will start the job. That gives you some emotional detachment from the patient. Sometimes you go and hold their hand and say, "I'm here," but most of the time when I walk in, the patient is already sleeping. I prefer that. (elite neurosurgeon)

positive — To "tee yourself up" for any operation which is new, obviously you want your brain to be in perfectly good order. You prefer to do the case in the morning ... You go to bed early so you're there nice and rested. (general surgeon)

positive — I like to do the same things in preparation for surgery. I will even use the same aftershave lotion. I usually operate on Tuesday. Monday night I like being home or going out and playing bridge, or just sitting down and reading the paper or watching TV. I like going to sleep at the usual time, getting up in the morning at the usual time, shaving, showering, having breakfast, and then just coming to work and starting in. I don't know that I have my game face on when I'm in the operating room, but certainly I'm a little more serious on those days than on the days I know I don't have surgery. I like to follow the same routine on the days that I have my surgery. I will be in the operating room on time because it's important that the case get off to a good start. I try to maintain the same routine day in and day out. It sounds very boring but I like to do it that way. (cardiac surgeon)

positive — Nothing more distracting than operating on a full bladder. You come in, you don't take two coffees, you only take one; you don't want to shake and you don't want your bladder to fill up too fast. It's a little detailed but if you want to talk about rituals, the last thing you do before going to the scrub sink is go to the bathroom. You don't have to worry about that at least. (general surgeon)

positive — One thing I've kept in mind was, "What would I do if it was my father and mother, brother or sister?" If you would do the same for them, then it should be applicable to this person. That is a good way of thinking. I find that gives me an assurance that I did the right thing. (elite cardiac surgeon)

positive crisis control — You hear other people telling you to stay calm and focused, do the best you can, and you realize that, "Yeah, it actually works." I think mentally you tell yourself, "That's the way I'm going to be." When you see a difficult problem coming up at surgery, you just tell yourself, "This is the way I'm going to be. Just relax. Just persist." Usually it will get fixed. (cardiac surgeon)

positive lull control — Surgery really does require a lot of quite deep concentration, even if you're doing something that you don't consider to be very mental, or that you do a lot of in surgery. Every once in a while you get chattering

away and you realize you're not paying attention. Then you bring yourself back again. I have a little chat with myself and say, "Stop this!" (general surgeon)

positive lull control — As the operation gets lengthy, you have to be careful that you don't start losing your patience because you want to finish. You have to say to yourself, "No, I should not rush. I should take my time." You have to tell yourself and remind yourself that when you start to rush, you get into trouble. ... You say, "I should slow down because it's better for the patient and it's better for me." In the long run, it will save you time and stress. (elite neurosurgeon)

Mental Readiness

Surgeons were asked to recall their preparation activities and unplanned influences prior to a recent successful performance in surgery. The intent was to determine what preceded top performances that allowed them to feel ready. Mental readiness was evident in surgery as follows:

I felt ready to do it. I was worried about various aspects as to how it would go, but I was up for it. I was primed. I knew I could do it. (orthopedic surgeon)

You have to prepare yourself well for surgery. You have to know what you're going to do. You also need a reflex for the unexpected things that can happen, and to suddenly be able to make a decision. (elite cardiac surgeon)

The decisions and the assessments done before are sometimes a lot more important than what you do during the surgery. The decision making process is sometimes more stressful than the actual surgical procedure. Once it's decided, you just follow your plan. Sometimes the decisions aren't that easy. (orthopedic surgeon)

Surgeons are good or bad mostly because of two things: judgement and preparation. Some people are clumsy with their hands, but because they think of things very carefully and work slowly they can achieve a good result. Other people are technical wizards who have not given much thought to the reasons for doing the operation. They get in trouble because they did the wrong type of operation on the wrong case. They chose the wrong approach. Most surgeons with experience are technically competent. I don't feel that I can tie my knots better one day than other days. Usually it's all in the background preparation. (elite neurosurgeon)

You come to grips with the situation by looking at the x-rays again and again, examining the patient, reading whatever is available, consulting other people and listening to what they have to say. Then you come up with an idea but this is still not to the definitive point. When you go into the operating room you can't impose your philosophy or your ideas on the problem. The problem tells you what to do. (neurosurgeon)

When I was young, I gained a reputation as a surgeon. One of the things that was frequently said about me was that I always knew exactly what I was going to do before I went in there. But I also had the capability of changing if I had to. (elite cardiac surgeon)

Planned, Positive Influences to Mental Readiness

The importance of good preparation is unmistakably clear from the interviews. All surgeons reported that they had planned a series of activities leading to a state of mental readiness before beginning surgery which resulted in best performances. A complete list of preparation activities, ranked in order of total surgeon responses is listed in Table 8.

Table 8
Planned Preparation Activities for Mental Readiness
Before Successful, Challenging Surgery

Ranking of Preparation Activities*	Total Responses (ranked percent)
Use of study aids: books, models, etc.	91
Imagery**	73
Anticipate complications and options**	73
Plan procedural steps**	70
Psyching: positive thinking, rituals, quiet focus time**	70
Setting clear objectives	52
Consultation with patient	49
Consultation with colleagues	49
Rest and relaxation through time management	27
Exercise and/or good eating habits	24
Review subconsciously	15

* All respondents had at least one planned preparation activity

** See *Positive Images* section for details

Study Aids

Murray (1988) found that the best surgeons instinctively review anatomy through dissection, films, manuals, and actual practice with the equipment. Most surgeons (91%) reported

the importance of using medical study aids and props in preparation. The aids specifically mentioned and the number of surgeons using them were as follows:

- books and diagrams 70%
- patient's x-rays/angiograms 55%
- anatomical models 15%
- tactile patient contact 15%
- cadavers 12%

The patient group seemed to influence the choice of visual aids. Surgeons dealing with children, compared with those with adults, used models in preparation (chi-square testing; $p = .004^{**}$) and various other study aids for evaluation ($p = .023^{**}$). Simple illustrations, animation, and repetition may be a more natural impulse with children than with adults. These results, together with the literature suggest that using study aids and props is a good practice to adopt.

study aids — What I personally do is trace a template on the x-ray, cut the template where I'm going to cut the bone and then realign it. I decide how much I need to take out of here and there, and how straight I want things. Basically, I make a pattern. I set it up as to how I visualize the final result to be. I usually do this the night before. That's what I do with most of the complex osteotomies, which are a bit more complicated. (orthopedic surgeon)

study aids, consult patient — To ready yourself you go and see the patient. You actually move the arm around, you feel him, you touch him, you see it exactly. You've read all the papers, and again you rehearse it in your mind. The other thing in our area, particularly in pediatrics, is that you tell the parents as well. You say, "Look, we want to try this. We think it's better for your child. Do we have your permission to do it?" and on. So you feel that the family is behind you. You've talked to the residents about it, and they're keen to see how it will work out. You're absolutely ready. (general surgeon)

Anticipate and Plan

A good game plan provides the surgeon with clear direction. An open mind ensures that the unknown and the unpredictable will be dealt with effectively.

One predominant strategy used by 73% of surgeons was anticipating complications and solutions. By answering, "What would I do if?" the surgeon develops a plan for dealing with the unknown and the unpredictable. Surgeons prepared by verbalizing potential complications, listing procedural steps, and subconsciously reviewing their plans.

Seventy percent of surgeons found it essential to make time to prepare themselves mentally before operating, regardless of how briefly. It was done through positive thinking, a personally planned ritual, or a quiet focus time.

anticipate complications, plan steps, imagery — I have to review in my mind all my knowledge about the technique, the consequences, the complications, and all the tricks of the trade for that specific procedure. I have to be prepared for all eventualities that may occur in the operation. ... I am prepared to instinctively react. Speed is very important. ... That's my preparation. I don't do any yoga, tai chi, or whatever. I surgically prepare myself. If I'm confident that I've gone over all the aspects, then I'm more relaxed because I'm not worried. I've done my best. I've done my homework before the case. I'm as surgically prepared as I can be. It's just a case of going ahead and doing the best I can. ... I'll get in contact with the information and I'll practice in my mind. I'll plan out what I'm going to do tomorrow — one, two, three, four, five. I make a game plan, especially when it's something not routine. I visualize in my head what events will occur, how they will occur, which way I will put that stitch, and which way I will start to stitch this line. (cardiac surgeon)

anticipate complications — Personally what I do is evaluate the opponent. ... I look upon the lesion, which we're attempting to remove or irradiate, as the opponent. I ask myself, "What are all those things that that opponent can do to me? Can he rupture? Can he bleed?" If he does one of those things, I'll do such and such. If he plays ball and falls behind me, well then I'll just walk all over him." (elite neurosurgeon)

anticipate complications, plan steps — I've been called a nit-picker. People around me have called me that. Before we did the first transplant we went over and over and over it. I insisted on full team meetings. Some people thought it was excessive. The thing is, you can't afford not to do it with these things because something will go wrong. The people who succeed in very complicated endeavours like that are people who are meticulous. People who fail are people who are not meticulous. Occasionally somebody who is not quite as meticulous will get away

with something. But they won't get away with it consistently. (elite cardiac surgeon)

plan steps, imagery — Before surgery I say, "Oh yes, I've done this before", then ... I try to recall what I'd done before. For that I have a very good memory, a very good visual memory. Even years after, I can visualize what I did. If I can't, I try very hard to think of what I did in that situation, and what steps I followed that led me to a good result. So that kicks in. (elite neurosurgeon)

plan steps — I was prepared for failure, the patient was prepared for failure, and the son was prepared for failure. I decided to devote a lot of time to it that day and to approach it as slowly and as cautiously as I could, every step of the way. ... Although initially I said (to the interviewer) I didn't do anything special, in fact, I guess I did. I thought it out very, very carefully and exactly what I was going to do, before I went in there. I've always done that. When I was young, I gained a reputation as a surgeon. One of the things that was frequently said about me was that I always knew exactly what I was going to do before I went in there. But I also had the capability of changing if I had to. (elite cardiac surgeon)

plan steps, subconscious — Operations with good results are well planned. You have to plan an operation. You go over the x-rays. Usually the day before, I take all the x-rays, put them up, then they stick in my mind. ... At home the night before, I go through the diagrams of the operation. Maybe I get the skull for orientation. ... You go to sleep, then it's in your subconscious, and it sticks. By the next morning I'm ready. When I was a university student, I would study things at night and the next morning I knew it. You sort out those things during the night. ... It's true, it works. (elite neurosurgeon)

Set Objectives

Cohen, Bonfiglio and Campbell (1990) emphasized the importance of goals in good procedural planning. However, clear objectives appear to give not only purpose and direction, but may help in providing emotional stability in times of stress. The 52% of surgeons who said they set clear objectives before surgery reported fewer emotional reactions to crises (chi-square testing; $p = .049$), and were able to refocus during a crisis by taking a moment to assess the situation and recall the backup options ($p = .019$).

objectives — With the team, we went over the case beforehand and they knew what our goal was. (orthopedic surgeon)

objectives, anticipate complications — We always review the objectives, but we also always review the complications. ... If you anticipate all the things that can go wrong during the operation, then if it does occur, you can deal with it more effectively than if you hadn't thought of it. (elite neurosurgeon)

Consult with Patient

The importance of optimism and sincere bedside manner in a doctor-patient relationship is a focal point of medical literature (Kuehn, 1989; Spencer, 1990). In substantiating this, elite surgeons and those with over ten years experience listed consulting with the patient as a significant preparation activity (chi-square testing; $p = .022$) more than the other surgeons.

consult patient — You gain mental preparation by thoroughly discussing it with the patient (if you can) and the family. You're explaining and venting part of your fear of death or complications. In our case, it's usually the parents. Dealing with parents is a very tough business. You are accountable directly to them as to what you're doing to their child. The parents are not sick. The one that is sick is the child, so the parents are in full command of their own mental abilities and demands. ... You have to gain the trust of that family. If you feel and sense that you've gained their trust, then you feel a lot more secure and more confident in what you are doing. ... If this is not an emergency and I see the slightest hesitation from them I won't do it. (elite neurosurgeon)

consult patient — The best advice that I could give a younger surgeon is to develop as good a rapport with the patient and parents as possible. That makes it easier to discuss difficult situations afterwards. (orthopedic surgeon)

consult patient — You have to speak plainly and say what you mean. If you do that, you're mentally in it. You have to be "in" with the patient. If you are, then you're prepared. If you're not, then you shouldn't be doing that operation. (cardiac surgeon)

consult patient — There are people who are more difficult than others to deal with. Sometimes I feel guilty to be so blunt to people and I apologize for that. I say, "Look, I'm sorry to be so blunt, but this is a reality. Would you prefer me to beat around the bush?" People say, "No, no, no, we want you to be straight." "Well, this is as straight as I can be." At the end, that helps me a lot. You get these things very straight in your mind. You know what you're doing. You know the people with whom you are dealing. You can sense trouble with people. The type of people who are thinking, "Well if something goes wrong, I'm going to get a lawsuit." I don't think about lawsuits. I mean, it's a problem, but I don't function with that in my mind. Whether or not they're going to sue me or not, well, that's their problem. If I get sued, well tough, I get sued, period, and that's it. That's an unusual occurrence. ... The thing that mainly worries me is my own conscience as a professional; that I've done the right thing for that patient. (elite neurosurgeon)

consult patient, study aids — I took time to prepare. I took time to make the decision. We had discussions with the child and the parents. We went over the x-rays. We were ready. (elite neurosurgeon)

Consult with Colleagues

Peer support may be an influence in effective goal setting. It was found that those who set goals, also showed a strong link in consulting with colleagues in preparation for surgery (chi-square testing; $p = .009$).

consult colleagues — We actually have a format here. We discuss all the patients on a Monday morning with everybody together. That gives us some clue as to the severity of their case. Once you know the severity, you get everyone's opinion, but then you make your own decision. (elite cardiac surgeon)

consult colleagues — We are lucky here that we have combined rounds with all the other surgeons. We present the case at rounds and then we poll the audience for opinions. We get everybody's approach to the problem: how would they do it, how would they expose it, whether or not they would go that route. (cardiac surgeon)

Good Health Habits

The 24% of surgeons who practiced good exercise and/or eating habits in preparing for surgery showed a significant difference in reporting more distraction control techniques for dealing with upsets prior to surgery (chi-square testing; $p = .023^*$).

Good physical health habits showed additional benefit. The 27% who reported rest and relaxation before surgery, also described an effective focus during surgery with controlled high energy (chi-square testing; $p = .050^*$), and the ability to anticipate the next step ($p = .012^*$). Taking R & R was consistent in surgeons who attempted first-of-its-kind procedures ($p = .046^*$). Effective crisis distraction control techniques of pausing and using positive thinking ($p = .004^{**}$), and assessing backup options ($p = .006^*$) were also present.

These practices of good exercise, eating, and resting habits would indicate that healthy habits predispose the surgeon to a better focus before and during surgery, and lead to better preparedness and handling of crises.

rest, exercise, psyching rituals — It's a whole discipline of operating. Your whole life is disciplined. You can't stay out late the night before. You have to get up early in the morning. You've got to get prepared. You've got to wait. You can't do anything unnatural. You don't want to be stuck in a traffic jam. That's why I jog in the morning; I get relaxed and I'm all set to go. You can't walk in and have a whole bunch of crises happening because you're obviously going to think about that. (elite orthopedic surgeon)

rest — The night before you don't party, you don't drink, you don't take a Valium before you go to bed, and you go to bed early so you're there nice and rested. (general surgeon)

exercise — You have to be in good health and you need the stamina. I'm not an athlete but I think I'm in excellent health and fitness. ... So I feel that I'm in shape. When I finish those long operations, and I don't feel beaten up. I'm tired maybe, but not beaten up — and I can do it again and again. (elite neurosurgeon)

Unplanned, Positive Influences to Mental Readiness

Sometimes unplanned events had a positive effect on mental readiness. Surgeons recognized that the attitudes and abilities of their team, the patient, colleagues, their own families, and the hospital administration ultimately affect their performance.

Those people most often described as capable of having a positive influence on the surgeon before and during surgery are listed in Table 9.

Table 9
Unplanned Positive Influences to Mental Readiness

Ranking of Unplanned Positive Influences*	Total Responses (ranked percent)
Proficient, keen residents and anesthesiologists	97
Proficient, supportive nurses	82
Patients and relatives with a positive attitude	76
Supportive colleagues	67
Supportive family of surgeon	55
Efficient and supportive hospital administration	49

* All respondents had at least one unplanned positive influence

Surgical Team and Colleagues

The proficiency, enthusiasm, and supportiveness of the surgical team was judged to have the greatest unplanned influence on mental readiness, yet this is something which surgeons perceive to have little if any control over. Positive words from colleagues, outside the surgical team, was also a welcomed support before surgery.

assistant — The anesthetist was there. He's a nice friendly guy. We just got talking while we were going along. Things were so nice. I remember it. I took my time with this case. I started in the usual fashion, ... everything looked like it was done, but then I got talking to the young fellow who was assisting me. I said, "I'll show you what we see when we swing the microscope in." He said, "I've never seen it done with a microscope." He thought everything was done. ... Well, lo and behold there's three more large fragments of disc. So we removed them and everything was clear, clean and positive, because things were relaxed and nice and quiet. (orthopedic surgeon)

assistants — There was a team with whom I was more familiar, or more comfortable. The O.R. team is generally pretty good. It helps if you have the best assistant that you know to help you, or the best anesthetist who will be doing the procedure. (cardiac surgeon)

nurse — The Head Nurse's personality makes a difference. Some have a calming effect and others create a confrontational edge. (neurosurgeon)

nurse — The scrub nurse has a positive or negative influence in the sense that you come in and you know that this scrub nurse is very good, or doesn't have the same faculties and is not as good. If I'm doing a difficult case, then I usually think, "Oh no, that's too bad" or I say, "Great! I'll know she'll be ahead and right on time. (cardiac surgeon)

Positive Patient Attitude

Patients with personal optimism and confidence in their surgeon create the best environment for success. Patients with a positive disposition were noted by 76% of surgeons to have a strong influence on their mindset during surgery. In recognition of this point, interaction with patients appears to be of greater priority with the more senior surgeons. Surgeons with over

10 years experience reported the importance of consulting with the patient significantly more than those with less than six years experience (chi-square testing; $p = .022$). This may mean that experienced surgeons have come to realize that patients do have a strong influence on their performance. A positive doctor-patient relationship appears to advantage both parties.

patient — The psychological behavior of the patient helps a fantastic amount. The lady was very, very positive about going back to surgery even for a fifth time because she couldn't survive the way she was. She was all confidence. ... You go in knowing that you're going to have a challenge. You're going to do something difficult. Again, your experience tells you that you will be able to handle the problem. I have enough confidence in myself, and I have done enough cardiac surgery in the last 15 years, that I've probably seen everything. (cardiac surgeon)

patient — You have to gain the trust of that family. If you feel and sense that you've gained their trust, then you feel a lot more secure and more confident in what you are doing. ... Basically, I go into surgery with the understanding that they are asking me to do the operation. I'm not demanding for them to sign a consent. I say, "Well, I'll do it if you want. Do you accept the risk? Yes or no?" "Yes we do." "Do you trust me? Yes or no?" "Yes we do." "Fine, if you trust me, then I'll do it." If this is not an emergency and I see the slightest hesitation from them, I won't do it. (elite neurosurgeon)

patient — I did a Senator who was 85 years old. That puts you under pressure. ... When I spoke to him, I even asked him, "You don't know me. Would you like Dr. So'n'so to do your surgery?" He said, "No, you're assigned, and I know you're going to do it. You do your best, that's all." if you have a patient with such an attitude, your stress level drops. (elite cardiac surgeon)

patient — Beforehand you communicate with your patient so they understand what you are going to do and what complications could happen. You see the patient has confidence in you. This gives you great pleasure. Some patients say, "I'm not going to make it, Doctor." A negative attitude in the patient puts you under stress. But if the patient has a very positive outlook, then they're telling you, "Oh Doc, don't worry. I know everything will be okay. You do your best." When such a thing happens, you feel great. ... If you have a patient with such an attitude, your stress level drops. (elite cardiac surgeon)

Surgeons' Family and Hospital Administration

Support from both the surgeon's home life (55%), and from the hospital's administration (49%) was a reported factor in their mental readiness before, during, and after surgery.

family — I have a supportive family, so if I'm late for an engagement in the evening, that really doesn't make a difference. My wife understands and all my friends understand. ... You've got to realize and keep your priority there. Everyone else will actually understand. Those who don't understand, you don't have to worry about that. You have to take that attitude — the patient comes first. (elite neurosurgeon)

administration — Often starting the case earlier is helpful. If they tell you "We can get your case started early," that's good. You're not wasting so much time. You can get at it and get the work done, because often you're really eager, especially if you're worried about a certain case. (general surgeon)

Full Focus

All surgeons described the experience of being in a fully focused state during their best performances. This focus was characterized by complete concentration, the ability to anticipate the next step, and/or being able to direct energy in a positive focused way. Most often the fully focused state was accompanied by an absence of anxiety. Ideally, the surgery took on a rhythm of its own and was experienced as very connected, flowing and enjoyable.

