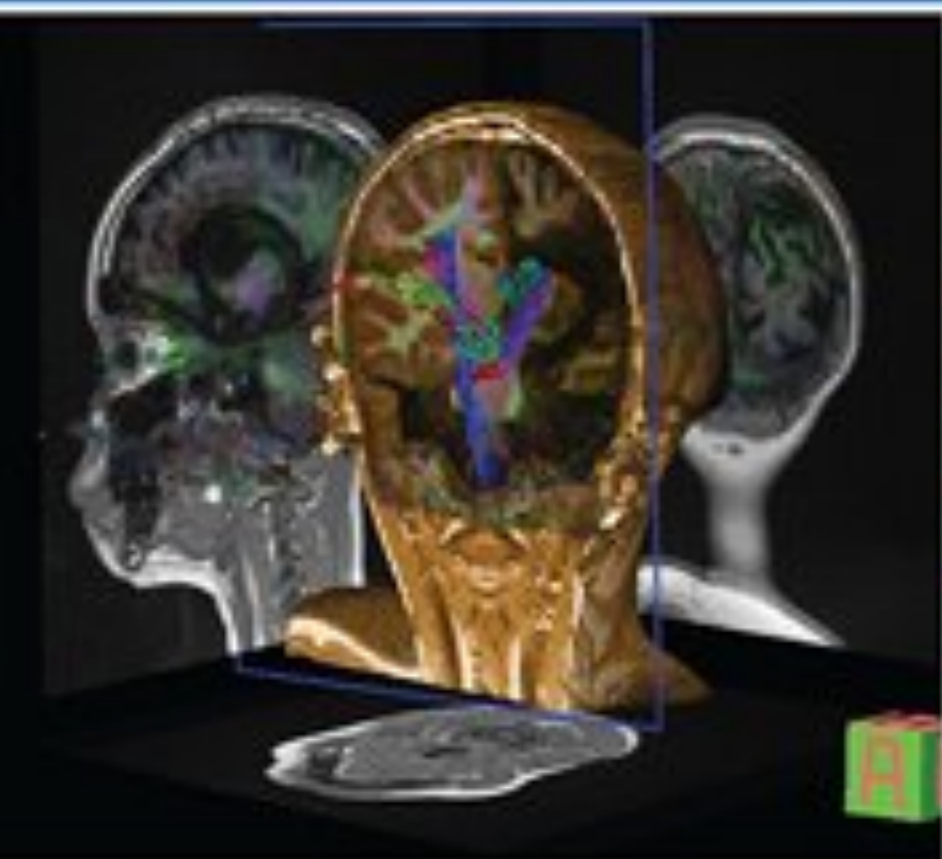


# THE HOSPITAL NEUROLOGY BOOK



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# The Hospital Neurology Book

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## The Hospital Neurology book

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*To my sweethearts Sayena, Ava, and Anahita and to my parents Sarah and Ali.*

**AS**

*To my grandchildren Selim, Ira, and Oz.*

**JB**



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# Preface

It is with great humility that we present *The Hospital Neurology Book* to the medical community. Traditionally, textbooks of medicine served the double purposes of being comprehensive repositories of information as well as pedagogical tools. We took into account the changing way physicians access information relevant to their practice. Most of our colleagues access detailed information online through review articles and medical sites. We concentrated on presenting hospital neurology in a digestible way, concentrating on practical information and approach, while providing references to more detailed sources of information. We chose the case-based approach, in line with the most recent research regarding the way we assimilate information. We avoided concentrating on rare diseases, however interesting or elegant their mechanism may be, and only explored disease mechanisms when we thought it would help with the understanding of the disease and its management. In short, we aimed the book to be a practical and pedagogical tool for the “gardener” rather than the “botanist” to paraphrase one of the greats.

We also took into account recent changes in the practice of neurology. Although classical neurologists were clinical neuropathologists who studied diseases according to the localization and category of a disease, the modern practice of neurology is symptoms based, relies heavily on internal medicine, and largely overlaps with it. We incorporated a minimum syllabus of internal medicine required for the practice of hospital neurology in the book and tried to organize the book around common presentations that a hospital neurologist or a hospitalist with neurology patients may encounter.

The editors first met each other on the sidelines of an educational conference where one was invited as an established chairman and educator, and the other as what was immodestly referred to as “a star of the future.” During that meeting, we discussed the changing nature of the practice of neurology, the way we learn neurology, and how we have not kept up with these changes in the educational settings. In time, we decided to have the courage of our conviction and put together a work that attempts to fill this gap. The enthusiasm with which the project was embraced by the publishers and contributors reassured us from the outset about the value of this project.

The book was originally intended for practicing general neurologists, neurohospitalists, and hospitalists. However, one of the editors (AS) has already started using some of the chapters in teaching medical students, residents, and fellows at Yale School of Medicine, and the overwhelming positive feedback suggests that this is an enthusiastic audience we did not anticipate in our original planning. AS has been presenting the cases and the questions from the chapters (eg, Dementia) as a way of structuring student teaching. The chapters are designed to be self-contained; however, to minimize duplication, we cross-reference information where it is appropriate. These chapters may be read in any particular order. We anticipate that hospitalists can skip the internal medicine-based chapters but we highly recommend these to the neurohospitalists and general neurologists.

Our thanks, first and foremost, goes to the many contributors who shared their knowledge to this book, Linda Turner who provided superb organizational assistance, and Alyssa Fried and Andrew Moyer from McGraw-Hill. AS would like to thank his sweethearts Sayena, Ava, and Anahita without whom life is meaningless, as well as his first and greatest teachers his parents Ali and Sarah. I am also grateful to the Yale Department of Neurology for having the capacity to provide the freedom to pursue educational projects. JB would like to thank his wife Rhonda for her unrelenting patience and contagious sense of humor.

