Impact of Immobility in Older Adults:
Use it or Lose it

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Keeping Residents Mobile

Mobility – the ability to efficiently navigate and function in a variety of environments, requires balance, agility and flexibility.

Clinical Foundation

Why?
• Humans are Meant to be Upright & Mobile

Optimal Body Function –
Upright for 16 hours/day

• Immobility, potential root cause of the following:
  • Falls
  • Skin Breakdown
  • Incontinence & UTIs
  • Development of diseases – Diabetes, Cardiac, etc.
  • Weight loss – muscle wasting
  • Depression
  • Delirium/confusion
  • Respiratory Infections
  • Constipation
  • Staff injuries

• Impact of immobility
  • Falls
    • Strength, Balance and Endurance issue
  • How big is the problem?
    • In 2013, the direct medical costs of older adult falls, adjusted for inflation, were $34 billion.
    • One in three adults aged 65 and older falls each year. Of those who fall, 20% to 30% suffer moderate to severe injuries that make it hard for them to get around or live independently, and increase their risk of early death.
    • Older adults are hospitalized for fall-related injuries five times more often than they are for injuries from other causes.
    • Annually, emergency departments treat about 2.5 million nonfatal fall injuries among older adults; more than 30%, or about 734,000 of these patients have to be hospitalized.
• **Impact of immobility**

  **Falls in the Nursing Home**
  - About 1,800 people living in nursing homes die from falls each year
  - About 10-20% of nursing home falls cause serious injuries
  - Each year, a typical nursing home with 100 beds reports 100 to 200 falls, however many go unreported
  - Between 1% to 3% of nursing home residents fall each year. That is twice the rate of falls among older adults living in the community
  - Residents often fall more than once. The average is 2.6 falls per person per year
  - About 35% of fall injuries occur among residents who cannot walk – 65% are ambulatory

  **The most common causes of nursing falls**
  - Muscle weakness and walking or gait problems are the most common causes of falls among nursing home residents.
  - These problems account for about 24% of the falls in the nursing home
  - Environmental hazards in the nursing homes cause 16 – 27% of the falls
  - Medication can increase the risk of falls.
    - Drugs that affect the central nervous system, such as sedative and anti-anxiety drugs are of particular concern.
    - Fall risk is significantly elevated during the 3 days following any changes in these types of medications
  - Other causes
    - Difficulty moving from one place to another (bed to chair)
    - Poor foot care
    - Poorly fitting shoes
    - Improper or incorrect use of walking aids

• **Impact of immobility**

  **Pressure Ulcers**
  - 11 billion annually in caring for pressure ulcers
  - Increase in morbidity and mortality
  - Increase in hospital length of stay (by five fold)
  - Increase in hospital readmission rates
  - Increase in hospital charges

  **NPUAP (2014) Statement:**
  "A number of contributing or confounding factors are also associated with pressure ulcers; the primary of which is impaired mobility"
• Impact of immobility
  • Non-Fatal Work Place Injuries (thousands)
    • Healthcare 589.7
    • Manufacturing 434.0
  • Days Away From Work (thousands)
    • Healthcare 167.2
    • Retail Trade 128.0
    • Manufacturing 120.1
  • More than 50% of these injuries were musculoskeletal

• The Causes of Immobility
  • Fractures
    • 95% from falling, most often by falling sideways
    • 1 out of 5 hip fracture patients dies within a year of their injury
  • Stroke
  • Obesity
  • Paraplegia & quadriplegia
  • Multiple sclerosis
  • Depression
  • Cognitive impairment
    • Alzheimer’s
    • Dementia
    • Parkinson

• The 2013 Survey of Occupational Injuries and Illnesses

• More than 50% of these injuries were musculoskeletal
• The Causes of Immobility
  • Cardiac disease
  • Vertigo
  • Weakness
  • Medications
  • Respiratory disease
  • Amputation

• The Causes of Immobility
  • Visual Impairments
  • Gait deficit
  • Balance deficit
  • Arthritis
  • Peripheral neuropathy
  • Arterial and/or venous insufficiency of lower extremities
  • History of falls and/or fear of falling

• The Causes of Immobility
  • Staff
    • Residents moving too slow or taking too long
    • Restricting them from moving on their own
• The Aging Process Impact on Mobility

• **Sarcopenia**
  - The loss of muscle mass with age
  - Each decade the aging adult has 5lbs less muscle and about 15 pounds more fat
  - Resulting in a 20lbs change in physical status and appearance

• The Aging Process Impact on Mobility

• The primary cause of the loss of muscle mass

**DISUSE**

• The Aging Process Impact on Mobility

• Dieting alone without exercise does not have high success rates
  - 25% percent of weight lost during low calorie diets without exercise is actually lost muscle tissue
  - Less muscle leads to slower metabolism
    - Reduced muscle tissue is largely responsible for a 2 – 5% per-decade decrease in our resting metabolism
    - Slower resting metabolism leads to calories previously used by muscle are routed into fat storage
• **The Aging Process Impact on Mobility**
  
  • All adults should perform regular endurance exercise such as walking and cycling to enhance cardiovascular function. However
  
  • Aerobic activities do little to prevent gradual deterioration of the musculoskeletal system
  
  • One study of elite middle-aged runners, the subjects lost about 5lbs of muscle over a 10 year period in spite of extensive aerobic training.