The qualities most frequently associated with this focused state are listed in Table 10.

Table 10

Full Focus Experiences During Successful, Challenging Surgery

Focus Experiences During Surgery*	Total Responses (ranked percent)
Total concentration	100
Relaxation and calmness	79
Enjoyment**	46
Anticipation of next step	46
Controlled or directed energy	46
Rhythm, flow, effortless	33

* All respondents had experienced at least one fully focused experiences

** See also *Positive Images* section

Concentration, Anticipation, and Controlled Energy

Total concentration was characteristic of the full focus state. For some this intensity led to the ability to anticipate and control their energy. Surgeons who reported being able to anticipate the next step or problem as they worked, also reported the feeling of having control over their energy (chi-square testing; $p = .012$), compared to those who said they did not anticipate.

concentration — The minute I'm in the O.R. I find the rest of the world can be blown up around me, and it wouldn't bother me. I find that the O.R. is like an oasis away from the world. (cardiac surgeon)

concentration — Once I actually start the surgery, then I focus on each step of the surgery. As I actually make the skin incision and all that, I'm focusing, concentrating on the layers below the skin. Each step has its own focus. (elite neurosurgeon)

concentration — I suffer from migraines. Say I go in for a challenging surgery in the middle of a migraine crisis — the migraine disappears! Why? Because I'm so busy concentrating on what I'm doing that curiously it makes my migraine disappear. ... In a regular case, my migraine will linger because I have time to think about my headache. (cardiac surgeon)

concentration — That's all you do — just be there with all your attention. When you're there, your mind is only on the operation. (cardiac surgeon)

concentration — A lot of it is just physical work. You have to know your anatomy. It's physically demanding because the actual stripping of the spine is hard work. You sweat quite a bit and you get thirsty. You're focused to such a point, that often we don't eat, drink, or even go to the bathroom for seven or eight hours. You're just completely focused. (orthopedic surgeon)

concentration — I thought only of the operation. In operations of lesser magnitude, you can let your mind wander. You can remember last night's hockey game, you can be thinking about what you're going to be doing on the weekend, because the operation is not stressful. It's easy. It's a routine thing. But in these major operations, you think only of what's happening. (elite neurosurgeon)

concentration — Mostly it comes with timing and concentration. One of the best ways that I know of to get rid of physical discomfort (for me anyway) is to walk into an operating room. You're so concentrated on what you're doing that you don't notice the discomfort while you're there. It really doesn't distract me at the time that I'm working. (general surgeon)

concentration, anticipation — You absolutely have to pay attention to what you're doing. If somebody came in and started talking to me about something, you can't. For that particular thing you've got to be totally focused, remembering the

steps, trying to see all the steps that are going through your mind, and trying to take them all down to their end point. (elite orthopedic surgeon)

anticipation — I like to constantly be thinking ahead — "What am I going to be doing after this procedure? What should I be telling the scrub nurse to get ready? What problems might we encounter after this stage?" (orthopedic surgeon)

control energy, concentration — You have to be able to, at the time of crunch, exclude other things from your mind. You can't think about last night's party when you're faced with a major problem. As soon as you've overcome the difficult part of the surgery, then I say, "Let everything hang out! — joke, laugh, relax, sit down, or whatever " — but you've got to be ready. You're at the starting line of a 100-yard dash in the Olympics. You have to have everything focused purely on the procedure. (elite neurosurgeon)

concentration, relaxed — It's a matter of total concentration and not allowing emotion to enter into it. During routine operations, it's wise to try to keep the atmosphere as relaxed as you can, especially with young trainees, to reassure them that you are supportive. Be friendly with them to inspire confidence in them. If they happen to go a little astray, you bring them back gently, so there won't be a crisis. (elite cardiac surgeon)

A surgeon must go beyond being fully able to focus at any time. Surgery is very lengthy, with many fluctuations in tempo, and surgeons need to flow between intense and more relaxed moments. It's important to remain alert. The slow, routine periods demand a different type of mental control, which is also vital to the success of the surgery.

concentration — If I'm doing a procedure that takes a lot of attention, I tend to be very focused. I don't see or hear anything that goes on around me. That's how I can tell when I am focused. I will just not be aware of anything. However, if it is something where my concentration is going in and out because it doesn't have to be in, I can chat with the nurses or my assistant. I'm still paying attention, but I don't have to be totally not thinking of anything else. If I'm doing a difficult part, then everything else gets shut out. (orthopedic surgeon)

This special type of focus is described in more detail as *Lull Distraction Control*.

Relaxation, Enjoyment, and Rhythm

Best performances were described as a pleasant, flowing, and relaxing experience. Similarly, surgery has been portrayed as a "state of flow" of quiet concentration (Csikszentmihalyi,

1975, pp. 18-20), quiet white noise (Dawson, 1990, p. 22), and a relaxed, positive mindset (Korn, 1989, p. 5).

relaxed — Having a dark room with the focus of light just on the patient's head or spinal cord where you're working is most relaxing. When you've got music and you've got that dim-lighting environment going, it's wonderful! I could be there all day. (elite neurosurgeon)

relaxed — I know I am basically a pretty happy person. I put myself emotionally into a neutral stage when I'm working ... it's not a high and it's not a low. (orthopedic surgeon)

relaxed, concentration — Once you get going you forget everything. Often we say that we're very relaxed in the O.R. because we can forget. It allows us to forget about the other things. You get very engrossed in what you do. It's the same thing as when I used to fly. As soon as you pushed the throttle, it was so important to keep the airplane flying that you forgot about absolutely everything else. Then as soon as you touched down, all of a sudden all of your problems would come back. It's the same thing as when I used to fly. (general surgeon)

relaxed, concentration — The important thing in good surgery is the economy of movements. Do everything right the first time. If you've got to go back in to do something, you're going to have many more problems. That's what you are really concentrating on and what you're trying to do. Do it right the first time. ... Don't rush through just because time is going by. Just carry on doing it. No matter what, just take your time and do it right. (elite cardiac surgeon)

relaxed, enjoyment — You're really not aware of how the time goes by. You may be struggling, or if it's really easy, you may be singing or wanting to make a joke or hear a joke. It's very comfortable if it's a smooth-running surgery. (elite cardiac surgeon)

enjoyment — It's fun and at the same time stressful. You have to have a perfect correction, but it's fun. Sure it is. I don't know any cardiac surgeon who is not happy in the operating room. (cardiac surgeon)

enjoyment — I was feeling good. I think that makes a difference. You know when sometimes you don't feel right? It's not fun. If it's not fun, then it's difficult. (neurosurgeon)

concentration, rhythm — You just have to keep going at a steady pace. Once you get to the clearing ... you change pace. ... To me the rhythm is not wasting any moves. ... At that time of the operation, you don't talk. You concentrate and you look. That's where the rhythm comes in. You've been doing the hard physical work and all of a sudden, you have to go from grunting type of work to the very delicate, where you're passing wires around the spinal cord. Then at the end, it gets physical again. (orthopedic surgeon)

Distraction Control

Reacting to disturbances can easily interrupt concentration. Distractions that prevent a surgeon from being alert, relaxed, and meticulous can quickly create a performance disadvantage.

In recalling distractions that occurred during best performances, all surgeons reported generally getting back on track quickly — although not for all types of distractions. They were exceptionally well versed at focusing in high action periods during surgery, be it a crisis or overcoming general hindrances. However as a group, they were not as effective during preoperative distractions or lulls in surgery.

Lulls rated as the most common distractions — having the lowest score (79%) with respect to surgeons' skill at dealing effectively with the distraction (see Table 11). Dealing with this downtime is perhaps first steps in an area that needs further attention.

Table 11
Distraction Control Before and During Surgery

Distraction Control Within Specific Periods	Total Responses (ranked percent)
Crises control (during surgery)	100
Hindrance control (during surgery)	100
Preoperative control	85
Lull control (during surgery)	79

Distraction Control In A Crisis

Surgeons described a remarkable "emergency mode" that they had learned and that took over in response to a crisis. It translates into an ideal performance state for managing a high-risk situation.

You probably perform better in times of crisis than you do in the routine elective situations. All of a sudden you can feel that your perception, all your senses, and all your responses are at a much more elite level than they are in a routine operation. (elite neurosurgeon)

Before successfully entering into this ideal focus state, most surgeons (67%) admit that feeling emotionally startled, either aloud or internally, is a common reflex in a crisis. This reaction can work for or against the surgeon. It may serve to release anger and alert others to stay attentive, or it can send a panic message and create unwanted anxiety within the team.

Clearly, successful surgeons have built in contingency plans so that quick, positive, alternative actions can be taken. Less obvious are the details of how surgeons recover or maintain control, after being emotionally startled, to successfully focus and perform the necessary actions. The full list of crisis responses appears in Table 12.

The strategies discovered for successfully reaching a full focus in a crisis consist of combinations of the following:

- briefly pausing and using positive thinking
- taking charge and instructing others
- briefly assessing possible options

The steps taken, after a crisis is successfully overcome, may also be of relevance. One elite surgeon noted that a time-out at this point can help to reduce tension before continuing.

post-crisis — When we get out of the problem we've been in, I tend to just stop for a few minutes. Usually then there is a sigh of relief from other members of the staff, the nurses, the residents, and so on. We always take a few minutes, break, ... possibly walking around the room, talking and just generally patting ourselves on the back for how we got out of that jam. Stopping, taking stock, and discussing with the staff are often very good tension reducers. (elite neurosurgeon)

Table 12
Distraction Control in a Crisis During Surgery

Crisis Responses	Total Responses (percent)
Emotionally reacting; aloud or internally	67
Crisis Distraction Control Skills*	
• Taking charge and instructing others	67
• Briefly pausing and positive thinking**	49
• Briefly assessing possible options	43
Responding with necessary action	100
* All respondents had at least one crisis distraction control skill	
** See also <i>Positive Images</i> section	

Take Charge

Taking control quickly and quietly was a first step in a crisis for most surgeons (67%).

take charge, pause — If something goes wrong that is catastrophic, the important thing is not to allow people to start jumping around and going hysterical. You just have to stand quiet, be in complete control, and keep totally focused on the area you're dealing with. I've gone through that many times. People will start jumping around and saying, "Get this and get that." I just say, "Be quiet. Just take it easy. We're going to do this, that, and that" and I just stand still. (elite cardiac surgeon)

take charge — If you encounter something difficult, then you don't want anybody to make a joke or too many people talking in the operating room. You want it silent. You want to concentrate. That indicates that you're under stress. There's no question there is stress, but the payoff of that stress is the successful finishing of that surgery. Afterwards you forget everything, and the stress is gone. (cardiac surgeon)

take charge — First, you've got to take control in the operating room right away. The worst thing in a crisis situation is too many chiefs and not enough Indians. ... I don't do it to irritate people, but I will make sure that people understand that I'm taking over. I'd say, "Okay, let's do this and this and this now" and I'd just go one by one and take control of everything. By my voice, people will know and understand. It's not just me, people also want that. Quite often nurses will say, "There's about five people giving orders." Usually, if you're not the senior-most person there, you have to let the senior guy take over. If the senior doesn't want to take over, then you take over but one person has to go through it. ... As soon as the crisis is over, you can tell a joke. I tell love stories in the operating room, just to

keep people balanced. But I shut up the moment things are serious. ... The last thing you want to do is to upset the nurse who is helping you because then you throw her off. If you find the nurse is a little uptight, you say, "Okay, take it easy, take your time, but give it to me because I need it right away." (elite cardiac surgeon)

Pause and Think Positively

Some (49%) insist on a brief pause for composure. This personal time allows them to think positively either by recalling past successes, using positive self-talk, taking deep breathes, counting, or saying a quiet prayer.

positive, assess options — The best way I find to get back on track is to slow everything down, rather than jumping all over from one place to the other. You address one thing: whatever's getting you into trouble. For example, if it's bleeding, just address the bleeding point control so it's not bathing the field. Tampon at it. Even though you're not correcting it right now, just stop everything so you can have some time for thought. This again is something I had learned when I was flying. When you start to get into trouble, what do you do? You slow the engine down, drop the noise level, get things settled to a nice normal level flight, then do your thinking and then address it. I've found the same thing happens when you're operating. When you get into trouble, you say, "Okay, let's stop everything, think, pause, and then think." (neurosurgeon)

positive — Don't panic. The key is "not to panic." I try to slow down the best that I can to control my nerves. Maybe start singing. Truly, if you panic, then you'll lose control of the whole thing. If you get into trouble, you try to bail yourself out and try to get your assistant, the nurse or whoever's there, to help. I say, "Well, here is trouble. We've got bleeding." You have to solve the problem quickly. Mentally, if you're a believer, you're praying, and if not, I don't know what you're doing. I do. I'm a believer and I get a lot of help from up there. When I'm in times of trouble, sometimes I say, "God help me." I say it to myself during surgery. For me it helps because I strongly believe. To be in this type of job your spirit has to be strong in spiritual preparation. That's the way I see it. I couldn't do it otherwise. (elite neurosurgeon)

positive — I just tell myself that panicking is not going to solve or help the situation, and it's likely to make it worse. Therefore, stay calm and attempt to prioritize things that have to be maintained, like circulation. You just work it through. This is over years and years of training that you automatically get into an emergency mode. You know the steps that will take you out of it. Also, you know the steps that will take you deeper into it. (orthopedic surgeon)

positive, assess options — Most crises are somewhat expected ... I would just put in action plan B or plan C, because I've probably rehearsed it. With experience, you've had so many crises before that it's just, "Well here we go again" type of thing. You go back and proceed with it as before. In other words, the operation

isn't going clean as you would like it to go but, at the same time, it's perhaps not unusual. My pulse probably goes up a little but I just go ahead and initiate a plan. (elite neurosurgeon)

pause, positive, options — I will simply use a suction in the field. While I'm not solving the problem, I'm biding time. I'm saying, "Okay now, above all don't create any other harm because if you just all of a sudden go in there, you may make a real mess of it, making it totally uncontrollable." I relax for a couple of seconds (and sometimes it seems like minutes and hours to all those around), and then just get on and deal with the problem. (elite neurosurgeon)

positive, options — I kept working away, telling myself to keep going and not to give up. If I can't get at it in one route, well then I'll try another route, and another route. At different times I would have reviewed all my different options to make sure that I didn't overlook a single option. I'd hate to think that I backed out of an operation and then said, "I forgot to do such and such." ... I think that you can split your brain so that you're attending to what you are doing, while at the same time you're also attending to a diverse task of reviewing options. (elite neurosurgeon)

positive, take charge, options — Usually when you slip with a knife, or your assistant slips, the first thing that goes through your mind is, "Oh shit!" Then you jump and you feel a little bit of tension. Then you say, "Well, what's done is done. I can't take that move back. Let's see what we can do to make it better." ... Quite often the problem is keeping the team motivated too. The nurses and your assistants get tired, especially on long operations. You have to say, "Okay, we're losing a lot of blood here. We have to get on with the job and finish it without taking any shortcuts. ... You just stop and analyze the situation. ... You don't necessarily think of lawsuits and all that stuff right away. You say, "Well look, this is a complication. Things aren't going well. Let's see what we can do to get out of this situation. (orthopedic surgeon)

Assess Options

The 43% of surgeons who were able, in the heat of a crisis, to assess backup options also shared many other traits in common. First, their crisis focus included the other two control strategies of pausing and using positive thinking (chi-square testing; $p = .008$), and taking charge ($p = .043$). Further to these refocusing skills, they described feeling calm and relaxed while performing surgery ($p = .037$).

Second, these same surgeons reported an extensive preparatory stage of setting clear objectives (chi-square testing; $p = .019$), using mental imagery ($p = .005$), consulting with

colleagues ($p = .001$), and ensuring that they were rested and relaxed ($p = .006^*$). Perhaps these three preparation activities are of important benefit in functioning optimally in a crisis.

assess options, take charge, pause — Besides saying, "Oh shit!" ... You can't panic and say, "Oh God" and run out of the room. ... You just do whatever is necessary to fix it. ... You stop and think. ... You stop and tell everybody what you are going to do. You say, "Well, here is what we're going to do." As you stop, you work out the steps. ... Communicating with others is a big part because you're actually thinking about it as you're doing it; "Is this the best way to do it or should we ...?" You're waiting on any feedback from somebody who is helping you, if they're any good. They might suggest another thing to do. Generally I recommend a few minutes of stopping and thinking: "Okay, it's bleeding. Why is it bleeding? What are we going to do about it?" (elite orthopedic surgeon)

pause, assess options, self talk — A totally unexpected crisis doesn't happen very often because we have most bases covered. But when we truly have an unexpected one, probably the first thing we do is to take a big breath and do a little mental count to three or four or five, rather than suddenly panic. ... "Okay, now let's just remember where everything is. Granted we can't see anything right now because it's all just a sea of blood, and the blood's coming rather quickly. And yes, you can hear the anesthetist rustling, and getting a little restless. And you know that the level of anxiety in the operating room is going up because everybody's saying, "What are you going to do, what are you going to do?" Instead of feeling compelled to do just anything to satisfy everybody, let's go at this methodically. Now just remember blah blah blah." I take that approach. I go back then to one of my contingency plans because invariably one will fits. You get on and deal with it. It creates a level of anxiety, but what you do is you basically talk yourself into a lower level of anxiety. Your performance is already heightened by the catecholamine rush that's going through your body at that time. (elite neurosurgeon)

pause, assess options — Usually I stop everything. It may only be for a matter of a second or two, but mentally and physically I stop, and take stock. That usually prevents panic. (orthopedic surgeon)

pause, assess options — I get really pissed off inside because I couldn't do what I wanted to do. ... I get cross with myself. ... Then I stop and realize that when nothing's working, there's got to be something consistently wrong. I don't get really, really excited. ... I've now got an automatic clock built in where I say, "Okay, I've spent this much time doing this. I've assessed the situation and this isn't going to work. So what's going to work?" (orthopedic surgeon)

The rule given as most important most often by elite surgeons is prevention. They are advocates of properly preparing the patient for complications, cautiously planning each step, and carefully doing things right the first time. Crises are also a time where it is common for junior surgeons to call upon a more senior colleague for assistance or general support.

crisis prevention — I was prepared for failure, the patient was prepared for failure, and the son was prepared for failure. I decided to devote a lot of time to it that day and to approach it as slowly and as cautiously as I could, every step of the way. I avoided getting into trouble with each step. On the way in, I avoided doing anything I couldn't undo. ... I knew exactly what I was going to do before I went in there, but I also had the capability of changing if I had to. (elite cardiac surgeon)

crisis prevention — By being prepared for potential complications, you prevent them. I believe in prophylaxis. The best thing is not to get into trouble. That's when you get the best result. Occasionally things happen, but not very often. If you take the precautions, bad things won't happen very often. (elite neurosurgeon)

crisis prevention — Do everything right the first time. If you've got to go back in to do something, you're going to have many more problems. That's what you are really concentrating on and what you're trying to do. Do it right the first time. ... Don't rush through just because time is going by. Just carry on doing it. No matter what, just take your time and do it right. (elite cardiac surgeon)

Distraction Control Over Hindrances During Surgery

Clearly, competent experienced surgeons know how to stay focused or to refocus when encountering obstacles during surgery. The types of mental rules that guide them through these distractions include:

- use positive thinking without blame
- take charge
- keep things that work the same
- persist and stay committed
- exercise patience and pace yourself
- be willing to improvise
- be willing to apologize
- rest and anticipate periods of high fatigue