Arash Salardini, MD  
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# Introduction to Hospital Neurology

Arash Salardini, MD  
Chad Whelan, MD

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## INTRODUCTION

All subspecialties are a product of their history, and Neurology and Internal Medicine are no exceptions. Classical Neurology evolved in Europe on the bedrock of clinical semiology and postmortem neuropathological correlation in places such as Pitié-Salpêtrière and Queen Square hospitals. The pioneers of Clinical Neurology in the United States and indeed other countries looked to these beginnings when they set up departments and training programs during the last century. From their point of view, a study of the brain and its meager relevant therapeutics had little in common with the wider Internal Medicine. Knowledge of Internal Medicine was not as crucial to the training of a neurologist at that time as neuropathology and repeated exposure to the intricacies of neurological examination. It is in this environment that the neurological method evolved in the image of neuropathological correlation studies: a lesion is localized by detailed neurological examination, differential diagnoses are generated, and individual hypotheses are tested. Apart from the intellectual elegance of this approach, any delay caused by the meticulousness and deliberate pace of progress hardly mattered. There were few time-sensitive therapies to be offered to the neurological patient, and for a long time, Neurology was seen as the very definition of therapeutic nihilism by other subspecialties.<sup>1,2,3</sup>

These beginnings had predictable effects on the development of Neurology as a profession, particularly in North America. Most Neurology departments separated from Internal Medicine and, in some cases, Psychiatry to form independent entities with a separate curriculum. Internal Medicine training was relegated to a single year in the immediate postgraduate year of training for neurologists and much of the neurology content was removed or simplified in Internal Medicine training. Most of the practice of neurology was conducted either in the ambulatory setting

or in the setting of hospital consultation to the primary care teams. This created a unique gap in American health care provision where the general physicians might not have the required expertise to manage neurological disease, and the neurologists, untrained in the treatment of multisystem disease, might inadvertently neglect the general care of their inpatients.

While Neurology was predominantly a diagnostic and consultative specialty, these deficiencies were less palpable. But since effective therapies are now become available for acute neurological conditions, it is no longer adequate for the neurologists to treat their patients in consultation only or to only accept less critically ill patients into their service. The neurology inpatients now often suffer from multiple serious systemic conditions that complicate their care in the hand of the general neurologist. Recent changes to reimbursements and hospital recruitment policies have taken note of these changes, so that neurohospitalist medicine is one of the fastest growing areas within neurology. Additionally, there is an increased demand for neurological knowledge, for management of strokes and seizures in community settings where access to neurological consultation is either difficult or untimely. Hospitalists, trained as internists, critical care physicians, or emergency physicians, have had to retrain themselves to incorporate many more neurological conditions into their repertoire. Meanwhile, no corresponding changes to the respective curricula have occurred to adjust for this change.

In other countries, neurology training is part of advanced training in Internal Medicine, akin to Cardiology or Endocrinology in the United States. The numbers who are trained in Neurology are therefore less than what is the case in North America. The care of most neurological patients, outside of major centers, is in the hand of (often excellent) general physicians who deal with the most common neurological conditions and may have access to neurological consultation. For these physicians, the minutiae of

rare neurological diseases are out of reach and a practical approach to common and critical conditions is prioritized.

## PART 1—THE PROFESSION OF HOSPITAL MEDICINE

### Case 1-1

You are called into the emergency department (ED) to assess Ms. JB, a 68-year-old woman with dizziness who presents with a 4-day history of intractable nausea. The problems started abruptly when she felt dizzy while getting out of bed 2 weeks ago. Her symptoms are positional and worse when she leans forward but are not made worse by rolling in bed. She has lost some weight since the start of these symptoms because of severe nausea. She has a history of microscopic colitis, which is under control. You arrive in the ED and introduce yourself to the physician in charge of the shift. You find that the ED staff are unfamiliar with the neurohospitalist model of care and you field some questions from the curious locals.

### SO WHAT IS A NEUROHOSPITALIST?

A neurohospitalist, whether a neurologist or an internist who sees hospital neurological cases, is distinguished by the type of conditions she treats, the skill set she must possess, and her general approach to the diagnosis and treatment of patients.

#### ► What conditions are seen by neurohospitalists?<sup>4</sup>

The hospital practice of neurology concentrates on the 3 “C”s: the common, the critical, and the curious. Although neurology abounds in interesting conditions that have clear syndromes that may be explained by their genetics and functional neuroanatomy, the recognition and treatment of the majority of these are not time sensitive and may be deferred to the outpatient setting. Most of neurohospitalist practice may be summarized as follows:

1. **The Common:** The most common neurological presentations to the hospital and the emergency department are strokes, seizures, headaches, exacerbations of multiple sclerosis (MS), and vertigo. One has to add to this list conditions that most neurologists do not consider neurological but are often consulted on: neurotrauma, syncope, loss of consciousness, back pain, and acute confusional states. An efficient and algorithmic approach to these conditions can streamline the high volumes and present the consulting team with consistency they can rely on for future referrals.

Some of the common consults for patients admitted for other reasons include management of Parkinson

disease (PD) while an inpatient, comatose patients, gait and balance problems, and management of other neurological conditions such as epilepsy before surgery to cite some examples.

2. **The Critical:** Neurological emergencies—although relatively rare outside of stroke, central nervous system (CNS) infections and epilepsy—are nonetheless important and time-sensitive conditions with which a neurohospitalist must be familiar. Strokes, seizures, myelopathies, neuromuscular emergencies, movement disorder emergencies, and rapidly progressive dementias fall in this category. A working knowledge of dementias and delirium is often necessary for diagnosing rapidly progressive dementia and dealing with confused patients. Whenever necessary skills do not exist in the hospital environment in which the patient presents, transfer to a hospital with higher available expertise should be considered.
3. **The Curious:** One of the more difficult set of consults that the neurohospitalist receives belongs to the category of patients who have isolated or atypical neurological symptoms. The patient may have numbness, weakness, movement disorder, speech or visual problems. A working knowledge of the basic physiology in each case can allow the neurologist to be able to distinguish the factitious from the real, and to direct the patient to the appropriate resources.

