

FALLING SHORT:

Adverse Events Related to Patient Height

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Measuring a patient's height is a routine part of a healthcare encounter. But once completed, how often is this information used? For most of us who fall within 95% of the mean population height, this metric is rarely discussed, but what happens when it is overlooked? And what about those on the outer tails of the bell curve of population distribution?

Almost 1 million (909,222) adults in the United States are at least 6'4",^{1,2} more than the entire population of South Dakota (884,659).³ Conversely, an estimated 30,000 Americans have a form of dwarfism, typically defined as an adult height no taller than 4'10".^{4,5} See **Figure 1**. However, despite this prevalence, the healthcare system struggles to provide consistent, adequate care for patients with extreme heights.

"Being tall is not a disease, but it is a consideration," shared one 6'3" woman, who descended from a long line of "Scottish Vikings."* "I am one of the short ones at family reunions," she continued; her father tops 6'8". Experiences like hers prompted this investigation into the medical mishaps and trauma that have befallen those who are not "average-sized."

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One story detailed a man who had his hip replaced a few years ago, the operation for which proved to be the least of his worries. As part of her routine, his wife called ahead to request a “tall-person” bed. The nurse assured her one would be available. When he went to preop, she called up to the unit where he would spend the night and confirmed the bed would be ready.

Following a successful surgery, he was transported to his room. He did not need to climb into the bed to know that it was standard-sized and unable to accommodate his 6'6" frame. The nurse apologized for the oversight and began the surprisingly arduous process to locate a larger model. Not wanting to impose, and in need of rest, the man quietly crawled into the bed to get some sleep.

Twenty-one hours later and still no progress, the man and his new hip had spent

“
Being tall is not a disease, but it is a consideration.”

the night contorted and without much rest. His wife expressed frustration and disbelief at how difficult it was to find an adequate bed in Los Angeles. “The Lakers play here. We have tall people.”*

Another patient, an otherwise-healthy 6'4" tall woman in her 60s, found herself in

need of a knee replacement. Though her surgery went well, and she only needed to spend one night in the hospital, she was eager to leave. A nurse wheeled in a bedside commode and told her one of the requirements to go home was the ability to self-toilet. After a few unsuccessful attempts, the nurse reluctantly informed her she would need to go to a long-term care facility to recover. The woman explained that the standard commode was too short, even with the toilet seat riser, and requested a taller model. Several hours later, the nurse was able to locate a commode that adjusted to 25", well above the standard Americans with Disabilities Act-compliant 19". She was sent home where she enjoyed a full recovery.*

Hearing these stories prompted a look at Pennsylvania Patient Safety Reporting System (PA-PSRS)** data to see if there were similar events where an adverse

event was related to the patient's height. The following are examples of events in which the patient was too tall:

Operating room table was modified to fit patient who was 6'10" and 410 lbs. Used two bed extensions and small pole attached for stability. Hydraulics were very slow to function throughout procedure. Table was modified to fit height with questions of safety based on manufacturer specifications, but operating room manager told team to “continue and everything will be fine,” because operating room table can hold up to 1,000 lbs.

Patient was 6'5" and in need of a bed extender. Bed extender ordered, but none were available, so patient was put on a waiting list. Patient's wife at bedside reported that a bed extender was also ordered yesterday. Relayed information that one is not yet available to wife. Patient's legs are bent, and bottoms of feet are pressing against footboard, possibly contributing to skin breakdown.