These skills and attitudes were said to denote the maturity of the surgeon.

details — Sometimes interoperative complications are inattention to detail, little tiny details that you've just got to stay on top of all the time. Other times it's probably unavoidable. (elite orthopedic surgeon)

positive thinking — I tell myself, "It's going to be all right. The end result will be all right." If it's not as I thought, then I say, "I didn't give this disease to the patient. I'm not the cause of it. I'm doing my best. What I can do, I can do. I'm not God." These are the types of things that I silently tell myself. "I thought this was going to be good but the disease is not the same as I'd seen on the film." Sometimes when you go in, you wonder if it is the same patient anatomy that you saw in the angiogram. ... There's no fault. ... This is the way you get over your stress. (elite cardiac surgeon)

take charge — If somebody suggests something, and it doesn't make sense to you, don't do it. You do things the way you've been doing them and they've been working. That doesn't mean not to expose yourself to other people's suggestions, but if you don't agree with it, then don't accept it. Take charge. (elite cardiac surgeon)

keep the same — The thing not to do is to do things differently just because it's a media event, a major operation, or you just want to be different. If you've been doing the same things and you've succeeded, you don't have to go around in a more complicated fashion. That's very important. (elite cardiac surgeon)

take charge — I really thought I was right, but I was obviously not totally convinced. I was still thinking about it. "You should really do it your way. Well you know, on the other hand, these guys have got more experience and are older. They've got grey hair and they've got the wisdom." I just finally said, "It's now or never." Sometimes you have to have the courage to do it your way because sometimes you're right. I wasn't facing a life and death decision here, but I just thought, "Darn it, I'll do it my way. I know just as much as these guys in this area. I'll do it. (orthopedic surgeon)

persist — Ultimately, as the surgeon and the patient's doctor, you are the guy who is responsible for the conduct of the whole theatre. There is a need for unrelenting and uncompromising attention to details in conducting surgery. Any time that I have felt really good about a difficult neurosurgical operation, it is invariably centered on my central dogma of "just sticking to my guns" and being tenacious in my persistence of trying to accomplish the task. ... You discipline yourself not to start taking short cuts to try to hurry it along a little bit ... You discipline yourself to just remain meticulous, just stick to your guns and stick to the basic strategy you've developed. (elite neurosurgeon)

patience — Outside the operating room, I am accused of having a short temper, but when I'm in my milieu, which is the O.R., I feel that I rarely lose my temper, even when I have somebody who is less skilled helping me, or a nurse who's only been there for the first two days. You just have to stop and go slower. (elite neurosurgeon)

patience — There are certain surgeons who think every little problem is a giant problem; they make it into a big flap. They're just not going to last. You want to last a long time. It's like running a marathon; you've got to go in at a nice, slow,

easy pace. Just keep doing it. Keep trucking along and don't make all these little mountains out of mole hills. (elite orthopedic surgeon)

patience — You'll hear, "Oh my God I forgot this. Oh my God, I forgot that." Getting frustrated depends on you, your mood before it happens. If you're in a jovial mood when it happens, you say, "Oh hell, it's as though it's the first time we've ever done it." If you're upset, well, then, you get upset over it, and that doesn't help the situation. (neurosurgeon)

improvise — It's not uncommon to find that instruments are missing or that instruments break. We have such an "armourmentarium of tools" that you can almost always do the operation with some other instrument. It may not be the most desirable or the most useful, but there are other instruments that you can use, and usually you can work around it. (elite neurosurgeon)

improvise — When I'm totally relaxed and tolerant ... I just make do with what we've got, without complaining. Essentially, I try to improvise. If a light isn't working, then I just say, "Okay fine, I'll use a head light. If we don't have a particular type of osteotome, I try to get by with something else, up to but not including compromising the surgical result. When that's the case, then I let it be known that this particular thing is important and the other things are just annoyances. (orthopedic surgeon)

apologize — If I feel that I've hurt my fellows' or the nurses' feelings, by my expression or by my voice, it makes me extra upset. ... Everybody always knows that when I settle down I'll always apologize. Even if I don't feel guilty or I didn't do anything wrong, I'll apologize. ... When I apologize I feel comfortable. (elite cardiac surgeon)

apologize — We were going to be there for eight hours, and the first step we did was to change our minds. Everybody was annoyed about that, especially because there was a lot of running around. On the other hand, there was no question that the decision was the right one. I apologized about four times and then I just went on with my work. ... That was the end of the discussion. Eventually the nurses changed, and it was okay. (orthopedic surgeon)

rest — The way we cope with fatigue is usually by having somebody senior to scrub in with you. Or you can say, "Look here, I'm going to step out for a while, take a break and come back in." Sometimes it's difficult. I just step out for a little while. (elite cardiac surgeon)

rest — Certainly if you're tired, you've been on call, or you've had a rough night, these will interfere for sure. Sometimes you'll find your judgement worse. When I know I'm going to be on call for a long period of time, I try to avoid doing a delicate procedure the following day. ... It can affect your speed, in that you feel you're not as efficient as you should be. (general surgeon)

rest — If something is very difficult, I try to do that as the only case of the day. I don't want to be pressed by time and thinking, "Look, I'm doing this but I have something else after." Usually, if I have something very major, that's all I book that day. ... I would say, "Okay, I'm doing a big case today. It's going to be six or seven hours of surgery. Bang! Let's only do this." Sometimes you can and sometimes you can't. Sometimes it frightens me. In those cases I think, "Gee, what

will happen? Tomorrow I have a very big surgery and what happens tonight if I get an emergency?" (elite neurosurgeon)

Preoperative Distraction Control

Distractions before surgery present potential performance blocks and require dependable skills to regain a proper focus. While the group reported good refocusing skills for dealing with hindrances during surgery, that ability dropped to 85% for preoperative distractions. Careful analysis revealed that surgeons who had developed effective preoperative distraction controls had learned to:

- put other issues on hold and isolate themselves from the distraction
- never expect things to be "normal"
- be persistent and remind others of priorities
- deal with only the necessary interruptions and then get back on track
- aim to always do their best and not take anything for granted
- set up a superlative atmosphere for surgery

isolate yourself — I know how important it is to be able to remove yourself from all your surrounding distractors so that you can really concentrate. That's what I try to do. I see this bubble getting bigger and bigger, with more and more hassles, where one little problem leads to another. Then the nurse gets a little nervous about something that she's forgotten to do. It becomes like an atomic bomb. What I try to do is say, "Let's get back to the common denominator. We've got an operation to do. Let's just think about that. Let's totally isolate ourselves from all this nonsense because it will resolve itself within the next five, ten minutes, you hope." You try to focus right down on only the patient or only the task at hand. (elite neurosurgeon)

on hold — When you're angry, it does physically and mentally affect you and spill over into other things. ... If I'm doing something totally routine, it's not so bad. ... If it's something major, I'd have to get it capped and buried before I get started. ... Sometimes you have to just say to yourself, "Okay, just calm down and try to forget about what's just gone on." I just sit down for three seconds and then I'll be ready to start. You've got to try to get all those things out of your head. (orthopedic surgeon)

on hold — I know I was fuming while I was at the scrub sink. I don't know at exactly what point it got put on hold. It was sometime between when I was at the scrub sink and when we started to work that it went on hold. It came off hold when I ungowned and ungloved. (orthopedic surgeon)

on hold — You come in the office and you find some upsetting correspondence. That can alter you very much. You're very upset but you just have to put it aside because you're committed to the other problem. You have to have that ability to put things aside. Disconnect your mind and concentrate on what you're doing. You cannot do both. (elite neurosurgeon)

isolate yourself, never normal — As you become more mature, more tired, and realize ranting and raving accomplishes nothing, you just kind of deflate. ... You realize you might as well be calm and cool about it because if you get uptight, then everybody else becomes very nervous and hostile. The whole atmosphere in the theatre deteriorates and your patient starts behind the eight ball. You start behind the eight ball. If I know that the situation is going to drag on, I will go to my office, have a coffee then come back in. Often times I'll just sit in a corner of the room and watch the people scurrying back and forth. I try to deflate myself. (elite neurosurgeon)

on hold, never normal, deal with interruption — Some days you think, "Somebody is trying to sabotage this thing." A number of things go wrong everyday. I make a number of rules. For example, I don't take phone calls. No calls to your broker in between cases. Nothing extraneous. If you've got a problem to deal with, you deal with it, but you don't want any extraneous stuff coming in. It's a whole discipline of operating. Yet it still comes at you. (elite orthopedic surgeon)

never normal — "Normal" would be a positive. We've come to expect that something is not going to go right somewhere along the line and that you're going to have to accommodate yourself to it. It's usually nothing that will compromise the patient, but it is a distractor to the smooth, efficient conduct of the operation. (elite neurosurgeon)

persistence — I did a case on Friday which was a difficult one. It had a lot of family implications because I knew the wife was a doctor with five small children. This played on my mind before the event. In this situation, you just stick to your guns. (elite cardiac surgeon)

persistence — It can all be worked out. It depends on how agitated you get. One of the things is that you can't get agitated. As soon as you get mad at anything, you lose your cool and you're thinking about that thing instead of focusing on your job. If you're going to work at doing surgery, you can't be on the phone to your broker. You can't have a mistress, you can't have all this other extraneous stuff going on, or you're not going to be focused. You've got to eliminate all that stuff out of your life or you just don't do well. You can't do a lot of surgery and not be focused. (elite orthopedic surgeon)

priority — I get called all the time when I'm not on call. I come in because that's the bottom line. You keep that focus in mind. Everybody around who deals with me knows that I will go. There are no ifs or buts. That's how I handle distractions. (elite neurosurgeon)

priority, deal with interruption — For a 6:00 a.m. emergency, not only are you aroused from sleep, which you need for the day ahead, but your mind gets sidetracked onto something else. You get completely defocused. Now this happens fairly often in neurosurgery, so that after a while you get used to these interruptions of your mind-set. You deal with problem number one, the emergency, and then come back to the elective case. But it does happen that you can get disturbed too much. For example, the emergency can take up too much time or too much energy. What I will do then is cancel or postpone the major elective case that was going to go on that day. (elite neurosurgeon)

priority — I have a mental mechanism of just putting all the rest out of my mind. I just say, "Those other things just aren't important. What's most important is that patient, who is now unconscious, asleep on the O.R. table, and whose life is in my hands. He is totally dependent upon me. ... I've got to do my best for this patient. (elite neurosurgeon)

do your best — There are high-pressure situations. For example, if you operate on a friend, a friend's friend, or someone well known. I once did a Senator who was 85 years old. That put me under pressure. But then I thought, "There is no other alternative for this patient. He cannot go home." You do your best, that's all, and your stress level will drop. (elite cardiac surgeon)

ideal atmosphere — I bring my own ghetto blaster with music. I find classical music to be the most relaxing, in particular Mozart and Beethoven. Sometimes if I see a lot of stress building up around the case, I say, "Put the radio on," or "Turn the volume up." I need that because the "beep beep" of the EKG and all that drives me crazy. That builds up more and more stress in the O.R. Also dimming the lights helps. We operate with the operating microscope. You're televising what you're doing so everybody can watch the TV. Sometimes I feel that turning off the overhead lights helps. Having a dark room with the focus of light just on the patient's head or spinal cord where you're working is most relaxing for the surgeon (although it may put the nurse or the anesthetist to sleep). When you've got music and you've got that dim lighting environment going, it's wonderful! I could be there all day. (elite neurosurgeon)

ideal atmosphere — The odd time if I am concentrating I will dim the lights in the room and just leave the focus lights on. I enjoy that. To me that's less distracting. I don't see a whole bunch of things around. That's another feature I use. Some rooms are poorly designed, where you're facing the door all the time, and you see the coming and going of the traffic. I find that a little distracting at times. Some people can just ignore it but others can't. Sometimes we try to position the table so we're not exposed. There are little things like that we try and address. (neurosurgeon)

Distraction Control In A Lull

Surgeons' concentration is often interrupted by lulls in the procedure. Of all the distractions in surgery, the one rated highest (94%) is this downtime and the danger of drifting caused by lulls.

And yet the ability to get back on track after a lull was the least common of all the distraction control skills (79%). It is possible that more skills for dealing with passive distractions need to be addressed.

The types of distraction control that were found effective in dealing with lulls are listed in Table 13.

Table 13
Distraction Control During Lulls

Ranking of Lull Distraction Control Skills	Total Responses (ranked percent)
Lull Distraction Control Skills*	
• Relaxing, leaving	61
• Continuing on by shifting surgical tasks	21
• Using positive thinking, persisting when drifting**	15
• Preventing by anticipating lulls	9
• Insisting to others to end the lull	9
* 79% of respondents used at least one lull distraction control skill	
** See also <i>Positive Images</i> section	

Relax or Leave

Typically, surgeons try to prevent frustration during lulls by relaxing or even leaving the room.

relax — Typically, if I am waiting for that x-ray to come back, and we have nothing to do, I will walk off by myself, sit down and not talk to anybody. I just want the mental break of being able to think, on my own, in my own thoughts about the case. It's funny. You don't think about how you do these things, but I do them on a regular basis without really realizing it. (orthopedic surgeon)

relax — If you've got a break, you consciously don't focus. That's one of the few times you do get a chance to not be really concentrated. (general surgeon)

relax — If I'm artificially forced to stop the operation because of an equipment failure or some hang-up, my tendency is to keep operating using another piece of equipment rather than the more sophisticated equipment I really want to use. In other words, going back to what I call fork and spoon surgery. ... What I have to do is discipline myself not to keep going in surgery, but to say, "No, I will stop

and wait (deep breath) until I have what I need available to me to do it the best possible way. Rather than to start something up that maybe I'll wish I hadn't started up, simply because I was impatient and wasn't prepared to take the extra five minutes to wait for the equipment. I find that takes self-discipline. (elite neurosurgeon)

relax — In any open heart procedure there are moments of pure routine, and there are moments of intense concentration. ... When it's routine, you joke and you pass time. ... There's a period when you have no control. You're waiting for the patient to rewarm. So what do you do? Relax, take it easy, ask the nurse to bring you a glass of juice, or ask the resident what was the latest dirty joke he heard. ... There are moments when you have to relax and then you face the next step as another stress. (cardiac surgeon)

leave — If that's their part of the operation, there's nothing I can do to make it go any better. I just go and sit down somewhere, think about how the operation is going to be conducted when I get to do my part. (cardiac surgeon)

leave — That was really a lull. We scrubbed out, went out, had a coffee, and came back. We tried not to let it put us off. We had other things to do so we went around and did them because they were still working on him. We just changed the order. We were supposed to go do rounds after the surgery. (cardiac surgeon)

Shift Tasks

Being flexible in completing tasks helps to prevent boredom, Csikszentmihalyi (1975) found that experienced surgeons assigned routine phases of surgery to junior assistants to prevent personal boredom.

shift tasks — If I'm waiting for the x-ray to help decide what to do next, then I'd go over the next phase of the operation in my mind. Sometimes it clarifies your own thinking to discuss it with the resident and say, "What do you think about that way or this way?" In discussing it, you decide that "that way" really wouldn't be a good one, and "this one" would really be the best. By talking about the plans A, B, and C you might eliminate plan A and C and settle for plan B, as the only real way to do it. (cardiac surgeon)

shift task — What I usually do is prepare so that I leave myself a little to do while they're out getting the x-ray made, etc. (orthopedic surgeon)

Be Positive, Persist and Prevent

To sustain an alert mind during long hours of surgery requires a positive and persistent mindset. The strategies used were detailed and individual.

positive, persistent — I use music and I talk to people. I don't come out from the O.R. I don't stop the operation. I just continue working. I stay there all the time. Usually I don't drink or eat or do anything. I just go on and on until I finish. If there is an assistant that wants to go out, then fine, they can go out. They can drink or whatever, but I keep on going. I don't like to stop. ... I'd get too relaxed. (elite neurosurgeon)

positive, persistent — When you feel too ready for things, they become boring because there is no challenge left to them. I never feel completely ready. ... I feel I'm always a student and I'm always learning as I go along. ... I feel ready competent-wise in handling it and I am prepared to do it. ... I don't feel ready in that everything's going to be guaranteed to go smoothly. Once you stop learning, you should stop operating. (orthopedic surgeon)

positive, persistent — You do drift. That's natural. It's human nature but that's when the risk factor increases. Of course, your attention span is decent the first hour or two, then it gradually decreases. I think the peak is between an hour and four hours. After four hours your attention span starts to lessen. ... You have to realize your attention span. As the operation gets lengthy, you have to be careful that you don't start losing your patience because when you want to finish, you have to say to yourself, "No, I should not rush. I should take my time." You have to tell yourself and remind yourself that when you start to rush you get into trouble. ... You say, "I should slow down because it's better for the patient and it's better for me." In the long run, it will save you time and stress. ... At the end of an operation, you do not want to get into trouble. That's when you want things to go smooth, so that you can finish, close and go home. Knowing these things does help you in your preparation during those moments. (elite neurosurgeon)

positive, persistent — What you didn't plan for was how tedious it was going to be when you got down there. ... When you get in there after about an hour you say, "Holy schmol, I'm going to be in here for a day, 'til the cows come home. Maybe we made a bad decision in going ahead with this. Maybe I should have planned this in stages." You go through these second thoughts even though you're already well on your way in the operation. You discipline yourself to just go at it. You discipline yourself not to start taking short cuts to try to hurry it along a little bit. Usually, if you just remain meticulous, stick to your guns and stick to the basic strategy you've developed, you'll find that it all works out in the long run. Then you feel really good about it. ... Your resident or your assistants are also having second thoughts throughout the whole case saying, "Why the hell are we here? Is this ever going to finish? Why doesn't the silly bugger stop, get out and come back another day?" Then all of a sudden, "Geez, it's all over and done with. Yeah, that wasn't so bad. Good thing we stuck to it and just went on with it. (elite neurosurgeon)

prevent lull — The trick is to try and avoid waiting by calling for someone beforehand, even though you may not have completed your part, like with an x-ray for example. You just hope that the two coincide. (cardiac surgeon)

Constructive Evaluation

The surgeons had all developed a process for evaluating their surgical performance. Evaluation was viewed as important, but did not include the same meticulous detail and enthusiasm described in preparation for or performance of surgery. This may be related to the view that assessing performance outcome is sometimes a difficult process. Often the results are not clear for several months, at which time details of the techniques used may no longer come to mind. Many surgeons viewed long-term evaluation of notes and records as a low priority. The quality and importance of personal performance evaluation is an area that could be given greater attention among surgeons.

difficulty evaluating — A lot of times the results are months down the road in terms of complications or occurrences. I don't have a self-evaluation in the O.R. When I see a patient several months down the line, sometimes I don't remember a whole lot about the surgical techniques or anything specific about what I did. (orthopedic surgeon)

difficulty evaluating — The unfortunate thing I don't do is write down what my comments are. You tend to forget unpleasant things and remember the pleasant things. Although it would be hard to do. I wonder if it would be of any value. Just to write it down would be no good because you'd almost have to have the x-ray there, and that's hard. It would be too long a story. Let's face it, we're not paid to be writers. (neurosurgeon)

The existing literature emphasized the scrutiny doctors receive from numerous different groups, outside the doctor-patient relationship, namely third parties of the patient, the Patient Admission Process, committees, governing bodies, and nurse specialists (Bosk, 1979; Callan, 1983). Judging if decisions and actions were blameworthy or blameless was generally the focus of the review.

The evaluation process was examined by identifying methods of evaluation, and sources of responsibility.

Methods for Constructive Evaluation

Evaluations generally took place spontaneously after surgery, during the patient's recovery period, at Morbidity and Mortality Rounds, and/or at a patient follow-up.

Self-evaluation was common to all, whether it was assessing results, visualizing to recall the procedure, or referencing with notes and photographs. Consultation with patients, colleagues, and the team was also listed, but to a lesser degree. The distribution in using these methods is listed in Table 14.

Table 14
Constructive Methods of Evaluation in Surgery

Ranking of Constructive Methods of Evaluation	Total Responses (ranked percent)
Self-evaluation*	
• Assessment by result	79
• Post-visualization, recall**	27
• Use of visual aids: records, photos	24
Consultation with patient	36
Consultation with colleagues	33
Consultation with team	15

* All respondents had at least one method of self-evaluation.