#### ► What is the skill set needed to become a neurohospitalist?

1. **Neurological knowledge:** A good knowledge of the 3 C’s of hospital neurology forms the basis of practice.
2. **General medical knowledge:**
  - a. **Critical care:** Neurological patients with critical conditions are looked after in intensive care units (ICUs). Where a neurological ICU is not available, the hospital neurologist often co-manages these patients along with the critical care physician. A working knowledge of the setup and equipment in the ICU is a necessary part of the job.
  - b. **General inpatient care:** Neurological patients may have risk factors for systemic disease. The neurologist should be able to at least recognize the signs and symptoms of a patient with systemic disease that requires immediate attention. Furthermore, some common day-to-day management of inpatient problems may save considerable time and improve efficiency.
3. **Diagnostic skill set:**
  - a. **Electrodiagnostics:** Interpreting electroencephalograms (EEGs) is important to the management of inpatient neurology. Recognition of epileptiform activity, often not subtle, can be taught in a brief

period of time. Identifying normal variant prevents unnecessary treatment. Some access to EEG reading, even if remote, can be arranged when the hospitalist does not feel prepared to interpret EEGs. Electromyography is used in the diagnosis of several acute neuromuscular diseases but not in the day-to-day management of neurological patients.

- b. Imaging: Working knowledge of stroke imaging is also important. Computed tomography (CT) and CT angiograms (CTAs) form part of the acute management of strokes. Radiological input in some cases may delay care. For other purposes, being able to interpret one's own images is definitely time saving and efficient. Unlike the radiologist who has to be versed in the rare and the subtle, the neurohospitalist's task is to be familiar with the rudiments of radiological signs as well as those which pertain to our narrower field of interest.
- c. Lumbar puncture (LP): The neurohospitalist is often the last resort after all others have failed to find their way into the cerebrospinal fluid space.
4. Therapeutic skill set: Administration of tissue plasminogen activator (tPA), familiarity with antiepileptic drugs (AEDs), and ability to manage pain are some of the core therapeutic skills.

### CaSe 1-1 (continued)

You review the history and elicit some extra information: the feeling of dizziness accompanies the nausea, which waxes and wanes along with it. There is blurring of vision but no "room going around her head". Her gait has been affected. She has had a number of falls in the last few days. She has no changes to her hearing. She also gets numbness around her mouth, worse on the left side, when exacerbations occur. She has a paternal family history of problems with balance but she does not know the details as her father left the family when she was 2 years old. She has type II diabetes, smokes "socially", and has a history of untreated arterial hypertension. Extraocular movements are intact, both vertical and horizontal. Smooth pursuit is normal. There is nystagmus on extremes of gaze, worse on right gaze. However, the Dix-Hallpike manoeuvre does not elicit a definitive response even though the patient does get dizzy. Facial sensation is normal bilaterally except during acute exacerbations caused by positional change when she had some subjective numbness on the left side of her face. Smile is symmetric. Hearing to finger rub is normal bilaterally. Uvula and palate elevate symmetrically. The gait is cautious but not parkinsonian or ataxic. There was slightly increased tone on the left. You decide to approach this problem systematically.

### ► What is the neurohospitalist approach?

The neurohospitalist approach combines the neurological method with that of general medicine. Here we present one possible approach to the problems of hospital neurology. The two parameters upon which initial decisions are made are risk and probability. The neurohospitalist would approach the differential diagnoses according to these two parameters:

1. Risk: The diagnoses that are potentially catastrophic if not treated in a timely manner should be prioritized. For example, the combination of some facial sensory changes and vertigo is statistically most likely due to relatively benign causes. The patient may have benign positional vertigo and hyperventilate in anxious response to the discomfort caused by the spinning sensation. However, missing basilar artery thrombosis, though a less likely diagnosis, would be unacceptable, so that the initial diagnostic inquiry should be directed toward brainstem vascular pathology in a patient with high enough pretest probability.
2. Probability: The probability of other differential diagnoses is a function of their semiology and presence of risk factors. So, for example, any focal neurological sign in a diabetic smoker in their 60s, however atypical, should prompt further investigation. Atypical symptoms, for example sensory changes, in a young healthy 20-year-old is less likely to prompt urgent imaging. Conversely, a highly typical syndromic presentation, such as one consistent with a classic lateral medullary syndrome, regardless of risk factors, should raise the possibility of vascular pathology in the posterior fossa.

Based on this approach, testing may be ordered. With each extra piece of information the risk and probability of items on the differential diagnosis should be reassessed. Ultimately a neurohospitalist is a safe pair of hands who rules out critical possibilities, treats the common probabilities, and knows what conditions may be relegated to outpatient follow-up. To paraphrase one of the greats, if traditional neurologists were botanists who knew the rare and wonderful species of plants without getting their hands dirty, the neurohospitalists are gardeners who have practical knowledge of successfully growing the important and common ones.

### CaSe 1-1 (continued)

You decide, given the risk factors, the patient is at high risk of strokes and that the vertigo and numbness in combination may not be ignored in this context. You order a short protocol magnetic resonance imaging (MRI) of the brain with diffusion weighted imaging, apparent diffusion coefficient, fluid attenuated inversion recovery, and gradient echo sequences, and find no evidence of a recent stroke. You then decide that

despite some atypical features, the patient likely has a peripheral vestibular problem. The numbness and the vertigo appear to be recurrent and completely resolve each time. Meanwhile, there are definitely functional and psychological issues that may be muddying the overall picture. You speak to the patient and reassure them that this is unlikely to be caused by serious pathology, and that you will organize a follow-up for them in the local general neurology practice.