The following are examples of event reports in which the patient was too short:

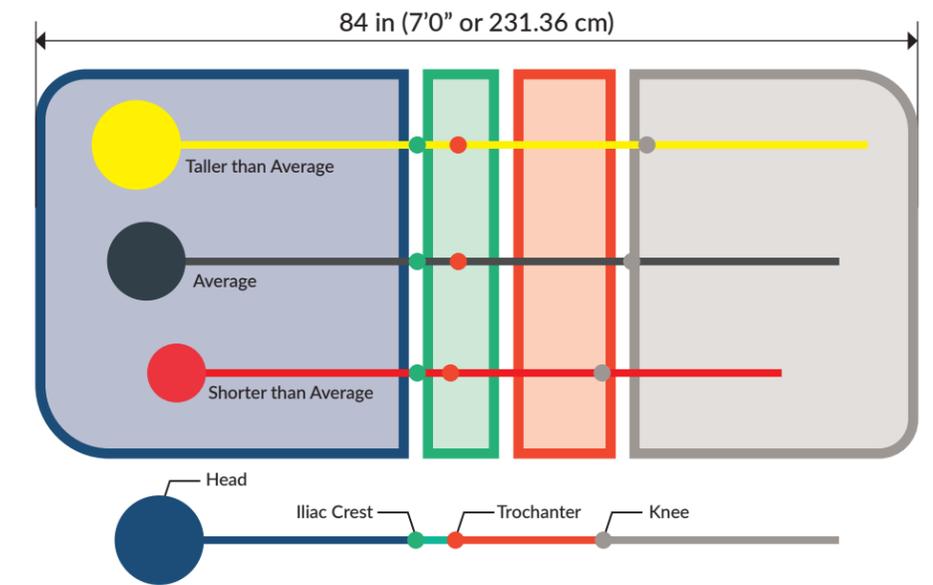
The patient, a 4'11" woman, was found on the floor in the middle of the night ringing her call bell. She was too short to climb in and out of her bed on her own and required assistance from the nursing staff several times during the day. She needed to use the restroom, and not wanting to impose upon them once again, she attempted to exit her bed by herself. Her legs slipped out from under her, causing her to fall and hit her head.

Patient was attempting to get into bed, she slid against nursing assistant and was lowered to the floor. Patient of short stature 4'11" and was too short for the bed height. Patient unable to stand independently while nursing assistant offered to get a step stool prior to getting into the bed.

Patient has been calling for assistance to get to and from bedside commode. Tonight, patient attempted to stand without assistance and fell. Patient denies injury and acknowledges that she knew she was supposed to wait but did not. Patient and nurse also report that the bedside commode is too tall for the patient. Nurse suggested shorter bedside commode. We found one on the unit that had adjustable height capability and replaced the current bedside commode.

This therapist transferred the patient from the wheelchair to the recliner upon the request

Figure 2. Hospital Bed Hinge Points



of the patient. The patient had a cushion in place on the recliner. Due to the patient's short stature and decreased strength, she was struggling to scoot herself back properly into the chair causing her to slide on the cushion rather than successfully lift her buttocks to adjust herself back in the chair. Due to her sliding on the cushion, the cushion folded under her. Patient was wearing shorts. While the patient did not experience skin injury from event, the potential was there. The cushion makes an already high surface higher for patients who are small in stature and/or those who have impaired mobility.

Even when the necessity of height-related precautions is recognized, adverse events can still occur.

A patient, 6'6", was admitted and given an order for a bed extender. He was weak from chemotherapy, and rather than forcing him to stand, his nurse decided to weigh him with a scale that connected to his hospital bed. Unfortunately, when she went to tare the weight of the equipment, she forgot to zero out the additional weight of the extender. The patient's weight was recorded as being an additional 12 kg heavier than he was. Thankfully, the error was caught by a pharmacist who was reviewing his order for a weight-based medication. Without this intervention, the patient would have received an incorrect dosage of a critical therapeutic.

Patient Height and Hospital Equipment

Many factors are considered when designing hospital equipment, such as functionality, durability, and cost. Common practice for designing medical equipment generally accommodates up to 95% of the population, while potentially excluding the most extreme variances in human attributes.⁶ In the United States, the fifth percentile female and 95th percentile male heights are 59 inches (4'11") and 74 inches (6'2"), respectively.⁷

Inpatient Beds

Specialized beds are available to increase comfort and range of motion for taller patients, and there are options to modify typical beds, such as bed extenders that can be added to the base or longer mattresses.