** See also *Positive Images* section.

Self-Evaluation

Personal evaluation of results was preferred by most surgeons (79%). The surgeons' decisiveness and eagerness to improve their performance dominated their responses.

results — Well, my evaluation is simple — results. No matter what you did on that particular occasion, one thing counts — What is the end result? Most of it has to do with your performance, and what you've done to prepare. In particular, it's your judgement in indicating the surgery and your judgement during the operation. That judges your skill. If you've done things in the right fashion, the result is good. (elite neurosurgeon)

results — It was more a question of finesse rather than heroics. ... It looks really nice and I'm really pleased with the result. I mean that's the bottom line. ... There was a lot of finesse and detail involved. Everything about it was very nice. It was a work of art. (orthopedic surgeon)

results — You're continually trying to improve upon little things that you do just to make the whole thing smoother, quicker, and more efficient. ... I know I'm continually trying to improve. I consider it to be a good operation if everything goes along carefree, there's no glitches, and everything's slick. That's how I evaluate it. (elite orthopedic surgeon)

results — We always evaluate it by the end result. Sometimes you get a good result even though you shouldn't have. You can do the operation the wrong way or you can have complications which you could have avoided, and yet the patient turns out okay. Some surgeons with big egos would say, "Aha, I'm one of these lucky ones who's never going to have any problems." Of course, that's a fatal commentary to make because surgery, especially neurosurgery, is very unforgiving. The moment you think you're riding the top, everything's going well and you'll never have another complication, then boom — that's when you have a big one. (elite neurosurgeon)

results and recall — Self-evaluation is a relatively instantaneous thing. If the outcome resembles and the conduct of the operation coincided reasonably close to my plan, then I give myself pretty good marks. I evaluate myself largely on the basis of: Did I cover everything that I encountered in the surgery? Did I deal with it as I said I would? Did I encounter the unexpected? In which case, I better make damned sure that this is in my strategy the next time. I evaluate myself in that way, and it's usually done on the spot. Unlike others, I don't go back and do the operation over and over again in my mind, unless there's been a real serious shortfall between my strategy and what actually happened. I try to review the situation to make sure that I learn from it. (elite neurosurgeon)

results — I don't use any formal evaluation strategies. I don't have a list of patients I've operated on. ... Nothing formal anyway. I see my patients in the clinic and mentally note the ones that have done well, and the ones who may have not had an optimal result. I try to note the reasons for that. (orthopedic surgeon)

recall — I'm probably my own worst critic. If it's just a little thing here or there, then usually acknowledging it in the operating room is sufficient. If there's a major problem, then I'll probably wait until I'm at home. I ask, "What did I do?" or "Why did I do that?" or "That was sort of silly and not to be done again" or "You did this or you ran into this problem, so you better not do that again. Let's try something else. (cardiac surgeon)

study aids — I just went through doing an American Board Qualification. ... You have to go back, look at six months out of your practice, take all your cases and very critically analyze them. ... They ask specific questions about all different

categories of things that you do. One of the categories is complications. Before I started looking at it, I would have thought that I had very few complications. When analyzed very critically, depending on what you call a complication, there are a hell of a lot of things. That was an eye-opener for me. Hopefully, that might help me analyze my performances more critically. ... It's hard to be critical and yet honest about your own work. (general surgeon)

Consult with Patients

Doctor-patient relationships were a valued source of evaluation and motivation for surgeons.(36%).

consult patient — You always make little notes in somebody's chart on what you did and what you were happy with. ... I don't do it in any extremely systematic fashion. Obviously, as you do 150 or so you'll see results over time. Certainly you're careful to try to keep people coming back each year, so you'll know what happens five years down the line. ... I try to see people for as long as I can. ... Just because I'm happy after one month, doesn't mean I'll be happy in a year. You do see the long-term results. You ask your patients questions, but not in any organized fashion. (orthopedic-plastic surgeon)

consult patient, self, consult colleagues — The most critical evaluator of my performance is my patient. That evaluation is usually done through discussion and examination. It's a gradual process during the post-operative period. ... The other aspect of evaluation, is self evaluation and the evaluation by my peers, my colleagues, both surgical and non-surgical colleagues. ... It's a multi-disciplinary thing, but I maintain that the critical evaluation is by the patient and the patient's family. You operate on the patient but you treat the whole family. (elite neurosurgeon)

Consult with Colleagues

Gaining colleagues' respect, feedback, and compassion ranked high for many (33%).

consult colleagues — If I have a very unusual case or something quite trying, my buddy and I often talk to each other. ... He comes over to my house usually once a week. He brings films over or we go to the hospital together and we talk about it, or we call each other. ... We try it out on each other. You can talk to anybody, if it's just a straight forward case that looks difficult or you're just wondering what approach you should use. But if you're concerned with outcome, or whether you should be tackling it, you have to talk to somebody you know. You have to have "a brother." ... We're like one family. ... Our first ten years of practice we almost lived together. We just talked about everything, every case.

Everytime we'd have a disaster, we'd be on the phone to each other. Maybe that is preparation and evaluation. What you're doing is you're dumping your soul, then you feel better and you do it again. Otherwise you might be shy to "get back on." (neurosurgeon)

consult colleagues — The other aspect of evaluation, is the evaluation by my peers, my colleagues, both surgical and non-surgical colleagues. That evaluation is a less defined type of an evaluation because that comes from discussions about cases at rounds and in reviews of the cases. Of course, that is very unpredictable. ... Another example is if the hospital decides that as part of their audit program they're going to review all back operations done between January and July, then that particular operation that I happened to do in June would be in that audit and would be evaluated by my peers. (elite neurosurgeon)

consult colleagues, recall — Even when you do the same surgery, you may come across something different. ... There are times when you can be technically very good but still you can have a problem. Whatever the results, post-operatively the person has to criticize himself: what he did, whether or not he did his best, why this happened, what should be done for next time, how do you manage. If he cannot answer, then discuss it with his peers. That's learning. You're always learning. (elite cardiac surgeon)

consult colleagues, self — I love morbidity and mortality rounds. There is a moment where I can have it out with myself. Then I can use them to re-evaluate myself, and to convey to my colleagues the particular difficulty I had, and what I did wrong, so the next time I will not do it. I even have the hope that they will benefit from what I say. (neurosurgeon)

consult colleagues — I don't personally find M and M rounds stressful. If it's a case where I know I've obviously made a mistake, I'll say, even before going in there, "Look, I'm going to admit my mistake." It's as simple as that. It depends on the kind of atmosphere that you create beforehand. I know that my colleagues are going to "forgive me" because they know damned well that next time it's going to be their turn. They have to project a certain degree of kindness and understanding when they make a comment about what you've done. ... We're washing our dirty linen in private, and we know we will do better next time. (general surgeon)

Sources of Responsibility

Cases chosen to demonstrate their successes and disappointments were directly attributable to one or more of three factors:

- Personal performance
- Performance by others
- Luck — good or bad

Linn and Zeppa (1973) described how surgical students had a stronger locus of control than other students, and believed that events were the result of their own behaviour rather than that of fate or luck. This was confirmed in successful surgery, but differed in disappointing performances.

Most surgeons attributed their successes to personal performance. In comparison, disappointing cases were generally viewed as a consequence of misfortune together with their personal performance. Less than a third of surgeons described cases in which they held others responsible for either outcome. As a total group, their responses are ranked as shown in Table 15.

Table 15
Attributed Sources to the Success and Disappointment of Challenging Surgery

<i>Successful Surgery</i>		<i>Disappointing Surgery</i>	
Sources of Responsibility	Total Responses (ranked percent)	Total Responses (ranked percent)	Sources of Responsibility
Good personal performance	72	70	Bad luck, misfortune
Good performance by others	27	67	Poor personal performance
Good luck, good fortune	22	30	Poor performance by others

Surgeons attributing success to personal performance, compared with those who did not, shared a number of other traits. First, this interpretation was more common to men than women (chi-square testing; $p = .046^*$). Second, honesty and communication were used as coping strategies for morbidity and mortality ($p = .027^*$). Third, imagery was a predominant skill both in preparation ($p = .025^*$), and in evaluation ($p = .031^*$). This goes towards supporting research that practicing imagery regularly helps develop an enhanced self-image and confidence with others (Loehr et al, 1986; Nideffer, 1976; Orlick, 1991, 1992)

When success was credited to the performance of others, three mental readiness traits were absent to all. First, they did not report a commitment to be the best (chi-square testing; $p = .010^*$). Second, rehearsal of risks and options was absent ($p = .010$). And finally, the use of imagery for evaluation was lacking ($p = .029^*$).

Attributing results to luck differed according to the surgeon's years of experience. In a successful operation, the less experienced surgeon (less than six years experience) was more likely to use good luck as an explanation for success than was the more experienced surgeon (over 10 years experience, $p = .024^{**}$). After a disappointing outcome, the more experienced surgeon was more likely to use misfortune as an explanation than was the less experienced surgeon ($p = .010^{*}$). Inexperienced surgeons have less of a track record to support confidence in their abilities. In contrast, after years of experience, improved skills, and dependable outcomes, surgeons probably view poor results largely as a consequence beyond their control.

PERFORMANCE BLOCKS

Surgeons find it painful to recall disappointing performances of any kind. Despite having good indications and good planning, they sometimes meet up with unexpected results, unaccomplished objectives, a less than perfect job, a dissatisfied patient, or poor teamwork. They expected to do well, wanted to do well, but fell far short of the mark.

There are many distractions before and during surgery that can challenge surgeons' confidence enough to put their performance at risk. They can sometimes find themselves completely discouraged.

There are times when a surgeon may say, "I wish I never was a surgeon" or "I wish I had never started this case." There are times like that, no question. (elite cardiac surgeon)

The interview transcripts revealed several obstacles that can interfere with an ideal mental performance state.

Lulls, crises, and prior upsets were the leading distractions noted in surgery. Personal fatigue, personal reactions to teammates, and extraneous interruptions were also seen to present blocks to judgement and performance. Surgeons in teaching hospitals elaborated on certain difficulties incurred by working with residents.

Other predominant hindrances in surgery included: limited preparation time, technical errors, and unusual anatomy in the patient. The ranking of all performance blocks is listed in Table 16.

Table 16

Performance Blocks Before and During Surgery

Ranking of Performance Blocks in Surgery	Total Responses by Surgeons (percent)
<i>Before Surgery</i>	
• Prior upsets	73
• Limited preparation time, other commitments	39
<i>During Surgery</i>	
• Lulls; delays: routine phases	94
• Crises	85
• Personal fatigue	61
• Negative reaction to nurses	61
• Negative reaction to resident/anesthetist	58
• Interruptions during surgery	52
• Technical errors	33
• Unusual patient anatomy	24

Lulls

Lulls were the leading distractors for surgeons (94%), yet lull distraction control was least developed (79%) among surgeons compared with effective control skills for crises (100%), hindrances during surgery (100%), and preoperative upsets (85%).

Surgeons are mentally and physically eager to make quick decisions and to act on them. Efficiency is frequently a deciding factor in the patient's rate of recovery. When unexpected or prolonged delays occur, the waiting and the watching can be painstakingly long, leaving the surgeon impatient and frustrated. Slow, routine phases of surgery or observer roles are often perceived as boring, and render the surgeon momentarily inattentive to the details of the surgery.

Lulls are produced by:

- delays in start time, test results, and preparation
- a failure or absence of equipment
- instrument contamination requiring resterilization
- the routine phases of surgery (e.g., opening, closing)
- having to just watch as a coach or an assistant

delays — You're really eager to get going. You want to put those cases at 8:00 in the morning. If they tell you, "You're going to be delayed" then that really throws you off. (general surgeon)

delays — If you have a tourniquet around a limb, which we frequently do, I like to keep it down below a certain time limit. If there's then a lull in the surgery, where you're waiting for something like an x-ray, I tend to get quite uptight. I tend to be a little bit intolerant of people who are not in as much of a hurry as I am and don't seem to appreciate the urgency. I get very fidgety when I don't have anything to do and I'm waiting for somebody else who doesn't appear to understand the urgency. (orthopedic surgeon)

delays — Anesthetists can be doing what you think are unnecessary things or unskillful things, like attempting to get an intravenous line and not getting it, over and over and over. He might be terrific, but he is painfully slow. That takes the edge off the day. You lose some of that smooth feeling of "no matter what happens you can do it." It would be better to have the surgeon put on hold somewhere else so as not to see that. I leave. I can't stay there. (cardiac surgeon)

delays — Sometimes I find I am very impatient. ... Time is an important component of a good operation. By waiting on somebody else, it cuts into my time. That's where the impatience comes from. ... In most situations where I'm waiting for something, I find that I don't say much but just wish it would be done so I could keep going. (cardiac surgeon)

routine — When everything is finished and you're closing the chest, then drifts can occur. I don't like this drifting because you can miss things during that period. ... It's the successful, happy ending that drifts you away from the caution you usually take. You think, "What could happen? I'm just closing. It's a very simple thing." That's when drifting can happen. (elite cardiac surgeon)

watching — My big problem is that I can't watch surgery very well. Like in sports, it's hard to sit on the bench. I find it very difficult to watch another surgeon operate, especially if it's a resident there with a fellow who I know is competent. I find it very hard to keep my concentration. I need to do the surgery. This is difficult in a teaching program. It's one of my failings. (orthopedic surgeon)

watching — It depends to some extent on what you're doing. I am fairly focused when it's a matter of the cutting and you're actually doing something that has any element of relevance to the success of the outcome. I find that my mind does wander when I'm assisting on a big, long, long operation. I think about other things that are not medically related. (neurosurgeon)

Crises

Surgeons are hesitant to label a situation "a crisis." A critical situation can improve or worsen in seconds depending on the surgeon's response.

Crises depend on the eye of the beholder. What one surgeon may think is a crisis, other surgeons may not — for example, if an instrument is not there. Some people will think that is a major crisis, and they can't do the operation unless they have that particular knife or fork. (elite neurosurgeon)

The situations that surgeons most often define as a "crisis" include:

- massive bleeding
- an unstable patient condition
- one's own panicky reaction to a serious problem

Two-thirds of the surgeons admitted having had an emotional reaction, either aloud or internally, when first alarmed by a crisis. A crisis can build up stress and become a prolonged distraction lasting the duration of the operation, particularly in elective surgery. Composure must be maintained both during and immediately after a crisis.

prolonged stress — During crises, you aren't even aware of the stress you have because your mind has an automatic reflex. You have to do something. Once you do it and the patient is stabilized, then stress starts. You think, "Now I'm going in. We started with a complication. How is the patient going to come out?" You may feel stress during the entire surgery. (elite cardiac surgeon)

emergency vs elective — I find it easier to deal with the crisis of emergencies because in an emergency situation the patient comes in with a major head injury or whatever that is killing the patient. You know that you're stuck against the wall.

You're forced to do it. If something goes wrong, it's easier to accept than if it was elective surgery. And it's easier to explain to relatives. (elite neurosurgeon)

frustration — The minute you're in the O.R., nothing else is going on in your mind. ... But when you start having some difficulty, that's when the scenario changes. Then you're just trying, trying, and trying. (elite cardiac surgeon)

panic — I find when I get excited or panicky, sometimes I have a hard time remembering the word of a specific instrument. For example, I'll ask for an instrument, but I meant another one. If I can get everybody else calmed down, I find I am fairly cool. (cardiac surgeon)

panic — Time and time again I have seen people panic. You can tell by their breathing, then they look up and they are sweating. (general surgeon)

unexpected crisis — I stuck myself with a needle. The only reason that could be a bit of a crisis is that the patient, who is now fifty some years old, was previously a biker. I'm not sure if he was a member of one of the motorcycle gangs but there was a possibility of things like intravenous drug use, AIDS and hepatitis. I was upset for thirty seconds, then I let it pass, and got on with the operation. (cardiac surgeon)

Prior Upsets

The surgeon's frame of mind at the onset of surgery can set a tone for the operating theatre. Many emotional upsets are forgotten once inside the operating room — but not all. Some sources of anxiety are physically painful, mentally preoccupying, and ultimately a hindrance to performance. Some surgeons found that they could be negatively affected by:

- poor results from a previous case
- preoperative, unresolved tension
- effects from a patient's high level of anxiety
- pressures from day-to-day functions
- tension from interpersonal conflicts
- emotional trauma

previous case — Your first one can go badly, and you didn't expect that kind of trouble. Your worst-case scenario is that the patient dies. This can definitely affect your emotions for the next operation. It can be very difficult to go in and do another one. (elite cardiac surgeon)

preoperative tension — The patient goes through almost the same stages before the surgery as the surgeon. She feels apprehension and tension. ... The surgeon feels like that too. With this challenging surgery, you're going in with the possibility of so many things, and you then come out with success. You feel exactly the same as the patient. You felt all the stress. It's not physiological pain but stress. That's worse than pain. It's anxiety. When you come out with a good result and you know that the patient is going to be okay, that gives you complete relief. It's just like you have taken medication for the pain. It's relieves your anxiety, it relieves everything. (elite cardiac surgeon)

preoperative tension — I get up just five minutes earlier, I grab my notes and read them. I go through it in my mind. I go through all of the steps. If I don't have the time to do that, often I'm not at ease when I get to the operating room. I'm a bit more tense. There's a little bit more adrenaline going, so I'm a little bit more hyper. (general surgeon)

patient anxiety, interpersonal conflicts — A patient outside the operating room suddenly says to you, "I'm really worried about this and my husband, he's a lawyer. He says if it doesn't work out that I should sue you." In other words, someone can say the wrong thing ahead of time. An irritating patient can get you riled up. Another example is you can have a disagreement with the nurses because they haven't got the equipment or they haven't got things ready. You're angry. When you're angry it does physically and mentally affect you and spill over into other things. (orthopedic surgeon)

day-to-day pressures — A typical situation will be where I come in a little bit uptight. I'm not happy with the way that the table is set up, the way the lights are or the equipment that we have. I'm maybe too critical about those things. I let them bother me and then I convey that to the staff. Of course, immediately I feel their guard and then a whole bunch of little things can make things go wrong. ... Basically, it's me being uptight right from the start, and that probably puts them off. It's just so different from when I'm totally relaxed and tolerant. I don't know what might set that off. Maybe just too heavy a schedule or other things. (orthopedic surgeon)

day-to-day pressures — I am not an expert at dividing myself in two; like number one is in the O.R. and number two is everything outside. There's a mix between the two ... It's not a problem, but I can't zip off number two and just go with number one. (orthopedic surgeon)

interpersonal conflicts — There's nothing worse than going into an operation mad, just having had an argument with somebody or being really preoccupied with something else. It really throws you off. It could be a fight with your wife or husband. It could be anything like that. Sometimes you might just end up cancelling the surgery. Sometimes there may be no particularly good way of going around it. Sometimes you find that once you get going you forget everything. (general surgeon)

emotional trauma — You don't want to do something elective on a day that you suffer some kind of emotional trauma. There's no question about that. (elite cardiac surgeon)

Residents

Working with residents presents one of the greatest challenges in a teaching hospital. While it occasions an opportunity for pride, there are certainly concerns about the effect residents have on the performance.