## WHAT IS THE FUTURE OF NEUROHOSPITALIST MEDICINE?

- **Demand:** Increased need for neurology services in the future is likely, as neurological therapeutics improve. The Neurohospitalist model represents an efficient model of health care delivery that minimizes unnecessary consultations as well as unnecessary testing caused by lack of confidence in one's own diagnostic ability. As more complex therapeutic interventions come to the market, the remuneration for neurohospitalist work is likely to improve beyond its current rates.<sup>5</sup>
- **Training:** Presently most neurohospitalists are general neurologists with greater comfort in dealing with acute cases. A large number of the neurohospitalists are trained in Vascular Neurology and have experience in neurocritical care. Training in Hospital Neurology in Internal Medicine programs is at the moment not available. There are a number of formal fellowships offered in Neurohospitalist Medicine (University of California San Francisco and Mayo Clinic Jacksonville were the pioneers). We anticipate the demand for this kind of training to increase, although there is some resistance to this within some constituents of the neurology community who, for understandable reasons, seem wary of yet another year of postgraduate training.<sup>6,7</sup>
- **Research:** Neurohospitalist research will likely concentrate on streamlining and standardizing approaches to common and critical neurological conditions. Use of checklists, algorithms, and biomarkers is better established in Emergency Medicine and Cardiology, which may serve as exemplars to be emulated.<sup>8,9</sup>
- **Teaching:** Academic neurohospitalists will be involved in teaching in 3 settings:
  - **Teaching Neurology residents** who will require less supervision: The Neurohospitalist model is more likely to resemble the hospital practice of neurology in the community than the hierarchical teaching general neurology model. As such, the experience in a neurohospitalist rotation will be of particular advantage to the residents.
  - **Teaching neurohospitalist fellows:** The neurohospitalist will be only one person in the mix of

teachers required for an academic neurohospitalist program. Other instruction is likely to be given by vascular neurologists, neurointensivists, and clinical neurophysiologists.

- Teaching upper level medical residents who will enter practices that may rely on them for neurology.

## PART 2—THE PRACTICE OF HOSPITAL NEUROLOGY

Whether you are leading a new or existing program or joining one, it is important to critically think about your neurohospital medicine program (NHMP) for both the program and your own career to thrive. In a time of rapid growth in any field, it is easy to start up a program or find a position. The challenge then becomes, how do you make sure that program grows and matures? Understanding the key decisions you will need to make and anticipating the challenges that you can expect to face will allow you to nurture the program. The most important question to ask is, "Why am I setting up this program?" A goal-directed approach will help drive the NHMP group leader's decisions across all the domains of operating a program.

### Case 1-2

Your major teaching hospital has acquired a local community hospital. The teaching hospital would like to have stroke certification for the center and to start a neurohospitalist program to cover the consults and to provide cover for the stroke calls. The neurology practice, which previously covered the hospital, does not agree to the terms of the new arrangement, and you and several of your colleagues are approached to set up a neurohospitalist program.

## WHAT ARE THE GOALS OF THE HOSPITAL ADMINISTRATION IN SETTING UP A NEUROHOSPITALIST PROGRAM?

Many hospitalist programs start up at the request of hospital administration in order to deal with concerns about staffing models, long lengths of stay, or to support a growing neurology/neurosurgical program. Other common reasons for implementing a program include managing the length of stay and resource utilization, supporting multidisciplinary neuroscience programs, reducing complications on the neurology service, and obtaining stroke certification.

### ► **Model of practice: Should we negotiate to become a private practice group or remain employees of the hospital?**

There are successful employed and private practice hospital medicine groups in all types of hospital settings. Thus, there is no right way to set up your practice. However, this

decision will affect every other decision you make, including who your partners are likely going to be.

- a. **The employed model:** The employed model means that the program is staffed by neurohospitalists who are employees of a large multispecialty practice or the medical center. Employed groups provide a more predictable income that tends to be on average lower than a private practice income. However, benefit packages may mitigate this difference to some extent. More importantly though, employed models generally have lower clinical activity that is offset by greater opportunities (and expectations) of getting involved in nonbillable activity that benefits your employer. These may include quality, safety, and other administrative activities. Employed models provide a greater variety in work but less personal control over your group's workload and demands.
- b. **Private practice models:** The private practice models tend to emphasize clinical activity and a large degree of autonomy. While neither model predictably leads to greater career satisfaction, the people who are happiest in one are not likely to be as happy in the other model.

While both private practice and employed models can be successful, the underlying reason for starting a program can help guide which model would be better suited to meet those needs. If the primary driver relates to increasing clinical activity, then a private practice model is highly aligned with the primary goals of the program. Growing clinical activity should translate directly into growing revenues from professional fees. If, however, the primary driver is related to cost control or risk mitigation, then an employed model may in fact have incentives that are easier to align with the group. While clinical activity and revenues from professional fees will be important in any model, the nonbillable activity that may be required to drive initiatives that are important to the medical center will be easier to support in an employed model than in a private practice model. Any successful NHMP will have multiple goals, some of which are more naturally aligned with a private practice model and some of which fit easier with an employed model. The goal is to best match the primary drivers with the model.

### ► In negotiations, what factors do the remuneration and funding depend on?

The business case should follow directly from the goals of the program. All NHMPs should have 1–5 primary reasons for why they exist. Clinical activity will be an important goal for any program and the business case for this should be relatively straightforward, and most administrators should be comfortable with clinical revenue projections. Other goals will be less easily translated into revenue but should be at least somewhat familiar to most administrators as the cost of doing business. For example, if a hospital is asking you to provide 24/7 in-house coverage for patient

safety reasons or to achieve a certificate in excellence in an area that is important to the medical center, the difference between the cost of your program and the revenues you will generate will be costs associated with providing a safer clinical delivery system or allowing the medical center to get certified in an area. It will be up to the medical center administration to determine whether the cost of doing business to achieve those aims will be worth the investment. Translating some benefits into a monetary value, though, will be important. For example, if you are proposing to reduce the length of stay across a population of patients, you should build the financial value of this into your business case. Similarly, if you believe that by providing neurosurgical co-management you will be able to increase surgical clinical activity, this should be built into the financial models. While the math behind these calculations may be relatively straightforward, it is best to build these models in conjunction with your medical center or practice plan administrators. Many of the inputs for these models, such as payer mix, contractual agreements, cost per case, volume back logs, etc., will require an in-depth knowledge of the local environment. Not only will you develop a more accurate business case, you will also demonstrate your willingness and ability to work collaboratively with administration to achieve shared goals.