However, both extenders and longer mattresses are an added expense, so facilities may keep a limited stock on hand, if at all. The ability to monitor this inventory in real time, such as through radio-frequency identification (RFID) technology, also requires additional resources. More financially challenged hospitals may then be forced to track the bed's location manually. Consider the difficulty of trying to find

Figure 1. Cumulative Percent Distribution of Population by Height and Sex: 2007 to 2008

Men						Height	Women					
20-29	30-39	40-49	50-59	60-69	70-79		20-29	30-39	40-49	50-59	60-69	70-79
-	-	-	-	-	-	4'10"	-	1.7*	-	1*	-	3.3*
-	-	-	-	-	-	4'11"	2.6*	3.1	1.6*	2.1	3.6*	8.7
-	-	-	-	-	-	5'	5.7	6.0	5.0	8.0	9.0	16.0
-	-	-	-	0.4*	-	5'1"	12.3	11.6	10.8	16.7	14.7	26.0
-	-	-	-	-	-	5'2"	20.8	19.7	19.8	23.3	23.4	36.9
-	3.1*	1.9*	-	2.3*	-	5'3"	30.4	31.3	30.8	36.3	38.4	51.9
3.7	4.4*	3.8	4.3*	4.4	5.8	5'4"	43.5	46.6	46.0	50.7	52.8	69.9
7.2	6.7	5.6	7.6	7.8	12.8	5'5"	54.1	61.2	58.0	68.4	66.6	82.8
11.6	13.1	9.8	12.2	14.7	23.0	5'6"	72.4	74.0	72.2	79.7	83.3	89.3
20.6	19.6	19.4	18.6	23.7	35.1	5'7"	82.3	84.9	83.0	88.4	93.3	95.4
33.1	32.2	30.3	30.3	37.7	47.7	5'8"	90.3	91.8	91.2	95.2	97.0	98.4
42.2	45.4	40.4	41.2	50.2	60.3	5'9"	94.1	96.1	94.7	97.3	97.8	99.6
58.6	58.1	54.4	54.3	65.2	75.2	5'10"	97.6	98.9	97.8	98.9	99.6	99.6
70.7	69.4	69.6	70.0	75.0	85.8	5'11"	99.6	98.9	99.4	100.0	99.8	100.0
79.9	78.5	79.1	81.2	84.3	91.0	6'	100.0	99.4	99.5	100.0	99.9	100.0
89.0	89.0	87.4	91.6	93.6	94.9	6'1"	100.0	99.9	99.5	100.0	99.9	100.0
94.1	94.0	92.5	93.7	97.8	98.6	6'2"	100.0	100.0	99.5	100.0	100.0	100.0
98.3	95.8	97.7	96.6	99.9	100.0	6'3"	100.0	100.0	99.5	100.0	100.0	100.0
100.0	97.6	99.0	99.5	100.0	100.0	6'4"	100.0	100.0	99.5	100.0	100.0	100.0
100.0	99.4	99.4	99.6	100.0	100.0	6'5"	100.0	100.0	100.0	100.0	100.0	100.0
100.0	99.5	99.9	100.0	100.0	100.0	6'6"	100.0	100.0	100.0	100.0	100.0	100.0

Each cell represents the cumulative % of people at a given height by age. For instance, 51.9% of women aged 70-79 are 5'3" or shorter. 69.9% of women in that age range are 5'4" or shorter.

Note: “-” Represents zero or figure too small to meet statistical standards of reliability of a derived figure. Values with an asterisk do not meet standard for reliability or precision. Source: U.S. National Center for Health Statistics, unpublished data, <<http://www.cdc.gov/nchs/nhanes.htm>>.

*Anonymous patient interview

**PA-PSRS is a secure, web-based system through which Pennsylvania hospitals, ambulatory surgical facilities, abortion facilities, and birthing centers submit reports of patient safety-related incidents and serious events in accordance with mandatory reporting laws outlined in the Medical Care Availability and Reduction of Error (MCARE) Act (Act 13 of 2002).¹⁶ All reports submitted through PA-PSRS are confidential and no information about individual facilities or providers is made public.