Results showed that surgeons do not often hold residents responsible for poor outcomes in surgery (see *Constructive Evaluation* section for details). Onsite resident instruction does, however, change the dynamics of the surgical environment. Surgeons face feelings of:

- losing control but still being held responsible
- settling for less than perfection
- trying to teach those with low skill levels
- being stressed by the increased complexity
- combating the boredom and frustration of having to watch
- longing to have "fun" again by doing it all

responsibility, complexity — Residents create a more complex stress situation. Residents can create a busy atmosphere. You have a sense of responsibility yet you're not really able to take responsibility. You're too preoccupied with teaching and not with the operation itself. (neurosurgeon)

responsibility, watching — Mentally, you're in a box because you can't wax and wane from day to day and say, "Well, today I'm going to let you do it," and then tomorrow I'm going to be in a bad mood and say, "No, you can't do it, I'm going to do it myself." You can't do that. So mentally you've got to swallow the bitter pill and let them do it, even if you don't feel in the mood. (vascular surgeon)

perfection, unskilled — It's something that's done by feel. His "three-dimensional feel" of how far through he was, was not good enough. It's hard when you're teaching to say, "Now are you sure?" It's like talking to kids: "Are you sure you went far enough?" ... They get a little uppity when you start to do that. It's as though you're checking on everything they're doing. Then again, they've probably only done a few, and I've done many hundreds. That's a problem due to my

inattention to detail. I was watching it, but I should have just said, "Okay, I know that that can be a problem. I'm just going to check that anyway." No matter how insulted he feels about it, I should do that check. (elite orthopedic surgeon)

perfection, watching — The things that would make me disappointed in an operation are that you cannot do it yourself, and you have to watch how somebody else does it. It might be very well done and perfectly acceptable, but it's not polished. ... It's just not slick. (vascular surgeon)

unskilled, watching — As a rule, you feel ready to do the surgery yourself. The question is, are you ready to watch somebody else at a junior level actually do it, while you're directing him like a robot? "Move left 30 degrees, hold your arm up." ... It can be very stressful when you have an unskilled person and you're trying to teach him. But everybody is unskilled when they start. You have to be patient enough and understanding to let them do that part of it, and to give them enough independence to feel that they did something in the operation. (vascular surgeon)

complexity — During the summer months, when we don't have the teaching and administrative load that exists during the academic year, things are much more relaxed. (elite neurosurgeon)

no more fun — We're often working with residents. They're doing it and you're helping them, which is sometimes just as frustrating. It's nice to do it yourself. On the other hand, there's a certain pride in having taught somebody how to do things. But sometimes I do enjoy doing my own work. I like to see how well I can work. It's awful to say, but I am very proud of my work. I am and I don't get to "play" anymore. (neurosurgeon)

Other Distractions in Surgery

Long work days and interrupted sleep are frequently standard, even an expected, way of doing business for surgeons. When personal fatigue has become too excessive, many surgeons (61%) stated that conditions for performance were not at their best.

Surgeons are also uneasy about their dependence on the complex teamwork required. The preliminary procedures needed to ensure a flawless surgery relies on the competence of anesthesiologists, residents, and nurses which makes surgeons uncomfortable. Having to depend on the behaviour of others can result in interpersonal tensions.

Extraneous interruptions, limited preparation time, technical errors, and unusual anatomy in the patient make up the remaining performance blocks.

fatigue — That afternoon I was tired and didn't feel like operating. The physical fatigue ended up being mental fatigue too. ... In that case (disappointing performance), I'd been on call the night before. I'd been actually operating from 2:00 until 4:30 in the morning ... They're so booked up and that's when you end up doing your cases, just to get them done. Yes, that day I was really exhausted. I like what I do but I have to be in good shape for it. If I'd had the time to have a good night's sleep, think about it, and arrive in the operating room so that I was not rushed, then I'd have been just fine. That's a luxury that never occurs. (general surgeon)

fatigue — I knew I was going into this feeling a little tired. I thought, "I'll have to take a little bit of extra care in what I do and not try to cut corners because I'm tired." That's something that you have to be conscious of. Being overly tired is something that can affect your performance. (cardiac surgeon)

fatigue — One always likes to operate when you're not fatigued. ... When you're tired, it's hard on you. It probably affects your performance if there is complication and you have to stay on longer. (elite cardiac surgeon)

fatigue — If I've been up all night the night before, it doesn't necessarily affect your performance per se ... but it makes everything more painful. It affects some of the more mundane aspects of the operation, not the operation itself. For example, the whole rigmarole of getting the patient ready, the tedium of standing around waiting for the operation to start, and then finishing the case. I find I'm less tolerant. It just gets to me more than usual. (neurosurgeon)

fatigue — There are times that you're tired, especially when you're on call. You've worked twenty-four hours and you still have to do the surgery. You're not maybe physically and mentally as bright or strong. There is that time when you may not be mentally and physically prepared, but it's not at a low level. No matter how tired you are, you're still in a good range. (elite cardiac surgeon)

reaction to team — It's teamwork. Your alertness is not enough. You can be a perfectionist, but if the others are missing something, then something can still happen. It involves a whole team. Certainly you pay attention to things but so often it's taken for granted that everybody is doing their best. Because of the complexity, usually something unexpected happens. ... It's difficult to recognize where the mistake was or where things went wrong. It's very difficult. (elite cardiac surgeon)

reaction to team, technical error — The surgeon assisting me was basically harassing me through the whole case. In other words, I didn't have control over the case. It just went from bad to worse. I lost confidence in my own technical abilities with each of his comments. The end result was that it took a lot longer than usual. I was very unhappy. Technically it was horrible. I just wanted to stop. Mentally, it just got worse, and I physically felt very tired, very sore and stressed. ... Once you self-criticize halfway through the case, you've lost what confidence you had and it's a real struggle to get yourself out of it. (vascular surgeon)

reaction to team — Eight o'clock in the morning, you look around and see who's helping you. There's always people you get along with better. It makes for an enjoyable day if you know you're going to spend eight hours with somebody you like. You may have a couple of old, crabby people and they're down about

something. If you get all that stuff going on then that detracts from doing a good job. It's an unexpected surprise when everything is nice and cool. There are certain people you like working with because things go along nice and easy. There are certain surgeons who think every little problem is a giant problem; they make it into a big flap. They're just not going to last. (elite orthopedic surgeon)

reaction to team — Sometimes your attitude is affected by the people around you. ... If somebody on the team or the whole group is not what you would like, that affects you in a certain way. ... You might try to overcompensate. It might throw you off a little bit. That happens a lot of times. (cardiac surgeon)

reaction to team — Someone else can do something wrong and jeopardizes my performance. That's a very definite situation that can happen because you're part of a team. Somebody else can mess up and the surgeon's responsible. ... Usually, you tend to let tension out somehow. I used to get angry — not a temper tantrum, because that's really poor and you can't do that type of thing in the operating room. I tend to get a little bit sarcastic. It's obviously getting out aggression or hostility. I point out what they have done wrong. I give myself a few seconds to see how I can fix their mistake. I'm the one who's going to hang for it. I find that really difficult because they can cause real trouble. Yet it's your show and you're totally responsible. (orthopedic surgeon)

reaction to team — The system right now has become so complex, so many people now interact in the conduct of even a simple operation. You have become so dependent on people carrying out their particular little role that what you discover is that, in fact, much of the time people aren't doing their own little part. All of a sudden the patient arrives in the operating room and you find out that an order that you had written wasn't carried out. Maybe somebody didn't do the blood count on the patient, or the cardiogram that was ordered isn't on the chart. ... It creates undue anxiety. ... In the meantime, they're all lining up outside your operating room saying, "Are you going to go ahead with this operation? Is this room going to be late today? Are you ready to cancel your last case, because you can't start your first case, because somebody didn't ... ?" It's all this. (elite neurosurgeon)

reaction to team — The anesthetist wants everything on time, the nurses want you to finish at a certain hour. ... If you're not finished by 3:30 p.m. then you get a letter saying, "Why were you late?" There's all kinds of silly little things, but that's unions. People work for a living. You want to go home at 5:00 p.m. So this is how it works. (neurosurgeon)

interruptions — The main distraction is that there's a lot of traffic in and out of the room. ... That can sneak up on you because you're concentrating and suddenly you realize that the people are changing over. For instance, the nurse is busy with another circulating nurse, or there's a changeover, or somebody's coming in with a case from "emerg". ... Once you get a whole bunch of different groups in, then I find that quite distracting. Currently, I find this to be a more and more prevalent problem. (orthopedic surgeon)

interruptions — You're in the O.R. in the middle of a difficult case, perhaps you're on call, and in comes something equally as difficult from emergency. You're trying to concentrate on one; then you've got another thing to worry about. That can be quite distracting. (orthopedic surgeon)

interruptions — Your pager or the phone goes off. You have to send somebody to answer it, find out the problem, and then you solve the thing. That makes it very hard to concentrate. (orthopedic surgeon)

interruptions — You can't be doing a case and knowing you have to be at a meeting in ten minutes. You feel that you have to be there. If you miss it, the people expecting you feel like it's the end of the world. I find this very, very bothersome. To me, this is one thing that disturbs me very much. When you're working, you have to try to eliminate other things from your mind. (neurosurgeon)

technical error — If you cut something in the anatomy ... it's probably going to be more difficult. It isn't routine and it isn't normal when something changes as you're starting. That makes you anxious, on edge, frustrated, and worried. (orthopedic-plastic surgeon)

anatomy — The stress happens mostly if you encounter something that was not part of your planning. You're doing the surgery and you feel that everything is going to be perfect; the patient's artery perfect for grafting. When you go in, you cannot find the artery, and then stress starts. (elite cardiac surgeon)

Surgeons who became disappointed in their performance because of a lack of finesse (chi-square testing; $p = .003$), shared three distractions in common. During surgery they found having a negative reaction to residents/anesthetists ($p = .003$), interruptions ($p = .029$), and nurses ($p = .024$) to be a source of distractions. The ability to try to prevent lulls by anticipating them was also identified ($p = .039^{**}$). It's possible that distractions or the lack of ability to deal with them has a major impact on finesse or success.

Surgeons reporting a negative reaction to team members during surgery did not report being able to anticipate the next step as they operated (chi-square testing; $p = .049$). However when engaged in very high-risk procedures, this performance block did not appear to be operational ($p = .049$). Does this mean that the higher the risk, the greater the quality of focus?

SPECIAL PROFILES OF EXCELLENCE

Characteristics which distinguished elite surgeons, high-mortality-risk surgeons, best performances, gender, and those with different views on success were identified.

Elite Surgeons

Seven elite surgeons were identified by their reputation among peers, the medical community, and the media as "elite" or "super-stars." They had a mean of 19 years experience. Interviews with these individuals left several immediate impressions, which were later confirmed through reviews of interview transcripts and statistical analysis.

First was the high level of refinement they had acquired in each of the seven success elements. They were consistent in providing intimate details in all areas of mental preparedness. They were also the most open and/or least inhibited in the disclosure of sensitive information. The seven elements included: commitment, belief, positive images, mental readiness, full focus, distraction control, constructive evaluation.

Second, while their expertise was unmistakable, their dedication was also very powerful. Compared with other surgeons, they were found to exhibit a higher level of commitment to do their best (chi-square testing; $p = .047$), and compassion ($p = .016^{**}$),

Patient understanding of the surgical risks and expectations was fundamental to proceeding, and even motivational to performance. This influence was true for both the elite and surgeons with over 10 years experience (chi-square testing; $p = .022$).

Elite group surgeons also viewed their strong spiritual perspective or religious beliefs as having an important influence in their mental readiness (chi-square testing; $p = .005^{**}$). They also recognized their tendency to get bored with delays and routine phases of surgery ($p = .041$). The

potential to become inattentive to details was taken very seriously, and this distraction, like others, was managed through preparing effective refocusing techniques.

High-Mortality-Risk Surgeons

The seven success elements were found in all best performances, but performing under high-mortality-risk conditions attracted the most uniform profile of success elements, compared with other high-performance challenges.

The traits found to be most unique to this group included: having belief from mentors (chi-square testing; $p = .044^*$), rehearsing with imagery ($p = .016^*$), experiencing focused energy during surgery ($p = .012^*$), evaluating by the result ($p = .046$), coping through forgiving and forgetting ($p = .037^*$), and recognizing that they did their best ($p = .046^*$). They were also the only group able to anticipate the next step as they operated ($p = .049$), despite reporting a negative reaction to team members.

Can we assume that the higher the risk, the greater the quality of focus and commitment to success?

Best Performances

All the success elements in Orlick's "Theory of Human Excellence" were found to exist for all 33 surgeons during their best performances, with the exception of positive images. Seventy-nine percent clearly identified the use of imagery. Perhaps this skill is one that clearly distinguishes elite and high-mortality-risk surgery.

Gender Differences

All female surgeons interviewed were engaged in a low- versus high-mortality-risk specialty. Based on this female sample group, females appeared to be less aggressive in challenges taken on, more able to remain emotionally stable, and more patient and accepting of routine.

Achieving exceptional results was of greater concern for males than for females (chi-square testing; $p = .024^{**}$). Disappointment due to unexpected results was also more common to men ($p = .016^{**}$). Females were less inclined to attribute success to personal performance to the same degree as males ($p = .046^{**}$). Overall, female surgeons seem involved in less risk taking and have a less aggressive approach to surgery.

Male surgeons reported a stronger influence from colleagues (chi-square testing; $p = .049$) than women, but little from their own family ($p = .010$). Team evaluations were also rated higher for males ($p = .028^{**}$).

Routine phases in surgery were reported as greater distractors for males than females (chi-square testing; $p = .024^{**}$). Males also showed a greater change in mental and physical readiness between successful and disappointing performances ($p = .005^{**}$ and $.010^{*}$ respectively).

Reasons for these apparent differences are unclear. As always, men can learn from women and women from men.

Different Criteria for Success and Disappointment

How an operation is judged successful or disappointing varied among surgeons. Surgeons with common views on success were found to share common mental readiness characteristics. When all surgeons were asked what made their performances successful or disappointing, five criteria were identified. These criteria are listed in Table 17.

Table 17
Criteria for Success and Disappointment
In Challenging Surgery

<i>Feelings of Success</i>		<i>Feelings of Disappointment</i>	
Reasons for Feelings of Success	Total Responses (ranked percent)	Total Responses (ranked percent)	Reasons for Feelings of Disappointment
Attained objectives	52	49	No finesse, not smooth
Finesse, smoothness,	42	46	Did not attain objectives
Satisfied patient	39	39	Unexpected results
Exceptional results	36	27	Poor teamwork
Good teamwork	18	25	Dissatisfied patient

Some of the reasons for feeling successful were:

- "accomplished in half the time"
- "technically expert and fun"
- "finesse rather than heroics"
- "a work of art"
- "doing the impossible"
- "slick procedure"
- "speedy patient recovery"
- "family was very grateful"
- "satisfaction of a good team"

In contrast, the reasons for feeling disappointed included:

- "we couldn't fix it"
- "patient died in surgery"
- "we were replacing rather than repairing"
- "it could have been smoother and shorter"

- "it was more intense afterwards because the family members were physicians"
- "the surgery was a failure"

Those who described attaining objectives (52%) as a criteria for success had strong links with their colleagues and role models; i.e., colleagues were consulted in preparation (chi-square testing; $p = .009$), colleagues were an unplanned influence before surgery ($p = .026$), mentors were a key support ($p = .037$).

Hindrances experienced during surgery were significantly greater for those striving for finesse and smoothness (42%); i.e., they reported negative reactions to assistants/anesthetists (chi-square testing; $p = .003$), nurses ($p = .024$), and interruptions during surgery ($p = .029$). The importance of distraction control may be of particular relevance to the detail work of performing with finesse.

When success was based on patient satisfaction (39%), there was an apparent calmness during surgery; i.e., low anxiety (chi-square testing; $p = .037$), controlled energy ($p = .036$), and time was taken to assess options in crises ($p = .005$).

Those who had aimed at achieving an exceptional result (36%) identified the importance of colleague support before surgery (chi-square testing; $p = .049$), anticipating the next step and possible problems during surgery ($p = .030$), and recognizing one's best effort ($p = .033$).

OTHER MENTAL PRACTICES

Other mental practices were described beyond preparation and actual surgery. These practices included post-operative coping strategies, development through training and experience, and external analogies drawn upon by surgeons.

Post-Operative Coping Strategies

Once surgery is completed, surgeons' coping mechanisms may be further tested. Post-operative pressures can be mentally fatiguing and may prove a hindrance to later surgical performances. Morbidity and mortality (M & M) illustrate the exposure to stress in surgery and the demand for effective long-term coping skills.

Post-Operative Problems

Surgeons confronted the following problems after surgery:

- living with mortality
- living with morbidity
- questioning personal performance
- battling long-term stress
- feeling anxiety from M and M Rounds
- being frustrated with technical limitations

mortality — When you're on your own the entire responsibility is yours. You have to talk to the patient's family after the surgery. If the surgery went well, you feel great. But if the surgery didn't go well, the patient is not doing well, or the patient died on the table (even when you know that this patient had very little chance of surviving the surgery), going and talking to the family is a very shocking experience, every time. (elite cardiac surgeon)

mortality — At what point in time do you decide to stop and say that she is "dead" now. For the first 100 or 200 cases that you go through like this, you will ask yourself afterwards, "Had I carried on for another two minutes, would a miracle have occurred?" or "Would the heart have restarted?" You never know when you will be able to restart a heart. So at a point in time you have to use your judgement as to whether the chances an hour or an hour later of restarting are essentially zero. But it's never zero. There's no absolute. (cardiac surgeon)

mortality — Sometimes you feel relieved if the patient dies. Everybody feels relieved because sometimes you have to put up with complications that can be long lasting. You wish that you could turn and it would disappear, but it doesn't. That thing haunts you every day. You come to work and you think, "Jesus, I have So'n'so that is ... you know." Sometimes it was not really your mistake but it was a result of your treatment. You really feel bad about that. (elite neurosurgeon)

mortality — You need to know why the patient didn't do as planned. You had a game plan, and something went wrong somewhere. Whose responsibility is it? Mine, or an accident, or the nature of the disease or what? I don't know about the others, but I have to know. If I have a death and I cannot give them an autopsy, I'm really, really pissed off. What can you do? The family says no. You try to convince them. You give them all your arguments and the family still says no. You're stuck. It bothers you for a day or two; then, well, life carries on. But it does bother you. (cardiac surgeon)

mortality — This was a condition for which the mortality is already 50%, no matter what you do. But in this particular case I wasn't very happy, not just with myself but with the whole management of the situation. (general surgeon)

mortality — The patient was about 75 years old and she had a very bad heart. Many, many members of her family were physicians, which of course always makes one feel a little bit more intense. During the operation, which I thought was going well, her aorta (the main blood vessel) tore and we couldn't fix it. She died in surgery. (cardiac surgeon)

morbidity — Morbidity is something you sometimes don't have too much control over. For example, with an infection in the leg, the surgeon is ultimately responsible. You can't say, "I really didn't do it." You can't tell that to the patient. You don't lay blame on anyone and you don't try to say, "It's not my fault" ... It's a reflection on you as a surgeon. It is difficult to take. (orthopedic surgeon)

morbidity — I can handle mortality. I have major problems handling morbidity, especially anything that I've added too. ... It seems to me, I could have done better. (I'm not talking about malignant brain tumors now, or people who are already worse; say, he had an infection or something like that) ... I'm not good at morbidity ... It bothers me. (neurosurgeon)

morbidity — I spent a lot of time worrying about the case. I re-operated, and then the surgery was a failure. To this day I don't know why. ... The case ended in frustration because I felt we had done a good job and that the hip was okay. It was really the next day when the subsequent x-rays showed that it hadn't worked, then we realized we were wrong. From a technical point of view, I couldn't tell you where I went wrong. ... I was so frustrated, disappointed and upset. (orthopedic surgeon)

morbidity — You can do a perfectly nice, technical job and the patient can wake up and be perfectly okay for about two days and then have a stroke. Obviously that's very disappointing. ... We often will do the same operation but get different results because of factors that are beyond our control. (elite neurosurgeon)

questioning performance — The kid survived, but I just about died. I just felt totally responsible. ... I remember walking out, thinking and being totally devastated that I had been incompetent as a surgeon. (general surgeon)

questioning performance — You do this, you do that, and you fiddle around for 45 or 60 minutes. Finally you've done your repair. At the end of the case we are not satisfied, so you take the valve out and replace it. My goal was to repair and not to replace. I was not satisfied. I could not perform. (cardiac surgeon)

questioning performance — The outcome was okay, but it could have been a lot smoother and a hell of a lot shorter. It seemed to me we picked around for two hours. It's so frustrating when you know you can do it better. ... I just couldn't get to the perfect, perfect plain to separate it. That's why it was frustrating. It's not normally a big thing at all. (neurosurgeon)

questioning performance — I'm probably the last person on earth to ask what to do when things go wrong. I tend to worry about things like that as much as anybody. I know I worry about it a lot. ... You can only do your best. As long as that's good, you probably can worry about it a little bit less, but I know most of us do. (orthopedic surgeon)

questioning performance — We all, to a greater or lesser degree, become emotionally tied to our patients and the results. When you have a bad result, even though you've done the best by the patient, it still bothers you. It bothers some people quite a bit, and some people in our specialty just can't handle it, and they retire. (elite neurosurgeon)

long-term stress — This is exactly where you need the spiritual strength that's based on your training and your individual qualities as a person. That's why some people have nervous breakdowns and others get burned out. You have to be strong. ... If you're a responsible person, sometimes these things really get you down and you get really depressed. You can go into a deep depression if you run into a series of complications; people dying and getting paralyzed. You get into "a boiler" and that's when you can crack up. (elite neurosurgeon)

long-term stress — The stress multiplies when you know the people. ... If things don't click, this multiplies everything. If you don't know the people, you feel bad about it. If it's a friend, a colleague, or a former employee, you feel double. If you have to see that person often, it's even worse. (elite neurosurgeon)

long term stress — Concern comes in handling life outside the O.R.; i.e., coping with your family. One would probably find differences in how married persons, singles, single parents, and persons married with no kids deal with life outside the O.R. The effect of O.R. stress shows up in outside work. (orthopedic surgeon)