In addition to the formal business case, it will be important to learn who your advocates are and who your challengers will be within the medical center. There are some stakeholders that will predictably be advocating for a program that promises increased provider presence and focus. Nursing, quality, care management, population health, and patient experience will generally be highly supportive of hospital medicine programs that are willing to work collaboratively with their areas. While these important stakeholders' perspectives may not be part of the formal financial plan, it is important to include them in any qualitative discussion about the benefits of a program. Particular challengers to your program will include any group with which you may be competing for patients or resources. These may include existing neurology groups, neurosurgeons (depending on your decision about neurosurgical co-management), and traditional hospital medicine groups. Building relationships with these potential competitors when possible will be important to reduce the number of adversaries within the medical center. As with all of the decisions you make when starting a program, you should expect to revisit the business case on an ongoing basis. Because it is likely that your program will require institutional support, C-suite executives will be constantly making sure that your program brings value beyond the support they will need to provide.

### WHAT IS YOUR STAFFING MODEL?

Developing a staffing model is one of the earliest and most pivotal decisions a new hospital medicine group faces. Initially this is based on projections of needs and volumes



that will invariably be wrong. If you overstaff, you will quickly run into budgetary shortfalls; if you under staff, you will lead to provider stress, poor customer (patients, nurses, and referring physicians) satisfaction, and possibly even poor clinical outcomes. Your staffing model will be a strong consideration for any candidate looking at your program and comparing it to all of the other options they may have. How, then, can you proceed? It is critical to know or predict the following factors.

**1. Will you be providing 24/7 in house coverage?**

If you intend to do 24/7 in-house coverage, you will need to consider 2 important implications. The billable clinical activity at night is often significantly less than that during day time hours, so you will need to consider this when you set target volume metrics, regardless of whether you use encounters or relative value units or some other measure. While it is relatively easy to complete a schedule to cover 24/7 with 4 full time equivalent (FTE) providers, the reality of covering that type of schedule is challenging. In general, a minimum of 5 FTEs is required to build a sustainable model of 24/7 in-house coverage. Once you determine the hours you will be covering, you will next need to decide what activities you will be hoping or expected to do, both clinical and nonclinical.

**2. Will you be doing neurosurgical co-management?**

Neurosurgical co-management is a growing area of hospital medicine and an NHMP would be a natural partner with neurosurgery. This role needs to be carefully defined to determine how it will affect your clinical activity projections. If your physicians are new to neurosurgical co-management and you are in charge of the length of stay, make sure that you build in a significant learning curve into your projections. If, however, your physicians are already comfortable with neurosurgical issues and the care is more evenly split between the neurosurgeon and your team, you will likely be able to manage more of these patients comfortably.

**3. Will you be covering the ICU?**

Managing ICU patients will also, in general, require more time/patient than for patients.

**4. What nonclinical roles will you be asked to perform?**

Understanding what nonclinical activities you will be expected to participate in is essential to budgeting your staffing needs. Participating in some administrative activities should be expected. However, if your team is expected to lead major improvement activities or serve in significant administrative capacities, it will be important to budget that time into your model.

**5. Are you in a teaching hospital in which a large majority of your clinical work will be as an attending on a teaching service?**

If your service is primarily a teaching service, you will likely be limited more by residency program restrictions rather than attending workload. Because these services tend to be less clinically intensive than services without residents or fellows, less time off between clinical rotations is generally needed.

**6. What is the realistic expected clinical volume on day 1, and what are your growth projections (with some built-in sensitivity analysis)?**

In general, if you are going to be the primary service (as opposed to a consulting service), you should anticipate being able to manage a lower volume of patients. Once all of these factors have been taken into account, you can then look to project your realistic patient volumes on day 1 and then build growth projections out for at least a year. It is likely that your program, especially if it is 24/7 in-house, will be in deficit requiring support from the hospital to cover your losses, regardless of whether you are in an employed or a private model.

## HOW SHOULD SHIFTS BE ORGANIZED?

After you have determined how many FTEs you need and your basic staffing model, you will also need to consider some second-order decisions about covering services throughout the year. One of the fundamental problems with the hospitalist model is that it introduces discontinuity into the care of the patient. Staffing models should minimize discontinuity as much as possible through the use of longer stretches of service, especially during the day-time rotation. However, there is an inherent tension in that longer stretches lead to fatigue and risk sustainability. In general, week-long rotations provide a reasonable balance. For most hospitalists, 2-week rotations prove to be difficult to sustain, unless it is a teaching service. Rotations shorter than 5 days begin to really threaten continuity and come with significantly increased hand-off efforts. Once you establish your baseline rotation (1-week rotations, for example), you will then need to decide if your system is fixed (all rotations are the same length) or if there is flexibility. Fixed rotations are the easiest to schedule and assure that the workload is evenly distributed in terms of the total number of shifts and the type of shifts (weekends vs weekdays, for example). However, over the longer term, most hospital medicine programs migrate to a more flexible shift system in which there are some guiding principles that provide boundaries for individuals to adjust their schedule but also allow for your physicians to nurture their lives outside of work. The ultimate goal is to provide sustainable careers for your providers in a system that provides a balance

between patient and provider focus, as highly engaged providers in a stable program that is structured to provide continuity and safe hand-offs will ultimately provide the best medical care possible.<sup>10,11</sup>