Points to consider:



Measure height and weight in metric units for each patient at every healthcare encounter.^{12,13}



Confirm the patient's measurements before prescribing any medication that is based on height and/or weight.^{12,13}



Consider patient height regarding staffing.¹⁴

- When possible, assign taller staff to assist taller patients
- Teach staff how to safely handle taller or shorter patients to prevent a fall
- Use ambulation equipment such as fall arrest vests or pants



Implement protocols to source specialized equipment when extremely short or tall patients visit the facility. Ensure all hospital equipment is appropriately sized for this patient and available when needed, including but not limited to:

- Bed
- Stretcher
- Wheelchair
- Bedside commode or toilet
- Mobile lift and slings
- Shower (or a reasonable alternative)
- Blood pressure cuffs
- Imaging equipment¹⁴



Test compatibility of specialized equipment with other devices (e.g., each model of bed is tested to confirm the use of bed extenders will not inadvertently shut off the bed alarm).



Confirm equipment or supplies required postdischarge are available, e.g., custom compression socks when standard sizes will not fit.



Complete thorough skin checks, including "height-related hot spots," e.g., the bottom of the patient's foot rubbing against the footboard.¹⁵

one "tall-person" bed from an inventory of 500. And then consider the implications if that bed had been previously assigned to another patient, because it was the only one available.

Another important consideration for comfort while lying in a hospital bed is frame articulation, or where the hinge points occur (Figure 2). If the hinge points of the bed are misaligned with the body, the patient may experience discomfort or slide down in bed.⁸ Although patients may technically fit within the bed, the movement of their body segments may not match the movements of the bedframe.⁸

Imaging Equipment

Patient size is a frequent concern with imaging studies, though these conversations typically involve weight limits, girth, or body mass index (BMI). However, the patient's height is an equally important consideration. The consequences of being unable to accommodate taller patients include prolonged exposure to radiation; delays of care; and the removal of metal dental fillings when patients are placed in direct, or near direct, contact with magnets due to their size.⁹ Some newer models of imaging equipment no longer indicate height restrictions.⁹

Safe Patient Handling and Mobility (SPHM)

SPHM equipment is used to reposition dependent patients in bed, transfer patients, hold limbs, and ambulate patients who are regaining their ability to walk. The slings used to lift and mobilize patients come in many sizes, but hospital units often only stock those that are most used. To accommodate patients who are significantly taller or shorter than average, hospitals should have the larger and smaller sizes available, possibly even consider pediatric sizes for the shortest adult patients. Higher capacity lifts and slings may also be needed for heavier patients.¹⁰ When using mobile lifts to ambulate patients, the arm is adjustable based on patient height; however, like hospital beds, the lifts may also have a maximum height capacity causing insufficient head clearance for the tallest patients.¹¹ Facilities may respond by padding the sling bar to protect the head of very tall patients and should consider installing ceiling lifts for ambulation which provide more vertical clearance for the tallest patients.

For Consideration

It is imperative for healthcare facilities to accurately capture patient height during every healthcare encounter. Patient height should be a factor when developing a plan of care, and hospitals may consider creating a checklist for treating those who are taller or shorter than average—just as they would for a patient who is a fall risk or has diabetes.

This checklist should include a process to ensure patients are measured accurately upon admission to determine whether specialized equipment, e.g., a bed extender, is required. Facilities should also consider a procedure to obtain height-related equipment quickly, e.g., locating and installing bed extenders when an extremely tall patient arrives without notice. Extreme patient height should also be considered by relevant clinical groups such as SPHM or patient safety teams, and in safety meetings such as fall prevention huddles.

A height-related protocol should include safeguards to prevent harm caused by height-related equipment whenever they are in use, for example, explicit guidelines to tare the weight of the bed and bed extenders when weighing a patient in bed. Failure to do so may be difficult to identify because of the relatively small, but critical, discrepancy.

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