M & M rounds — Morbidity and mortality rounds can be stressful because you're subjecting your result, which is less than desirable (otherwise you wouldn't

be there), to the scrutiny of your peers. You're going to have another surgeon say, "Well, Jack, you should have used a different suture." Then you have to defend yourself. (elite neurosurgeon)

M & M rounds — Unfortunately M and M rounds aren't that challenging because people are afraid of the truth. Legally it's fine, but philosophically or psychologically I don't think they are right. Very often the final comment is that the patient died of multi-organ failure, kidney's failure, liver failure, lungs failure. Why? ... What doesn't come out is if there was any problem while changing the valve, or was there too much time spent? A lot of details are not looked at. ... The surgeon involved is just not ready to accept them. We may bring up an argument and then it's pushed away. People are afraid to look at themselves and the truth. (cardiac surgeon)

technical limits — Sometimes I feel frustrated with certain surgeries because of the technical limitation. There's only so much you can do. You wish you could do more. That happens quite often with brain tumor surgery. ... The surgery may go fine, the outcome all right, but there was still a lot of tumor in the head that we couldn't get because of technical limitations. Technically we could have gotten it, but the results would have been disastrous. (elite neurosurgeon)

Coping With Morbidity and Mortality

Strategies were identified by every surgeon for coping with the sorrows and doubts from morbidity and mortality. Recognizing and dealing with these personal reactions is a challenge, since they often are hidden by what are contradictory professional reactions. Elective surgery also creates a different impact than an emergency does.

personal vs professional — From a personal point of view, dealing with the mortality was very rough on me. I went to the wake because I felt terrible. From a professional point of view, this was an unforeseen complication. ... From a purely professional, technical point of view, I didn't do anything wrong. This child just had unusual complications and died. I had no problems discussing it at M and M rounds. (orthopedic surgeon)

emergency vs elective — If I lose somebody in an emergency operation, I'm more easy to console than in an elective operation. (vascular surgeon)

emergency vs elective — In an emergency situation the patient comes in with a major head injury or whatever that is killing the patient. You know that you're stuck against the wall. You're forced to do it. If something goes wrong, it's easier to accept than if it was elective surgery. And it's easier to explain to relatives. I find that easier to deal. (elite neurosurgeon)

Surgeons learn to form personal philosophies to overcome negative experiences and return to the next case fully functional. Recommended coping skills are as shown in Table 18.

Table 18
Coping Skills for Morbidity and Mortality

Coping Skills*	Total Responses (ranked percent)
Draw lessons and adapt the approach	73
Be honest and communicate	67
Accept the statistical probability for error	49
Realize you planned well and did your best	42
Allow yourself to relax, forgive, and forget	36
Other strategies; e.g., spirituality, ethics	33

*All respondents had at least one coping skill for morbidity and mortality

draw lessons — Morbidity for some is sometimes very unlucky. You have to scientifically look at why it happened. You have to take the human element away from it for a while. There's always a reason why something doesn't happen right. It's not good enough to just take the attitude, "Well, this happens and it happens to everybody." You've got to analyze what happened and why. Heart by heart you will find out the reason. If you can analyze it, you can correct it. (elite cardiac surgeon)

draw lessons — I don't subscribe to "I just did my best so that's just the way it happened, or that's the specialty I'm in. There's going to be so much of it and it's too bad." We all try and say these things but ... I'm not good at it ... It bothers me too much. ... You can't sit and mope about it all day, but you have to try to improve it or avoid it as much as possible. If it bothers you, you should avoid it. (neurosurgeon)

draw lessons — Our morbidity and mortality rounds are a very useful learning exercise and as well, a little bit of a catharsis. It's like going to confession. You say, "Well, I had this problem. This is what I did. What do you think?" Usually it's a pretty free-wheeling discussion. Somebody will say, "You should have waited a little bit longer," or else, "I think you did all right." That obviously makes you feel better. (general surgeon)

honesty — There have been times in the past where I've felt guilty. There the rule is honesty. In fact, the effect of conveying it in an open way probably brings out more positive feeling than just hiding it. (neurosurgeon)

honesty — Your greatest defence is honesty. Some surgeons try to sweep it under the rug, and that's the worse status you can ever have. If you do that once, colleagues won't think you're a bad surgeon. If you have to do that on a continuous

and regular basis, you're going to start to believe that what you're doing is acceptable. Then you'll never have a true assessment of yourself and your abilities. Don't lie to yourself or anybody. If you know you have a complication, recognize that complication, ... and correct it. Eventually, you're going to think that you have to go somewhere else (in order to practice with a clean slate). (neurosurgeon)

honesty — Be as compassionate as possible. Give enough information about what happened and give it in such a way that it doesn't lay blame. It's a diplomatic thing. ... Was this the only chance that he had? You have to be realistic about some of these things. You can't cure everything, but you give it the best you can. If that's what you've done, then you should be pretty well satisfied. If it was a technical problem that you felt was all your fault, then it's going to be much more difficult to deal with. (orthopedic surgeon)

honesty — Be perfectly honest and put everything on the table. You say, "I did this, and maybe this is what I should have done. Do you have any other ideas?" (general surgeon)

honesty — If you would do it differently next time, you have to first admit it to yourself, and then admit it to your colleagues. If it's something that you strongly believe you had no control over and you thought you did the best you could, then you say that. You've got to have insights, otherwise you can blame everybody for everything except yourself. ... You can always blame something else, somebody else, the weather, the nurse or the instruments. Was it a technical thing that you could have done differently? It's important to know when it's your fault and to be honest about it. (cardiac surgeon)

honesty, communicate — One of the key things is "communication with people." You're trained in the skill, you're ready, and you're the technician, but then you need the other qualities of the technician. You need the spiritual balance and honesty. If you're honest with yourself, and you're honest with your patients, you can function forever because you have a clear conscience. You'll do well and you'll perform well. ... That helps a lot in putting up with the stress. (elite neurosurgeon)

communicate — Communication is very important. What I've done is that, although I didn't go to the funeral, if the patient died, I've written them a very nice letter about my feelings and frustrations with it, how much I appreciated their trust, how bad I felt that things didn't work, and how things went out of control. People really appreciate that. These are the ways that I would suggest to people to cope. But each one has to find the cooperation in their own heart on how they're going to act. (elite neurosurgeon)

communicate — We've gone into situations where we've known that the patient is most likely to die. We went in because he was going to die within a few hours anyway. It was our last ditch of the battle. That's not very stressful because you know everything is prepared. The family knows. You say, "Okay, we know he's not going to live." (elite cardiac surgeon)

communicate — What helps a lot is your communication with the patient and the relatives. That will help you sail through the storm. If on top of the complications you run into a hostile family who turns against you, that multiplies the stress. You have to communicate and keep them updated daily or hourly on the progress or deterioration of the patient. (elite neurosurgeon)

communicate, do your best — The important thing is to have thought it through and have planned it. Basically, you have to have talked to the family so both the surgeon and the family are aware of the potential problems. You have to outline it to them that these things can happen. ... You can only do your best. As long as that's good, you probably can worry about it a little bit less, but I know most of us do. (orthopedic surgeon)

statistics — You work with senior surgeons, 50 or 60 years old, that have been in practice for 30 or 40 years. I look back at their morbidity and mortality. It's reassuring that when I compare myself to them, I find that my morbidity is really not any worse than theirs. ... So if it happened to someone with 30 or 40 years' experience and then it happens to me, I take consolation in that. (vascular surgeon)

statistics — You have to learn to live with it. ... This is the downside of the specialty. If you're busy, you're going to run into complications. Even if you're not busy, in the long run you'll have some. Everybody will, no matter how perfect or good you are. And the more you do, the more you get. It's an exponential thing. The more challenging the operation, the higher the risk. You do 100 in a row and bingo, 101 goes down the tube, and sometimes in the worst possible situation where things are magnified. That happened to me doing very risky surgery of one kind, all the time. All of a sudden, the son of a former secretary of mine had a very difficult tumor of the brain, that I'd successfully done a lot of. I operated on that kid. And you know what? He died the next day. (elite neurosurgeon)

statistics — For mortalities it's hard. We try to rely on our defence mechanisms. I compare myself to the other surgeons and take consolation in the fact that it's part of surgery. To do surgery you have to be prepared to accept some losses. It depends if the cases are elective or emergency. If I lose somebody in an emergency operation, I'm more easy to console than in an elective operation. (vascular surgeon)

statistics of error, do your best, spirituality — At night I read a book on Hindu philosophy, which always keeps my mind on basic goals in life. It was written many centuries ago and still applies now. For example, not to worry about the result but do the best you can (which almost all religions state). Second, I watch people who are respected, to see how they have gotten through crisis situations. You see the way they handle it. I've seen people at all levels lose patients and make mistakes. You don't feel unique for losing a patient or for making a mistake. You try to minimize those situations, so hopefully there's no guilt feeling, but there are feelings of disappointment. (elite cardiac surgeon)

statistics, do your best — Morbidity and mortality rounds can be stressful because ... you have to defend yourself. Most of the time, defence is very easy because we know that if you do enough operations of a certain kind that there's an incidence of morbidity that you can't go under. ... But there are occasions when morbidity rounds can become heated. ... The final ultimate defence is that you were there and the other surgeon wasn't. It's easy for a guy to say, "Well look, I would have put a big clamp like this on the aneurysm." The answer is, "Well Jack, you weren't really there. You didn't really appreciate that the clamp slipped and we couldn't get it on. (elite neurosurgeon)

statistics, did your best — If you operate and do big surgery you get big complications. You have to know that at the end of the surgery, whatever the

outcome, you felt prepared, you did your best, and you cared about your patient. (orthopedic surgeon)

statistics, forgive — Essentially all patients we treat have a lethal disease and it will kill them in the short or long term. What you are really doing is weighing survival with or without surgery. You get used to it, like you get used to death. It's very tough making the choice. It's very difficult to go and tell a family that their beloved father or husband has just died in your hands. For the first few years you feel really rotten the first night after the death of the patient. After a while, I guess you get hardened a bit, otherwise I don't think you would be able to function long in our field. (cardiac surgeon)

did your best — It's very hard to cope with mortality, whatever the reason is. The only way that you can cope with it is if you're satisfied that you did the best that you could. If you don't have that satisfaction then it is extremely hard to cope. (elite cardiac surgeon)

did your best — You have to be batting 99%. You've got to be doing your operations for good sound reasons, not for mickey mouse reasons, and certainly not for soft indications. Otherwise you're going to end up in a morbidity and mortality conference and feel terrible. ... You can handle it very easily if you can go to that conference with a clean conscience. (elite neurosurgeon)

did your best — I try to intellectualize things for M and M rounds. I say, "Okay, this is a learning experience." I try to present it as if it were rounds. I try to thicken my skin because you'll get the colleague who likes to hammer at it and criticize your management. My way of dealing with that is to say, "I did my best." If they've got a suggestion, I'll try to incorporate it in the future, but I'm not going to kick myself because somebody criticized what I did, even if it went wrong. You've got to have some protective mechanisms for yourself. (orthopedic surgeon)

forget — When I'm finished ... I like to put my mind blank and disconnect myself if I can. ... I come here to the office and relax. At least there's nobody around. I close the door and stay here for a half an hour or so. I try to simmer down a bit, and then go home as soon as possible. (elite neurosurgeon)

rest — At one point I thought I was sick. I thought I had cancer. I lost about 25 or 30 pounds. ... I went for a checkup to my family doctor (I seldom do that) and ... he said, "One thing — too much stress. Take off six weeks." I did that and then I got better. I had made a mistake. I had worked too hard and too long for about twelve months. I didn't take any breaks. ... In our job, there is too much stress. We have to renew the batteries from time to time. The more often you take a little break, the better. I try to take a break at least every six months; ideally, every three months. I take a week or two off on a trip, and I'll go to conventions. ... This builds your strength for coping with situations. (elite neurosurgeon)

spirituality — The person who is a believer is going to have a lot of comfort in his/her own heart. ... You have a hiding place in your heart and your soul. It helps a lot if you have a strong spiritual life. I was once told that "doctors are at two opposite poles: they are either believers or not. Either you do believe a lot in God, or you don't." Many doctors become skeptical about God, the existence of a God, the perfection of God, because of what they see in their results of treatment, etc. ... We have contact with life and death all the time. That's very hard to understand. In my view if there is nothing above, then how do things work? Why do little children

die of brain tumors? ... That is a big tragedy. These things are very hard to understand. I think these are "mysteries of faith."(elite neurosurgeon)

ethics — Some surgeons are afraid to operate on serious situations because they're afraid of losing the patient. It's reached a ridiculous point where surgeons in Los Angeles are publishing their statistics in the paper. ... You cannot allow that to influence your decision-making. If a person has no option but death in two or three weeks, your reputation is not important. You've got to try to do something. There's too much damn emphasis now on how many cases out of one hundred are living and dying. If your mortality is too high in a given operation, then you've got to take a serious look at yourself and find out why. But I'm talking about another issue. (elite cardiac surgeon)

These results provide intimate details for coping with failure. They confirm the importance of learning and drawing lessons through self-evaluation (Applebaum, 1981; Bosk, 1979) and of retaining a certain amount of defensiveness and detachment (Hayward, 1987; Wright, 1984).

Training and Experience

Medicine takes years and years of judgement and experience. Everyone has his/her own learning curve, and unfortunately patients sometimes pay the price for the surgeon's skill refinement.

Training was not the focus of this investigation but, from the following quotes, it is obvious that surgeon's belief in themselves increased as they learned and perfected their job over a long period. This learning process could probably become more efficient and quicker by effective use of role models, imagery training, and teaching mental skills. These quotes help to tell the story.

early stress — I remember my early years in residency. ... I was doing gall bladder surgery on a young woman. It was inflamed and it was very, very difficult. I remember very well that I was thinking, "If someone comes with a gun and puts it to my head, I would say "shoot." It was that stressful. I didn't think I was going to successfully finish the surgery without harming the patient. But everything went okay. What a relief. (elite cardiac surgeon)

early confidence — You're generally scared to death (when you're first starting). Here you are, responsible for this patient and you don't have a lot of experience behind you. Other people say that you can do the operation, but you

don't know it inside yourself. You think you can, and you're pretty confident you can, but it's kind of a "papier maché confidence". ... You change over the years as you develop your skills. (vascular surgeon)

early stress — [When I first began doing surgery], I was more concerned and less confident. I know that before major surgeries I spent sleepless nights thinking and worrying about what I was going to do the next day. I was told by older surgeons, "Look, as time goes by this will disappear." It does, particularly after being in practice for ten years. ... Once you've gained experience, you gain confidence, and then you feel fine. (elite neurosurgeon)

early confidence — After you finish your formal training and you become a surgeon, you think that you can touch the sky with your fingers. ... You learn that sometimes you burn your fingers. It is intelligent and good to learn through someone else's experience, if you can. But sometimes you have to touch the reality with your own hands and get burnt. That's what teaches you. Sometimes there are limits to things. You have to know your boundaries and the limits of human science and technology. (elite neurosurgeon)

changes in responsibility — The kid survived, but I just about died. I felt totally responsible. ... I remember walking out, thinking and being totally devastated that I had been incompetent as a surgeon. The resident turned to me and said, "Thank you so much, that was a great case." I remember so many times, seeing major car accidents and people dying on the table. Even though it got to me, I felt it was a great experience. Every time I saw something like that, I just thought it would enrich me so much more as a surgeon. I'd be so much better because I'd already been through it — I saw how it was supposed to be done. I never realized the emotional impact because I was never responsible. There was always somebody else who was in charge of the patient. It was his ultimate responsibility. (general surgeon)

changes in responsibility — Preparation varies a lot with the stage of your career. First you're doing years of training. During these years I didn't worry that much. ... The night before, if you had time, you went to the library, or at home you went through the books and read the technique. You got yourself in shape. You never worried that much. You knew that because you were a resident, you were relatively safe. Once you start your practice, things change dramatically because there is no one to bail you out, just yourself. At the beginning of your career, you worry more. If you get into trouble, boy you're in trouble and it's your show. You are accountable directly to the family and to the patient from every angle. There is no one behind you. It is you, period. The preparation is different when you're on your own. (elite neurosurgeon)

courage — I really thought I was right, but I was obviously not totally convinced. I was still thinking about it. "You should really do it your way. Well you know, on the other hand, these guys have got more experience and are older. They've got grey hair and they've got the wisdom." I just finally said, "It's now or never." Sometimes you have to have the courage to do it your way because sometimes you're right. I wasn't facing a life-and-death decision here, but I just thought, "Darn it, I'll do it my way. I know just as much as these guys in this area. I'll do it." (orthopedic surgeon)

experience — I have an advantage now over when I was just starting in practice. I've seen a lot more, and I've seen that maybe you have five disasters in a row, but

the sixth one will turn out. Don't assume that just because the last three cases went hummers on you that you've now become incompetent and shouldn't operate anymore. I now have the confidence to know that if you just stick to your guns and not allow yourself to be distracted, the next case will go fine. It's largely a matter of confidence from experience. (elite neurosurgeon)

relearning — Things change. Things that you couldn't do ten years ago, you can do now because there is better technological advancement. That helps. (elite neurosurgeon)

impatience — If I'm artificially forced to stop the operation, because of an equipment failure or some hang-up, my tendency is to keep operating using another piece of equipment rather than the more sophisticated equipment I really want to use ... simply because I was impatient and wasn't prepared to take the extra five minutes. ... I find that takes self-discipline. (elite neurosurgeon)

surgical career — You have your "rookie years", productive years, veteran years, and hanging-on years. You need to recognize when to quit. (cardiac surgeon)

Analogies — Sports, Flying ... the Arts

The working images drawn upon for surgery went beyond a medical setting. Sports, flying, and visual arts analogies were often used by surgeons to describe their preparation or mental approach. Recalling performances was another popular use of analogy. Clearly these surgeons draw a parallel between operating in a sporting arena and surgical theatre.