### WHAT FACTORS DETERMINE BURNOUT AND ATTRITION IN NHMP?

While the foundation of an outstanding NHMP requires a solid understanding of what you are attempting to accomplish and a staffing model that supports both patient care and sustainable careers, a thriving program also requires ongoing management to assure positive engagement from your providers. While hospitalists are generally very satisfied with their specialty, burnout among hospitalists is high. Programs that focus on the issues of importance to their hospitalists may suffer from less turnover related to burnout. Key attributes of a program with highly engaged providers include satisfaction with organizational climate, quality of care provided, organizational fairness, personal time, relationship with leaders, compensation, and relationship with patients. NHMP program leaders should pay particular attention to these issues and develop plans to address any shortcomings their program may have. Not all program leaders will feel confident in their knowledge and skills in being able to improve some of these issues such as organizational climate and fairness or the relationship with the leader, which are less about clinical care and more about management in complex systems. Program leaders should obtain training and skills in leadership and management so they can effectively deal with both clinical and nonclinical programmatic issues.<sup>12,13,14</sup>

### FINAL WORD TO THE WISE

Finally, a successful NHMP will need to nurture relationships with collaborators outside of the program as well. Nursing is a key partner, and paying special attention to how your program interacts with nursing will be essential to your success. A relationship, both at the bedside and in administrative meetings, that is built on collaboration rather than hierarchy will prove very successful in assuring that nursing remains staunch supporters of your program. The other external collaborators that are essential to pay particular attention to are your referring physicians. While personal relationships are invaluable, it is also essential that you pay particular attention to the patient care aspects of that relationship. Develop a shared

understanding of how communication and hand-offs will take place between the outpatient physician and your team on admission, during a hospitalization and at discharge. The discontinuity inherent to hospital medicine must be managed not only at the program level but also at the level of every single patient.

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# 2

## Potential Harms to Physician and Patient

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### Abstract

Potential harm to both physician and patient remains a constant challenge for the neurohospitalist. Physicians can be faced with violent or threatening patients where a strategic approach can include assessing for contributing factors, as well as pharmacological and nonpharmacological measures. Inadvertent risks to physicians include exposure to body fluids and needle sticks. Precautions have advanced along with our understanding of transmissible disease. Patients can be subjected to harm. As the systems of delivery and diagnostic and treatment modalities become more complex, the opportunity for medical errors can flourish. Individual errors and system failures can result in serious adverse events or near-misses. Hospital-acquired conditions can be infectious or noninfectious and generally have a deleterious effect on outcomes, cost, and length of stay. Evolving health care policy and hospital practices aim to reduce the potential for harm.

### VIOLENT OR THREATENING PATIENT

#### cAsE2-1

A 65-year-old man with bipolar disorder, hypertension, hyperlipidemia, prolonged QT interval, and diabetes mellitus presented to the emergency department with headache and vision loss. He was found to have a subacute ischemic stroke. The night following admission, he became agitated and threatening toward staff. He screamed and repeatedly punched the walls. He lacked decisional capacity, and no family members could be reached. Repeated attempts by staff and the on-call physician were made to calm him, but he remained aggressive.

### Background

- Workplace violence is a problem in many industries, but hospital workers have the highest rates of nonfatal workplace assault injuries.
- Most are violent acts committed by patients toward staff.<sup>1,2</sup>
- 50% of healthcare workers will be a victim of workplace violence during their careers.<sup>1</sup>
- Nurses, mental health professionals, and security staff are at greatest risk.<sup>2</sup>

### What are contributing factors to violent or threatening patients?

- Neurological, psychiatric, and genetic disorders, and drug abuse can predispose to aggressive behavior (**Table 2-1**).<sup>3,4</sup>
- Social factors can also contribute.
- Identify contributing factors early to mitigate risk.

### What are nonpharmacological strategies to deal with violent or threatening patients?

- Environmental elements should be controlled, such as physician and staff attitudes and patient comfort. Offering blankets or refreshments, and relative isolation in a private quiet room can be considered.<sup>1,2</sup>
- Physicians and staff must be vigilant about their surroundings, body language, and exit locations.
  - Maintain a safe distance and be near an exit in case a situation escalates.
  - Do not convey a sense of anxiety with body language.
  - Avoid appearing confrontational.

**Table 2-1.** Predisposing Factors to Violent Behavior

<b>Neurologic</b>
Delirium
Dementia
Seizures
Traumatic brain injury
Focal intracranial lesions (eg, neoplasm, stroke)
<b>Psychiatric</b>
Substance abuse
Schizophrenia
Post-traumatic stress disorder
Oppositional defiant disorder
Intermittent explosive disorders
Dissociative disorders
Antisocial and borderline personality disorders
Conduct disorder
Intellectual disability
<b>Social History</b>
Poor social support
Childhood abuse or neglect
Prior violence
Low socioeconomic status
Medication noncompliance

- If a patient becomes agitated, convey concern for the patient’s well-being. Reassure patients that the goal is to help them, and that they are safe.
- Whenever a threat is perceived, seek help immediately.

### ✕ When should isolation or physical restraints be employed?

Once a patient has demonstrated violent or threatening behavior, it may be necessary to implement isolation or physical restraint.

- Indications for restraint or seclusion include:
  - Prevent harm to the patient, other patients, or providers

- Prevent environmental damage
- At the patient’s request<sup>1</sup>
- When restraints are necessary:
  - At least 5 trained staff members should be present to avoid injury to the patient and others.
  - Frequently re-evaluate the on-going need for restraints according to hospital policy.
  - Routinely monitor skin integrity, vital signs, range of motion, and toileting needs.

### ✕ What are pharmacological approaches?

If nonpharmacological methods fail, medications can be used for chemical restraint (**Table 2-2**).

- It is preferable for the patient to choose the route of administration when possible. Providing patients some control over their care can help de-escalate some situations.
- If medication must be administered involuntarily, some agents can be given intramuscularly (IM) and intravenously (IV).
  - Typical antipsychotics provide rapid sedation, but have several drawbacks.
    - Extrapyramidal symptoms (EPS) can occur rarely after only 1 dose.
    - Torsade de pointes can occur from QT interval prolongation. A baseline electrocardiogram is necessary, which can be challenging in a violent patient.
    - Neuroleptic malignant syndrome (NMS), which presents as autonomic instability, hyperthermia, altered sensorium, and rigidity, occurs in 1% of patients receiving antipsychotics.<sup>1</sup>
    - Haloperidol has a sigmoidal dose–effect curve. Doses over 15 mg provide no additional benefit.<sup>5</sup>

**Table 2-2.** Common Medications Used for Chemical Restraint

Medication	class	routes	Dose (mg)	significant side Effects
Haloperidol	Antipsychotic	IM	2.5–10	EPS, prolonged QT
Risperidone	Atypical antipsychotic	IM, PO	0.5–1	EPS
Olanzapine	Atypical antipsychotic	IM, PO	2.5–10	Mild hypotension, anticholinergic, EPS
Zispridone	Atypical antipsychotic	IM, PO	20	Prolonged QT, EPS
Quetiapine	Atypical antipsychotic	PO	25	EPS, sedation, prolonged QT
Aripiprazole	Atypical antipsychotic	PO, IM	2–15	EPS, prolonged QT
Lorazepam	Benzodiazepine	IV, IM, PO	0.5–2	Confusion, nausea, ataxia, respiratory depression
Midazolam	Benzodiazepine	IV, IM	5	IV: significant hypotension

EPS, extrapyramidal syndrome; IM, intramuscular; PO, per os; IV, intravenous.

- Second-generation antipsychotics are preferred given a lower incidence of EPS.
  - Risperidone, olanzapine, and ziprasidone are the most commonly used parenteral agents.
  - Risperidone and olanzapine have a rapidly dissolving oral formulation.
  - Ziprasidone can prolong the QT interval.
  - Mortality is increased when these drugs are used in patients with dementia.<sup>6</sup>
  - Quetiapine and aripiprazole can be used if the patient is not an immediate threat and is willing to take oral medication.
- Benzodiazepines can also be effective.
  - Lorazepam is widely used because of its variety of formulations. It is the most reliably absorbed IM benzodiazepine.
  - Midazolam has a rapid onset of action. When administered IV, significant hypotension can occur.<sup>1</sup>
  - A trial comparing midazolam, haloperidol, and lorazepam found similar effectiveness, but midazolam had the fastest onset (mean 18 minutes) and shortest time to arousal (mean 81.9 minutes).<sup>7</sup>
- Dexmedetomidine, a continuous IV alpha 2 agonist, can be used for ICU delirium and alcohol withdrawal symptoms.<sup>8,9</sup>

## ✕ Conclusion

Violent patients are a common challenge. Ensuring the safety of the patient and others is paramount (**Figure 2-1**).

### cAsE2-1 (continued)

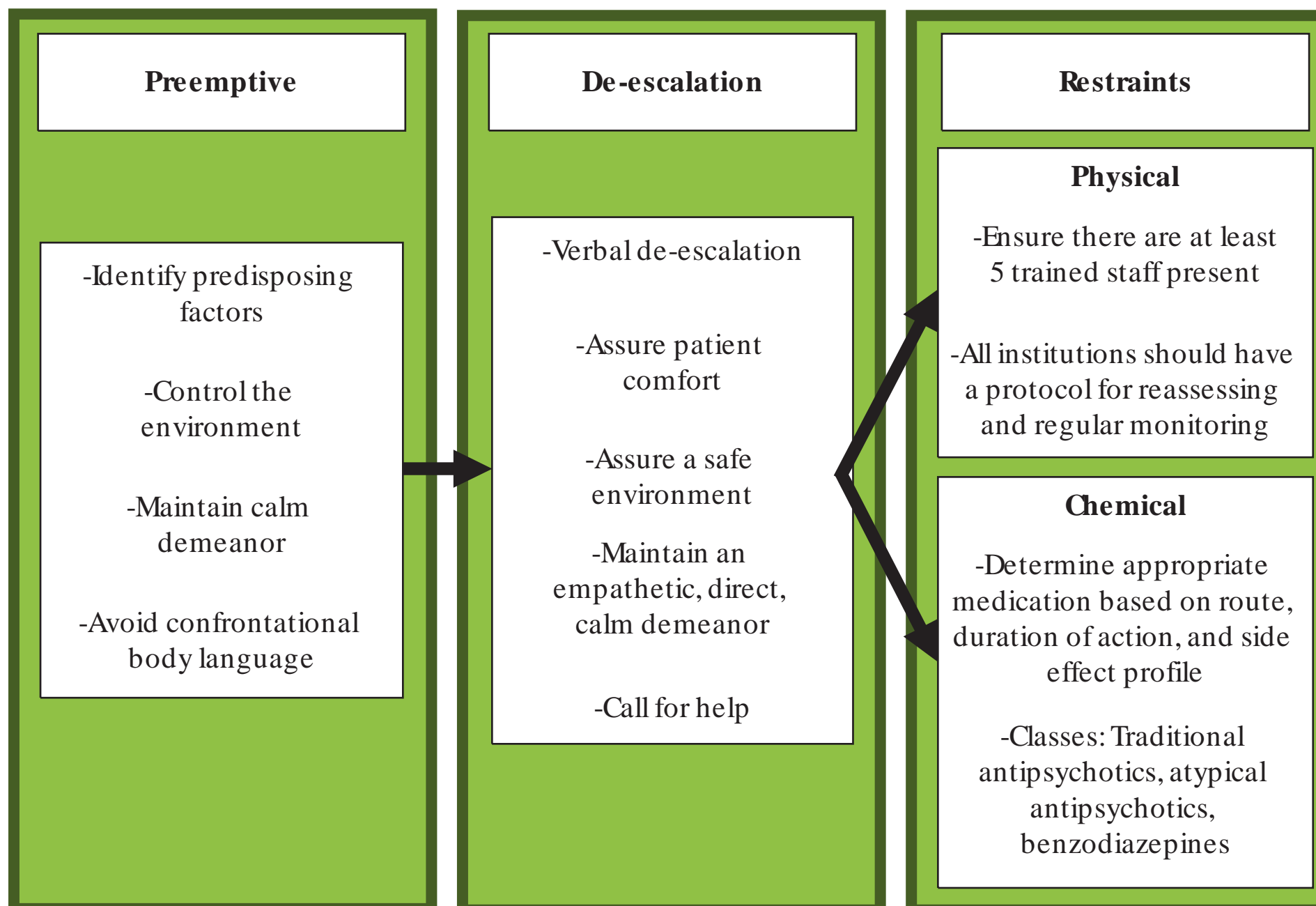
The patient above had an underlying psychiatric condition accompanied by an acute ischemic stroke, which resulted in aggression. His prolonged QT interval limited medication options. IV lorazepam was administered without effect. Security was called and he was physically restrained. He subsequently calmed down and was willing to start oral quetiapine, which helped him maintain a calmer demeanor, allowing discontinuation of physical restraints.