Sport Analogies

Personally what I do is evaluate the opponent. ... Athletes that are competing directly against others will say, "Well, this guy runs faster in the first 400, therefore I'll keep up with him and pass him," and so on. I look upon the lesion like we're attempting to remove or irradiate the opponent. I ask myself, "What are all those things that that opponent can do to me? Can he rupture? Can he bleed? If he does one of those things, I'll do such and such. If he plays ball and falls behind me, well, then, I'll just walk all over him." (elite neurosurgeon)

You've got to be ready. You're at the starting line of a 100-yard dash in the Olympics. You have to have everything focused purely on the procedure. (elite neurosurgeon)

Athletes are often said to run the race in their own mind before they actually run it. We do exactly the same thing — "What kind of incision am I going to make? What do I do if this, what do I do if that?" You develop a sort of algorithm in your mind. (general surgeon)

Surgery's a very physical thing. There's a famous quote that I took from somewhere that says, "Surgery is the ultimate body contact sport." It really is. There is a lot of touching and feeling involved. When you're doing a case, not only do you see the pathology, but you always have to lay your hands on it. (general surgeon)

It's very sensory. It's just like when I downhill skied. At home the night before, I could do the downhill race. I could visualize where to turn and at the bottom. The feeling was the same. It's the same thing for surgery, but I do this only with unusual procedures, not with routine ones. (cardiac surgeon)

You want to succeed for two reasons. One is for the good of the patient, because it's better if the valve is repaired than replaced. The second one is for the personal enlightenment, like the athlete who has won the race. (cardiac surgeon)

My big problem is that I can't watch surgery very well. Like in sports — It's hard to sit on the bench. I find it very difficult to watch another surgeon operate, especially if it's a resident there with a fellow who I know is competent. I find it very hard to keep my concentration. I need to do the surgery. This is difficult in a teaching program. It's one of my failings. (orthopedic surgeon)

It's like climbing a mountain. If you start climbing the mountain and you stop in the middle, you don't want to continue. That's what I feel. I don't climb mountains, but even walking up a hill, I don't say, "I'm going to have a seat on that rock" because then you're too relaxed. I want to go to the top and finish. It's the same thing with an operation, I don't feel like stopping. (elite neurosurgeon)

It's interesting that a lot of people who go into surgery have an athletic background, probably because of hand-eye coordination or something. There are very few klutzes, or at least we try to get rid of them before they get too far on in the training program. But we never do any real physical testing. I've often said, particularly for orthopedics, that we should take them down to the lab, hand out screws and plates, and see if you can put a plate on a bone. As a student, that should be one of the tests for three-dimensional hand-eye coordination before you actually come in. (elite orthopedic surgeon)

There is a lot of ambidexterity. You have to be just about as good with one hand as you are with the other. You have to see three-dimensionally, or blind. Without actually seeing it, you have to aim two things to meet in the same spot at some three-dimensional point. (elite orthopedic surgeon)

You have all the steps that you plan in your mind just like somebody who's doing any kind of complex diving skill. They would say, "I'm going to do this, this, twist and bang!" You go through it all in your mind. (elite orthopedic surgeon)

There are certain surgeons who think every little problem is a giant problem; they make it into a big flap. They're just not going to last. You want to last a long time. It's like running a marathon; you've got to go in at a nice, slow easy pace. Just

keep doing it. Keep trucking along and don't make all these little mountains out of mole hills. (elite orthopedic surgeon)

It's just like if you're going to do an athletic event. You know what you're going to do, you prepare for it, you go through all the rehearsal and you have all the discipline and training. Surgery is like that. A lot of people don't do this, but if you're disciplined and you're doing a lot of surgery, you can't do much else in life. It's like if you're training for the Olympics, that's it. There's not much else you do. I don't do very much else except surgery. That's maybe pretty narrow-minded, but I can't have a lot of other outside influences. ... You're physically training, you're mentally preparing, you're not out drinking or carousing. It's a rigid routine that you're into and you can't deviate from it. It's important especially when you get older. You just can't go out drinking the night before. Some people only operate one or two days a week, so that gives them some time off. If you're working a lot, it's just like training for the Olympics. You do it to the exclusion of everything else. (elite orthopedic surgeon)

There are many sport analogies that can be made in the field of medicine. For example, you have your "rookie years," productive years, veteran years, and hanging-on years. You need to recognize when to quit. Athletes have undergone training for many years. So have surgeons in school and in life. (cardiac surgeon)

Let's say you're in the Stanley Cup and it's game seven of the series. You're going to be a little more geared up for that than you are in the fourth game of the season. The same thing would go for the surgery. When I'm fixing a broken hip in a little old lady, it's kind of routine. (orthopedic surgeon)

After holidays you get a little bit rusty in your planning phase, but it's a bit like riding a bicycle. The actual physical technique is the same. You might say, "Oh no, I forget this stage or that stage." Once you get into it, it's almost like automatic pilot. You get into a mode. (orthopedic surgeon)

Flying Analogies

It's like the pilot of the airplane panicking. It doesn't take much for the passengers to flair up. I find the most important thing is not flying off the handle. (general surgeon)

Once you get going you forget everything. ... You get very engrossed in what you do. It's the same thing as when I used to fly. As soon as you pushed the throttle, it was so important to keep the airplane flying that you forgot about absolutely everything else. Then, as soon as you touched down, all of a sudden all of your problems would come back. It can sometimes be like that in the O.R. (general surgeon)

This is something I had learned when I was flying. When you start to get into trouble ... what do you do? You slow the engine down, drop the noise level, get things settled to a nice normal level flight, do your thinking, and then address it. I've found the same thing happens when you're operating. You get into trouble, you say, "Okay, let's stop everything, think, pause, and then think." (neurosurgeon)

With the routine cases mental readiness is not as important. A coronary bypass graph is like an appendectomy for us, or a pilot flying a plane. Sometimes I will operate, and I find myself thinking of other things. I try to think, "Concentrate now!" It's so routine that I think of other things. In really challenging surgery, you don't have time to think. (cardiac surgeon)

It's like a pilot getting in his plane. He doesn't care if he's getting in a 747 or 737; it's automatic. It's like riding a bicycle after a while. It's really those little variations on the theme you prepare for. Like somebody flying -- they may get concerned if they get weather at an airport they haven't been at before. All of a sudden the preparation starts before you start your let down. If you start preparing just when things are happening, you're in trouble. (neurosurgeon)

Other Workplace Analogies

I farm too. I drive a tractor, heavy equipment, and all that stuff. When I get into trouble, the first thing I do is slow everything down. Just slow things right down. Reduce all extraneous noise. I'm impressed with how it works. (neurosurgeon)

With orthopedics, it's never ever perfect. It's a little like carpentry. You shave a little off, put it together, and match it. We use saws, drills, and all that kind of stuff. So it can never actually be perfect. Some say, "Oh that's perfect." It's pretty good, but it's not perfect. (elite orthopedic surgeon)

We have been trained progressively throughout our lives to react to any emergency as part of our life. Take the firefighters. They do nothing all day long. Then there's a fire. They are all on the spot ready to go, no matter what they were doing beforehand. There are people who respond well to crises. If they're not skilled in responding, perhaps they shouldn't be a firefighter. If the young resident is not capable of handling a nervous situation, he's slowly weeded out of the surgical program. He's made to understand that his place is not in this kind of field. (cardiac surgeon)

You need a reflex for the unexpected things that happen, to suddenly be able to make a decision. It's just like your first time driving a car: They can teach you to turn here or there, but there are still reflexes gained by experience. It comes from experience. (elite cardiac surgeon)

Arts Analogies

It's like a dance after a while. It's a small enough place that we all know each other. You get into this rhythm of things with the nurses and the assistants who you work with. They know what's coming next because they've worked with you for so long. You don't often have to say anything. (general surgeon)

When it's a really stressful situation, we scrub without talking. We do the final rehearsal, like an actor going on stage and rehearsing the last role. We just sit there, scrub and think about things. (vascular surgeon)

When you're using a different technique or trying out a different twist, the pleasure comes from the same pleasure an artist would have in fashioning a sculpture or painting something nice. (general surgeon)

It's like an artist. You take pride in your work. You know a patch-up job can work but it's not as satisfying as something that technically goes well. You can look at the x-rays and they're perfect. You like to know that if you took pictures of this x-ray and pictures of this patient, you could put them in a text book as an example of the problem, how to fix it, and the results you should get when it goes well. (orthopedic surgeon)

There was a lot of finesse and detail involved in that operation. Everything about it was very nice. It was a work of art. (orthopedic surgeon)

CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS

The rationale and purpose of this study was best summarized in an interview with an elite surgeon:

This is the first time that I've really analyzed certain aspects of mental readiness. We'd looked at aspects of complications — how to stay out of trouble and avoid problems — but we'd never sat down and looked at mental preparation. We certainly prepare to do the technical aspect of the case. I don't think we mentally prepare well enough. ... And how do we mentally prepare for it? (elite surgeon)

The primary purpose of this investigation was to assess factors that are related to mental readiness for performance excellence in surgery. Orlick's "Theory of Human Excellence" was used as a framework to confirm the transferability of excellence in sport to excellence in surgery. The secondary purpose of the study was to provide a list of effective mental training techniques relevant to excellence in the surgical arena.

This investigation confirmed the many similarities in mental preparation procedures and perspectives engaged in by top surgeons and top athletes. For example, extraordinary discipline and mental skills are a MUST.

The following conclusions may be drawn from an integration of the qualitative and quantitative findings in this study:

1. **Mental readiness** is an extremely important influence on a surgeon's performance. Of the three major readiness factors rated by the surgeons — mental, technical, physical — mental rated as important as technical. Mental readiness was the factor that showed the most significant change between successful and disappointing performances.

2. The following **success elements** (i.e., based on Orlick's "Theory of Human Excellence") were clearly evident among the elite, and high-mortality-risk surgeons: commitment, self-belief, positive images, mental readiness, full focus, distraction control, and constructive evaluation. These elements were also present during best performances by all subjects, with the exception of positive images. Seventy-nine percent clearly identified the use of imagery. The remaining 21%, while they thought in other positive ways in their job, may or may not have engaged in imagery.
3. The three **major performance blocks** that interfered with high-level performance in challenging surgery were: lulls, crises, and preoperative upsets — lulls were the most common source of distraction with the least amount of control strategies. The importance of distraction control may be of particular relevance to the detail work of performing with finesse.
4. The following characteristics distinguished the elite, high-mortality-risk surgeons, gender, and those with different views on success:
 - a) **The best surgeons** (i.e., surgeons with an elite reputation) all possessed highly refined mental skills within each of the seven elements of success. They also projected intense compassion, a commitment to be the best, a strong spiritual perspective or religious belief, a desire for the patient to clearly understand the risks, and concrete distraction controls for boredom of routine or delays.
 - b) **As risk of mortality increased**, the success elements appeared to hold greater importance. Mentor belief, positive images, full focus, constructive evaluation, and coping strategies became most noticeable.
 - c) **Several gender differences** were evident from this study. All **female surgeons** practiced in low-mortality-risk specialties, appeared to demonstrate greater patience and acceptance of routine, and showed more consistent mental stability. **Male surgeons** practiced in both high- and low-mortality-risk specialties, were more aggressive in their

criteria for success, and demonstrated a greater involvement with colleagues. As always, men can learn from women and women from men.

d) Surgeons with **common views on success** shared common mental readiness traits. First, **setting and attaining clear goals** existed more among surgeons who had developed mentors and strong colleague supports. Second, when striving for **patient satisfaction** was a priority, relaxation and controlled energy were experienced while operating, and time was taken to assess options during crises. When **finesse and smoothness** were desired outcomes, annoyances with the surgical team, and interruptions became major distractors. Finally, anticipating during surgery, having colleague support, and recognizing one did one's best, were importance to those who aimed at achieving **exceptional results**.

5. Effective coping strategies for morbidity, mortality, and other **post-operative stressors** were vital to consistently perform with excellence. Analogies to other disciplines were valuable tools in allowing surgeons to make vivid, universal associations in their approach to medicine.
6. Mental preparedness is derived from a number of **learned mental skills** that must be continually practiced and refined for a surgeon to perform consistently up to potential. Practical considerations for mental readiness training were developed for the surgical setting (See Appendix G).

It is clear from the investigation that mental readiness influences a surgeon's performance. Refined mental skills help surgeons consistently perform their best in challenging surgery. It also clearly illustrates the tremendous amount of knowledge that can be tapped by an in-depth examination of highly proficient surgeons.

RECOMMENDATIONS

The findings of this study suggest the following recommendations:

1. Surgeons could benefit from systematic mental training in specific mental skills. This approach has been effective in sport and could likewise play a meaningful role in helping surgeons improve their mental readiness for the challenges they face.
3. Role modeling is an effective approach for profiling excellence. Differences in the mortality-risk of a specialty, gender, and criteria for success should be considered when identifying mental readiness features.
4. Post-operative coping skills are essential to short- and long-term effectiveness in surgery. Mental readiness has application beyond the preparatory and active phases of surgery.
5. Further investigations into the area of mental preparedness is encouraged for those interested in nurturing research and skill development in the medical profession and other high-performance disciplines.

CONTRIBUTIONS TO EDUCATION

Surgery is an admired field of human excellence. From this investigation, the mental profile of surgeons during high-level performances is now better understood. Factors related to excellence in surgery are clearly defined, as it relates to commitment, belief, positive images, mental readiness, full focus, distraction control and constructive evaluation.

This study has both extended knowledge from a theoretical perspective and provided effective mental training techniques pertaining to performing with excellence in the medical environment.

The aim of this study was to draw from the vast experience and seasoned patterns of the highly proficient surgeons. This investigation should be of practical value to the participating surgeons, as well as to less-experienced doctors, and has the potential to enhance the curriculum of internship studies.

By expanding research with respect to the mental components of performance excellence, other professions and students within our secondary and post-secondary school systems may also one day benefit.

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APPENDIX A

SUCCESS ELEMENTS WITHIN
ORLICK'S "THEORY OF HUMAN EXCELLENCE"

Orlick's "Theory of Human Excellence" introduces a conceptual model which outlines seven basic elements of excellence that allow human beings to excel. The success elements include: commitment, belief, positive images, mental readiness, full focus, distraction control, and constructive evaluation. They are described as follows:

Orlick stipulates that *commitment* and *belief*, as the underlying core of excellence, can become the central focus in one's life without becoming the only focus. Commitment implies that an individual has a strong personal reason to excel, or a powerful driving desire to be the best that he or she can possibly be. This ensures that the individual puts in the quality or quantity of work required to excel, and dedicates the necessary time to fully develop the critical mental readying skills required for the successful pursuit of excellence. (Orlick, 1989, pp. 8, 9).

The series of mental readying skills that produce a superior performance at critical events are defined as follows (Orlick & Partington, 1988).

Positive Images allow one to pre-experience or re-experience desired performance skills or results in one's mind. It is used in preparing to get what is wanted out of training, perfecting skills within the training sessions, making technical corrections, imagining oneself being successful in competition, and seeing oneself achieving the ultimate goal. It is a skill that needs to be very well developed and used daily to achieve quality (i.e., seeing and feeling) and control in the visualization.

Mental readiness is developing systematic procedures for drawing upon one's strengths in important competitions. It includes the use of mental imagery, warming up well physically, rituals, positive thoughts, and reminders to focus on what has previously worked well. This pre-event plan must be well developed, refined, well practiced, and followed consistently to ensure a constructive focus going into the event.

Full focus is developing the ability to stay centered in the present, focused on the task at hand. One connects totally to what one is doing and only on what is within one's immediate control for the duration of the task, to the exclusion of irrelevant thoughts or input. A poor focus is one in which the individual dwells on factors over which he or she has no direct control. For example, concentrating on the desired outcome, other competitors, or other distractions can actually decrease performance (Newman, 1985). Success depends on refining this skill to form a focus plan for use during the event.

Orlick defines *distraction control* as the ability to deal with "things that are expected or unexpected that can pull you off track". This requires strategies for getting back on track quickly when faced with distractions, negative input, or random bad luck. It may mean avoiding the scoreboard, deciding not to watch everyone else, or using a Walkman. Under high-level stress, the likelihood of a negative impact on performance is greater; consequently, more refocusing skills are needed (Newman, 1985).

And finally, with *constructive evaluation*, a procedure is developed for extracting the important lessons from every critical event. Proper debriefing, based on these lessons, allows one to continually adapt or refine one's mental approach, thus attaining an ever-higher level of personal excellence.

APPENDIX B

SURGEON INTERVIEW TRANSCRIPT

0. Opening Remarks

Interview: 00

Date:

Time:

Type of Surgery:

Years Experience:

1a. Are there any surgical procedures where you prepare more rigorously for or need to have a greater sense of readiness for? (For example, some doctors prepare mentally when performing an unusual operation such as a hemi-pelvectomy, or when trying out a new technique, or when having to perform serious surgery on someone who is basically in good health).

1b. If yes, how do you prepare? Do you ever physically or mentally rehearse or try to visualize in order to prepare for this particular type of surgery? (For example, some surgeons mentally reverse procedural diagrams in order to operate upside-down, others review how they will brief nurses and colleagues, others imagine the body as a "mine field" where they have to watchout for nerves and arteries, and some organize their thoughts relating to all the choices they may face).

1c. If no, did you ever? (Probe for details about source of ideas, actual strategies and mental training practices in terms of when, where, how often, with whom, with what success)

2. When you face a crisis during a surgical procedure what normally works best for you to help you maintain or regain control. (Some doctors stop everything for a time-out, others ask everyone to stop talking and the music to be turned off, and others interject humor). How do you effectively stay focussed or become refocussed in a crisis situation?

3a. Are there ever any unforeseen or unexpected things that happen, before (or during surgery), which may affect your performance for better or worse? If yes, what sorts of things can happen? (Positive things such as a well prepared operating room, nice music playing, a certain attitude among the staff or negative things such a hot operating room, poor lighting, an argument on the way in).

3b. If things like this happen that are negative, how do you get back on track? (What do you say to yourself or think or do?)

4a. Pick a challenging operation that you did within the last month or two where you were really happy with your performance (it was one of your best). What makes you feel that your performance was successful?

4b. When you got to the surgery room, were you ready?
If not ready, ask: What was missing? What might have helped?

4c. What did you do in preparation for that particular surgery? Immediately before were you doing anything physical, doing any mental rehearsal or running things through in your mind? (For example some surgeons imagine doing their instrument check like a pilot would before take off,

some follow individual patterns that make them relax or feel good, like having the music either on or off) If yes, what did you do?

4d. If no, what did you do?

4e. Select a number from each of the following scales to represent the how ready you believe you were for the scenario you've described (i.e., best performance).

	100% ready										0% ready
Technical	10	9	8	7	6	5	4	3	2	1	0
Mental	10	9	8	7	6	5	4	3	2	1	0
Physical	10	9	8	7	6	5	4	3	2	1	0

5a. What were you focussed on, thinking about, saying to yourself or how were you feeling immediately before the start of that particular surgery?

5b. Were you focused or totally concentrating on what you were doing through the whole operation (or were there times where you drifted)? (Were you totally connected while you were engaged in the actual surgery) Was there a crisis?

5c. There must have been periods of no action or natural lulls in the surgery. When were those times and what did you do during those times to keep things light or to keep yourself on track? (Do you start to plan the next phase?)

6a. Pick a similar challenging surgical procedure (and similar patient condition) that you did within the last month or two where you felt disappointed in your performance or where your performance was not at the same level. What makes you feel that your performance was not as successful?

6b. When you got to the surgery room, were you ready?

If not ready, ask: What was missing? What might have helped? What would you have done, if you could have done something differently?

6c. Were there any differences in your preparation for surgery, your use of mental rehearsal, your thoughts or actions immediately before the start of the surgery, your concentration during surgery, your thoughts during lulls, and your handling of crisis situations?

6d. If there was a crisis situation what did you try to do to get back on track? (Did it help?)

6e. Select a number from each of the following scales to represent the how ready you believe you were for the scenario you've described (i.e., less-than-best performance).

	100% ready										0% ready
Technical	10	9	8	7	6	5	4	3	2	1	0
Mental	10	9	8	7	6	5	4	3	2	1	0
Physical	10	9	8	7	6	5	4	3	2	1	0

7a. Did you ever have any direct contact with anyone who influenced your ability to be mentally ready to face the situations you face? (For example, a colleague, a supervisor, a mentor who showed you how to prepare, how to stay concentrated, and how to handle crisis) If yes, who was it and what did they do or say?

7b. If no, how did you develop your private strategies? (e.g. was it something you read, heard or saw; was it something your parent(s) or a teacher taught you; was it some combination of such things; how did it all come together?)

7c. How many years have you been a qualified surgeon? When you first began in surgery, had you developed to this extent? How did it happen?

8a. Have you developed a personal strategy or style in evaluating your performance in surgery?

8b. What advice would you give younger surgeons in coping with morbidity and mortality?

9. How much do you think your overall performance depend on your mental readiness (your ability to concentrate, mentally rehearse, refocus and manage crisis). _____%

Total readiness using 100% distributed over:

technical _____ %

mental _____ %

physical _____ %

Total: 100%

10a. How stressful are M & M meetings compared to your other surgical functions? How do you prepare yourself for these meetings?

10b. Have you found anything effective in coping or dealing with the stress during the meeting when it's your turn to report?

11. Do you have any other comments or recommendations regarding how to teach mental readiness, concentration and crisis management that is relevant to your field?

12. Closing Remarks

The tape will be transcribed, and then a copy send to you to confirm that it correctly represents what was said.