## PREVENTION OF TRANSMISSIBLE INFECTIONS

An 84-year-old man is admitted for acute ischemic stroke. During the admission fever, leukocytosis, and diarrhea develop. Stool is positive for *Clostridium difficile* toxin.

## ✕ What precautions can prevent nosocomial transmission of infections?

Transmission of infections by healthcare workers is not novel. In the mid-19th century, a lack of hand-washing



▲ **Figure 2-1** Algorithm for approaching a violent or threatening patient

after autopsies led to the spread of puerperal fever. Hand-cleansing with chlorinated lime reduced this risk.<sup>10</sup> The HIV epidemic in the 1980s led the Centers for Disease Control and Prevention to define universal precautions (UP), after recognizing that most patients with blood-borne pathogens are asymptomatic.<sup>11</sup> Definitions and guidelines have evolved over time.

- Standard precautions (SP), including the UP principles, and transmission-based precautions comprise the 2 tiers for preventing nosocomial infection<sup>12</sup> transmission.
- SP and body substance isolation (BSI) assume that all blood, body fluids, secretions, excretions (except sweat), nonintact skin, and mucous membranes contain transmissible pathogens. They apply to all patient-care in all settings (Table 2-3).<sup>11</sup>

### ✕ What is the role of hand hygiene?

- Hand hygiene is the most important factor for preventing nosocomial infection.
- Wash hands with soap and water or use alcohol-based solutions before and after entering and exiting patient rooms and before/after donning/doffing gloves.<sup>12</sup>

### ✕ Body fluid exposure and needlesticks

Needle-stick injuries are a risk for transmitting blood-borne infections. Despite advancements in education, disposal systems, and equipment engineering, needle sticks remain a common cause of occupational exposure to human immunodeficiency virus (HIV), hepatitis B virus (HBV), and hepatitis C virus (HCV). The risk depends upon the pathogen's prevalence in the patient population, nature of the exposure, and pre- and post-exposure prophylaxis.<sup>13</sup> Caution must be taken when handling needles and other sharp instruments (Table 2-3).

### ✕ What should be done after a needlestick injury?

- Wash the wound immediately with soap and water and report the injury per institutional policy.
- Post-exposure prophylaxis (PEP) should be considered and is recommended for HIV. The HIV status of the exposure source should be determined to guide the need for HIV PEP.<sup>14</sup> If positive, PEP should be started immediately. The HBV and HCV status of the exposure source should also be ascertained.<sup>13</sup>
- Healthcare workers should be immunized against HBV. PEP with the hepatitis B vaccine and/or immune globulin should be administered after suspected exposure, depending on the individual's HBV immunity.<sup>13</sup>
- There is no PEP for HCV. Early post-exposure testing is recommended.<sup>13</sup>

- Seroconversion risk after HIV exposure is 3 per 1000 without PEP. The infection risk is 23–62% after HBV exposure and 1.8% after HCV exposure.<sup>15</sup>

### ✕ Special precautions for patients with neurological disorders

#### Case 2-2

A 79-year-old woman presents with 2 months of increasing confusion. She has upper extremity jerking movements while sleeping. MRI shows bilateral basal ganglia hyperintensity. The differential diagnosis includes Creutzfeldt–Jakob disease, and a lumbar puncture is performed.

Prion disease occurs in sporadic, familial, and acquired forms. Sporadic Creutzfeldt–Jakob disease is the most common. The worldwide incidence is 1 per million. Transmission can occur during neurosurgical procedures, human cadaveric-derived hormone usage, dural and corneal homografts, and lumbar puncture. Prion disease is invariably fatal. Preventing nosocomial transmission to patients and health-care workers is vital. Although precautions are paramount when handling affected tissues, isolation is not indicated.<sup>16</sup>

### ✕ What precautions should be taken in confirmed or suspected prion disease?

- Social, clinical, and noninvasive procedural contact poses no risk. Infectivity is highest when exposed to central nervous system-related tissue.<sup>16</sup>
- Brain, spinal cord, and ocular tissue are highly infective.
- Cerebrospinal fluid (CSF), kidney, liver, lung, lymph nodes/spleen, and placenta have low infectivity.<sup>16</sup>
- Other tissues, secretions, and excretions are noninfectious.
- Cutaneous exposure to intact skin or mucous membranes poses negligible risk.
- Diagnostic procedures such as endoscopy, cardiac and pulmonary function tests, and vascular and urinary catheterization only require SP.<sup>16</sup>

Despite lack of confirmed occupational transmission, case reports suggest a relationship in health care workers. Physicians should be vigilant when performing lumbar puncture with precautions for disposal and decontamination of spillage.

- Although CSF has low infectivity, instruments and materials contacting CSF must be handled as those contacting highly infectious tissues.<sup>16</sup>
- Collection, transport, and analysis must not involve automated equipment.<sup>16</sup>
- Materials contacting CSF must be incinerated or decontaminated according to published standards.<sup>16</sup>