APPENDIX C

ATHLETE INTERVIEW GUIDE

- 1a. When you "got to the line" (or appropriate phrase), were you ready?
- 1b. If *not* ready, ask: What was missing? What might have helped? What would you have done, if you could have done something differently?
- 1c. If ready, ask: Do you think that you trained differently than other athletes in your sport? How did you get yourself to push, or train, when you didn't feel like it? Do you think that your mental preparation differed from other athletes in your sport?
2. Did anything unforeseen happen, either before or during your competition (s) which may have affected your performance, for better or worse?
- 3a. What was your goal for the 1984 Olympics? Did you achieve it? Before the competition (s) began, did you believe that you could achieve your goal?
- 3b. If *no*, ask: Why do you think you lacked that belief?
- 3c. If *yes*, ask: How did you develop the belief that you could do it?
4. What kind of mental training and psychological preparation did you initiate for *yourself*. (Probe for details about source of ideas, actual strategies, and mental training practices in terms of when, where, how often, with who, and with what success.)
- 5a. Did you try to follow a specific pre-competition plan just prior to your event?
If *yes*, probe for details: e.g. specific pre-race warm-up, imagery of the course, positive self-talk, ritualistic equipment checking, etc.
- 5b. If *no*, ask: What various kinds of things did you do, and think about before your event(s)?
6. What were you thinking or saying to yourself, how were you feeling, and where was your attention focused?
 - a. *immediately before* the start of your event(s)?
 - b. *during* the event, when performing best, and when going less well?
 - c. *between* specific periods of action (between halves of a game, between dives, or jumps, or heats)?
7. Compare your 1984 Olympic performance with another much worse or much better competitive performance, (during the Games, or at some other important meet that year). What were the major differences in your thinking, feelings, and attentional focus?
 - a. *immediately before* the start of these two events?
 - b. *during* these respective events?
 - c. *between* specific periods of action (between dives, jumps, heats, halves of the game)?
8. What role did your coach and/or others, such as consultants, play in your mental preparation?
9. IF APPROPRIATE, ask the following questions about the sport consultant:

- a. What brought you together with a sport consultant?
- b. How did you get started? What did the consultant do first? What did (s)he ask you to do? What did you do? (Probe for details about the consultation, e.g., identifying goals, developing a contract, teaching mental skills such as relaxation, imagery, etc., frequency and duration of sessions, mental training homework assignments.)
- c. What was the consultant like as a person?
- d. If appropriate, ask: How did the consultant fit in with the coach, athletes, and other staff?
- e. How effective was his/her work with you? (Probe for basis and criteria for this evaluation.)

10a. Think back to how you felt just before you event at the 1984 Olympics. How ready did you *believe* you were at that moment? Select a number from each of the scales to represent the degree of your physical, technical and mental preparation.

	100% ready										0% ready
Physical	10	9	8	7	6	5	4	3	2	1	0
Technical	10	9	8	7	6	5	4	3	2	1	0
Mental	10	9	8	7	6	5	4	3	2	1	0

10b. In light of what you *now* know, and especially recognizing your performance at the 1984 Olympics, how ready would you judge that you *actually* were at that time?

	100% ready										0% ready
Physical	10	9	8	7	6	5	4	3	2	1	0
Technical	10	9	8	7	6	5	4	3	2	1	0
Mental	10	9	8	7	6	5	4	3	2	1	0

11. What changes should be made in order to improve the readiness of Canadian athletes like you (e.g. within you own situation and within the sport system)?

APPENDIX D
RELATIONSHIP BETWEEN
SURGEON AND ATHLETE INTERVIEW GUIDES

Element & Details	Athlete Questions	Surgeon Questions
Success Opportunities	A1a,b,c	S4a,6a
- to establish success	A1a	S1a
scenarios in surgery	A7a,b	S4a,6a,10a
<i>"Theory of Human Excellence" Success Elements</i>		
Positive Images	A1b	S1c
- quality & control of imagery	A1c	S1b,1c,10b
	A11	S8b
Mental Readiness	A1a	S4b,6b
- quality, simulation, goals	A1b	S4b,6b
- refined pre-competition plan	A1c	S1b, 4b, 6b,10b
	A3a,b	S2
	A4	S7b
	A5a	S4c,6c
	A5b	S4d,6c
	A6a	S5a,6c
	A7a,b,c	S10a
	A7a	S5a, 6c
	A8	S7a
	A11	S8b,11
Full Focus	A1c	S1c
- refining competition plan	A6a	S5a,6c
	A6b	S5b,6c
	A6c	S5c,6c
	A7a	S6c
	A7b	S5b,6c
	A7c	S5c,6c
Distraction Control	A1c	S1a,10b
	A2	S3a,3b,6d
	A6c	S5c,6c
	A7a,b,c	S10b
	A7c	S5c,6c
Constructive Evaluation	A1c	S8a,10b
- procedures	A4	S8a
- future recommendations	A11	S8b,11
Performance Blocks	A1a,b	S4b
- specific to surgery	A2	S3a,3b
- compared to changing patterns that	A6c	S5c,6c
work, last minute changes/late	A7c	S5c,6c
selections, blown away by distractions		
Success Variables	A2	S3a
- to look for possibilities in surgery;	A8	S7a
i.e. readiness factors, mental imagery,	A10a	S4e,6e,9
attentional focus, helpfulness of others		

For example: In the "Surgeon Interview Guide", 1a.(SO-A1c) means question 1a. addresses a success opportunity (SO) in surgery the same as question 1c. has done in the "Athlete Interview Guide".

APPENDIX E

DEFINITIONS FOR CHALLENGING, ELECTIVE SURGERY

The following quotes illustrate the seven high-performance conditions identified by the surgeons:

High-risk procedure was generally life threatening or had a high risk for paralysis or a major disability such as a ruptured cerebral aneurysm, an open reduction to a congenital hip dislocation, major corrective spinal surgery, or the insertion of an artificial heart. This procedure is most common to neurology, cardiology and vascular surgery.

high-risk procedure — There are some very complicated procedures that require total concentration during the entire procedure because the slightest little mistake is fatal. For example, the insertion of an artificial heart. If you happen to get a tear behind where the heart was, it's totally impossible to recover from it. You get one chance at it, and that's it. (elite cardiac surgeon)

high-risk procedure — In major surgery the downside is very great. In neurosurgery the worst downside is not death, it's quite often paralysis. ... People who are dead leave the scene, whereas people who are paralyzed may stay around a long time. So often our downsides are much more agonizing than death. (elite neurosurgeon)

high-risk procedure/patient — I do arrhythmia surgery. Usually they are very young, healthy people. They are athletic and very active people. They don't have any serious disease, but their conduction system is abnormal. We have to do very tedious surgery. We know what we're going to do, but it gets you a little more tense psychologically because you're dealing with otherwise very, very healthy people. Any mistake or accident during surgery can end in quite serious damage to the patient, which is unforgivable. (elite cardiac surgeon)

Complex case described surgery which is not life threatening but is a multi-phased procedure as seen in a triple injury, multiple ligaments reconstruction, or a series of skin grafts. This procedure is most common to orthopedics, general surgery, and plastic surgery.

complex — A young teenager had multiple fractures to his left leg. He had a compound fracture to his tibia, a compound fracture to his femur, and a bad assitabular smash. Any one of those injuries could be a serious injury. The combination was particularly tough. (orthopedic surgeon)

High-risk patient referred to the patients condition as being unusually stressful, for example a 75 year old with a bad heart, a fifth time surgery with scar tissue, or an unstable infant.

high-risk patient — We're doing things now that we wouldn't have dreamed of doing 10 or 15 years ago. We're operating on older patients who are more frail. We're operating in situations where one literally didn't dare tread to go years ago. (elite neurosurgeon)

high-risk patient — With children, we find it very stressful. We handle a lot who are apparently normal. ... When a child comes to you with minor complaints with a very serious problem, the room for mistake is very little. You can't make a mistake. If you make a mistake, things will go wrong. You can be blamed for it, and you feel tremendously guilty. (elite neurosurgeon)

Teaching others while performing surgery was reported to increase the complexity, the responsibility, and the lack of control in an already challenging situation.

teaching — Residents create a more complex stress situation. Residents can create a busy atmosphere. You have a sense of responsibility yet you're not really able to take responsibility. You're too preoccupied with teaching and not with the operation itself. (neurosurgeon)

First-of-its-kind procedure refers to new advancements never tried before in the field.

first-of-its-kind — We researched the literature and adapted what was there, with a little twist of our own. The first time we did this, we were sort of terra incognita. We didn't know whether we could pull it off or not. It went great. We were able to carry out the surgery very well using this new technique. ... Now we're writing a paper about it, and we'll be presenting it at one of our national meetings in August. (general surgeon)

Unfamiliar procedure refers to surgery dealing with an area of anatomy or a procedure uncommon to that surgeon.

unfamiliar — The most rigorous surgery that I do is something like cancer surgery for a bladder. It's not the kind of surgery you do everyday, and that makes a difference. I would be removing the whole bladder, or the prostate, and making a new bladder. You do tend to go over it more. (general surgeon)

Special patient relationship pressure occurs as a result of such things as operating on a patient who is a relative, a friend, a child of a physician or is threatening to sue.

special patient relationship — All of a sudden, the son of a former secretary of mine had a very difficult tumor of the brain, an operation I'd done a lot of successfully. ... That multiplies the stress when you know the people. ... You have had some relation, not a relative but a good friend or former employee. If things don't click, this multiplies everything. It doubles it. If you don't know the people well, you feel bad about it. But if it's a friend, a colleague, or a former employee, you feel doubly bad. And if you have to see that person often, it's even worse. (elite neurosurgeon)

special patient relationship — Every patient is treated the same, but when a patient's husband is a physician and the son is a physician, there's a little more stress. ... I knew it would be difficult and that I may not succeed. I could foresee that the husband was a difficult man. He's a surgeon and a difficult man. I knew that he only partially understood what I was saying. There was a lot more than the operation itself. (cardiac surgeon)

special patient relationship — One person was our hundredth transplant. ... It was being recorded, so I had to be careful not to say anything that may be misrecorded. ... If there's going to be pressure and there will be laws, and your patient dies, you're really under the gun for something that could have normally happened. If that patient dies in the operating room, it doesn't make for good publicity. (elite cardiac surgeon)

APPENDIX F

DIFFERENCES WITHIN READINESS FACTORS
BETWEEN SUBJECT GROUPS
(Mann-Whitney Testing: 2 groups with 1 score)

Group	Readiness Ratings for					
	Successful Surgery			Disappointing Surgery		
	Ment	Tech	Phys	Ment	Tech	Phys
Total Subject Mean	9.4	9.3	9.3	8.2	8.8	8.8
Total Subject Standard Deviation	.69	.91	1.04	1.95	1.36	1.39
Males vs. Females	.789	.268	.478	.669	.798	.139
High vs. Low Risk of Mortality	.769	.922	.279	.942	.683	.979
Adult vs. Child Surgery	.091	.278	.060	.080	.756	.384
1-6 vs. 10 or more yrs. experience	.339	.955	.251	.300	.130	.198
1-3 vs. 10 or more yrs. experience	1.00	.377	.438	.711	.044*	.161
Elite Reputation vs. All others	.387	.787	.297	.845	.424	.449
Elite Reputation vs. 1-6 yrs exp.	.256	.764	.200	.733	.293	.327
Elite Reputation vs. 1-3 yrs exp.	.705	.532	.706	.858	.150	.271

* sign. <.05

APPENDIX G

PRACTICAL CONSIDERATIONS FOR MENTAL READINESS TRAINING IN SURGERY

This investigation pinpoints the mental skills needed to be developed and refined for consistent high-level performance. The following considerations, drawn from the study findings and from the interviews with elite surgeons, are intended to assist in future teachings of excellence in the surgical arena

Recognize the Challenge

1. High-performance situations need high-performance surgeons. Seven challenges: first-of-its-kind, high-risk procedures, high-risk patients, unfamiliarity, complexity, special patient relationships and teaching.

Commit Fully

1. More times at bat, more hits. Full-time surgeons produce full-time results.
2. "Dispassionate achiever" is a contradiction in terms. Applaud passion.
3. Careers demand choices: absolute dedication or a balanced lifestyle. Both are challenges. Commit to be your best.
4. Take control and prioritize — even the urgent urgents.
5. Learn to anticipate the next step, the next setback.
6. Persist and you'll find commitment. Commit and you'll be persistent.
7. Leave statistics to baseball. Have the courage to operate in serious situations. Surgeons give help when help is needed, and can't fear increasing mortality point standings.

Develop Confidence

1. Find mentors. (The better the better!) The best inspire compassion and responsibility.
2. Be a mentor. Check the details in residents' work. Set high standards and good examples. That's what mentors do.
3. Find spiritual maturity. Religion is reinforcement from the imperfections in life and medicine. Believe with the best of them.
4. Revisit medical study aids. Props promote confidence and good memory.

5. Get bonus points. Imagery pays off in crises, self-evaluation, good visual memory ... and confidence.
6. Mix and match odd ideas. Mental skills from jogging, flying a plane, or woodworking can be valuable in the O.R.
7. Male surgeons can best learn patience, acceptance of routine, and mental stability from their female colleagues.
8. Female surgeons can profit by adopting their male colleagues' attributes of risk taking, aggression, and team support.
9. Think back on glory days. Some of the best mental training comes from previous successes. Recall odd hobbies and life experiences.
10. Talk to yourself. "Gee, that worked out well" or "Get back on track!" Like vegetables, home-grown confidence is best.

Refine Imagery

1. Imagine "perfect." See it. Touch it. Feel it.
2. Imagine "perfect." Rotate it. Tilt it. Handle it. A picture tells a story.
3. Rehearse the screenplay — the scenes, the complications, the backups, the results. It's a key to being relaxed and staying relaxed in a crisis.
4. Prepare for the physical drama — hard sweat, three-dimensional hand-eye coordination, ambidexterity, precision.

Prepare

1. Be positive. Make reasonable odds, be convinced, hear it from the patient, pay attention to details. It's not hit-and-miss.
2. Ask: "Would I do this if it was my father or mother, sister or brother?" Confirm the right choice from the start.
3. Listen to colleagues. History repeats itself.
4. Listen to everyone. Ideas and support can come from anywhere.
5. Don't believe everyone. If it doesn't make sense ... don't do it. Take charge.
6. Zero in on patient satisfaction and patient contact. Teamwork, focused-energy, and crisis control will improve because of it.
7. Speak clearly to patients. (Go get those props.)

8. Get patients on your side. Their support is invaluable to performance. Hesitant patient, hesitant surgeon. Learn to sense trouble and say so.
9. Have clear goals. Distractions are more easily resolved.
10. Target the goal. Learning from negative experiences will come more easily. Team, colleagues, and mentors will better understand.
11. Be ready for failure. Make sure you know it, and make sure the patient knows it.
12. Great game plan, great results. Know exactly what to do before going in. Have the capability of changing if necessary. An open mind will be your reflex for the unexpected
13. Be meticulous, even excessively. Plan the details over and over and over. Evaluate your opponent — the condition.
14. Great health, great results. Exercise and eat well. It reroutes pre-op frustrations. An apple a day ...
15. Get R and R. Be good the night before. Directed-energy, foresight, and crisis control will improve.
16. Sleep on it. Let the subconscious work it out.
17. If it's Tuesday, it must be surgery. Develop performance rituals. Use the same cologne. Eat the same breakfast cereal. Take a safe route to work.
18. Be confident. Be prepared before going in. Know that you've done everything possible to be ready. Then do it.
19. Make the last stop the "john."

Manage Pre-op Distractions

1. Dispatch emotional upsets — previous case, unresolved tensions, emotional conflicts. Put them on hold, isolate yourself, or cancel. You can't have both.
2. Know that nothing is ever "normal."
3. Don't get into a big flap; if you do, you'll never last.
4. Deflate. Ranting and raving accomplish nothing. If it drags on, leave or sit in a corner. Stay cool ... deflate.

Focus Fully

1. Anywhere worth being is worth being mentally.
2. Be mentally ready (for more than just sewing). Somebody's unconscious, waiting for YOU — not the intern, or the nurse, or the anesthetist — you. Discipline and compassion.
3. Scrub up and psyche up. With a wall in front, real or imagined, use this time to focus.
4. It's hard to sit on the bench. A change in mindset is necessary to be a more passive participant.
5. Make the O.R. a "zone," an "oasis away from the world."
6. Trigger emotional control. See every operation as "the big one." The higher the risk, the higher the focus.
7. Take care of the little things — turn down the peripheral lights, put your back to the door, turn up Mozart (the ECG beeps will disappear).
8. Be friendly. Your family, your colleagues, the team, the patient, and the hospital administration can all pave a rocky road. Your performance stands to gain.
9. Concentrate, relax, and be friendly.
10. Focus purely on the procedure.
11. Channel high energy. Anticipate both the next step and the unexpected.
12. Find the rhythm — changes in tempo, demands in effort, flows in movement.
13. It's not enough to make *most* of your bridges safe. Crooked is not okay. Be compulsive and meticulous ... with every detail.

Control Distractions

1. Run a disciplined operation. No taking calls, no making calls between cases. Nothing extraneous.
2. Deal with only necessary interruptions and then get back on track.
3. Apologize when necessary.
4. Eliminate negative emotions. Bad feelings distract from finesse and make anticipating the next step more difficult.
5. Disconnect. All the nonsense will resolve itself. Focus on the task at hand.
6. Keep things the same if they're working. Media events, major operations, or just wanting to be different aren't good reasons to change.

Deal with Crises

1. Do it right the first time.
2. Prevent. Avoid getting into trouble with each step. Avoided doing anything you can't undo.
3. In trouble? Slow down the engine, drop the noise level, get things settled to a nice normal flight, do your thinking and *then* address it.
4. Stand quiet ... be in complete control ... keep totally focused. Work out the steps in the crisis.
5. Talk to yourself. Tell yourself to keep going and not to give up.
6. Take a deep breath ... do a mental count to three or four or five, rather than panic. Judgement is everything.
7. Stop, take stock, and give pats on the back for the recovery. Post-tension reduction is part of crisis control.
8. Give no-fault assurance to others.

Attend to Lulls

1. Anticipate. Leave a little to do while someone's out getting the x-ray.
2. Improvise. Pick from the armourmentarium of tools.
3. Don't compromise. Say no to "fork and spoon surgery" (deep breath). Wait the extra five minutes until you have the sophisticated tools available.
4. Get a break, take a break. It's a chance to defocus. Use downtime to discuss plans A, B, and C, not to misdirect patience, persistence, and high energy.
5. Avoid short cuts or trying to hurry things along. Be unrelenting and uncompromising to detail. Be meticulous.
6. Learn tenacity and stamina. Stick to your guns. Teach others persistence too.
7. Take routine phases seriously. They're the worst distractors to performance. Keep positive when faced with tedious work, repetition, and slowpokes. "Be as nearly bored as enthusiasm will permit." Sir Edmund Gosse
8. Drifting is human, rushing is unfair. The end is the wrong time to make errors. Know your attention span. Step out briefly — you can be replaced.
9. Delegate. Boredom can mean inattention to detail.

10. Delegate. Folks who get support "own" their cases and take more at bats. Make responsibility easier and earlier for residents.
11. Successful, happy endings are what errors are made of. "What could happen, I'm just closing."

Evaluate

1. Ask dumb questions. Take a fresh look at evaluating.
2. Keep a mental video. Review it after the performance. Edit it for next time.
3. Look for glitches. Draw lessons to be smoother, quicker, and more efficient.
4. Use visual aids to remember — records and photos. Pediatric surgeons do it best.
5. Consult with colleagues and the team. Make the "network" work.
6. Share all information. The more real-time information out there, the more good stuff happens.
7. Give the patient the final evaluation.
8. Feeling lucky is fatal. Surgery is unforgiving. Just when you think you'll never have another complication — boom, the big one!

Recover

1. Doing your best helps you to forgive yourself and forget.
2. Count on Morbidity and Mortality Rounds. This is the place to wash your dirty linen in private.
3. Tell it like it is. Honesty is your best defence. Colleagues will understand and trust you for it.
1. Find a "buddy." Get the hurt out, feel better, and get back on the horse.
4. Rest and anticipate periods of high fatigue.
5. Take time off. Get away six weeks a year on a trip, conventions, or time at home. Otherwise, it's a burnout job.
6. Take sabbaticals.