• **The Effects of Immobility**

**The Solution – Strength Training**

• Systemic strength training – use of resistance
  
  • Adding muscle
  
  • Losing fat
  
  • Raising resting metabolic rate
  
  • Increase daily expenditure
  
  • Increase bone density
  
  • Enhance glucose metabolism
  
  • Increase gastrointestinal transit
  
  • Lower resting blood pressure and pulse
  
  • Decrease in depression

• **The Effects of Immobility**

• Loss of Independence & Psychosocial effects
• The Effects of Immobility – Muscles
  • There is a 12% rate of loss of muscle strength and muscle atrophy (wasting away) in one week
  • In as little as 3-5 weeks of immobility, almost half the normal strength of a muscle is lost


• The Effects of Immobility – Muscles
  • First muscles to become weak are in the lower limbs
  • Keeping a muscle in a contracted position will significantly increase atrophy
  • In stroke paralysis or immobility due to splinting, muscles atrophy around 30-40%


• The Effects of Immobility – Muscles
  • It takes 4 weeks to recover from atrophy with exercise
  • Totally degenerated muscles are permanently replaced by fat and connective tissue
  • Disuse of the muscle will also effect the neuromuscular function – essentially the body forgets how to properly coordinate motor function

The Effects of Immobility – Muscles
- Complete rest will decrease endurance levels
- Causing fatigue, affecting motivation
- Then leading to a cycle of greater inactivity

The Effects of Immobility – Connective Tissue
- Connective tissue consists of:
  - Tendons
  - Ligaments
  - Articular cartilage (covers joints)
- In 4-6 days after immobility changes in the structure and function of connective tissue become apparent
- These changes remain even after normal activity has been resumed!!

The Effects of Immobility – Contractures
- Contracture:
  A decrease from the normal range in parts of the body responsible for motion (joints, ligaments, tendons and related muscles)
- In 2-3 weeks of immobilization a firm contracture can develop
- After 2-3 months of immobility, surgical correction may be needed.
• The Effects of Immobility – Bone
  • Disuse osteoporosis
  • Bones most susceptible:
    • Vertebra
    • Long bones of the legs
    • Heels
    • Wrists

• The Effects of Immobility – Bone
  • Within 3 weeks of immobilization calcium clearance is 4-6 times higher than normal and hypocalcaemia can occur. This can lead to:
    • Formation of calcium-containing kidney stones
    • Anorexia
    • Nausea
    • Vomiting

• The Effects of Immobility – Skin
  • Normally we continually shift our weight, even during sleep
  • Immobility or decreased sensation prevents shifting in weight leading to prolonged pressure on skin capillaries, ultimately resulting in death of skin tissue
  • Formation of pressure ulcers
• The Effects of Immobility – Skin
  • The ONLY area of the body designed to bear weight are the soles of the feet
  • Immobility leads to large surface areas of the skin bearing weight
  • Areas where skin is stretched tautly over bony prominences are at the highest risk for breakdown


• The Effects of Immobility – Skin
  • Repositioning a totally dependent resident can cause additional forces of shear and friction
  • Skin laying next to the bed sheets can cause moisture and lead to moisture related skin conditions


• The Effects of Immobility – Cardiac System
  • When an individual is confined to bed, there is a shift of fluids away from the legs towards the abdomen, thorax and head.
  • In as little as 24 hours, a shift of 1 liter of fluid from the legs to the chest
  • Increases venous return to the heart and elevated intracardial pressure
• The Effects of Immobility – Cardiac System
  • Increases in blood volume and venous return stretch the right atrium in the heart
    • Stimulates the release of atrial natriuretic peptide (ANP) a powerful diuretic
      • Increase in urine output
      • Decreases in blood volume
  • Leads to dehydration

• The Effects of Immobility – Cardiac System
  • Immobility leads to atrophy and loss of muscle mass in the legs
  • This impairs the muscle pump action which reduces venous return
  • Lower extremity edema
    • Ulceration
    • Venous dermatitis
    • Cellulitis

• The Effects of Immobility – Cardiac System
  • The heart is a muscle and too needs activity to stay healthy
  • Immobility can lead to atrophy of the heart muscle
• The Effects of Immobility – Cardiac System
  • Postural hypotension (drop in blood pressure upon standing) can be noted in little as 20 hours of immobility
  • This can lead to dizziness, anxiety and falls
  • Postural hypotension, even in fit, healthy adults can take several weeks to fully recover once they start moving

• The Effects of Immobility – Respiratory System
  • Development of fixed contractures of the costovertebral joints, leading to inability to expand the lungs
  • Risk of lung collapsing
  • Pooling of mucus in the lower airways
  • Increased risk of respiratory infections
  • Stroke patients confined to bed for 13 days or more are 2-3 times more likely to develop a respiratory infection then mobile people

• The Effects of Immobility – Hematological
  • Decrease in oxygen saturation
  • Increase in carbon dioxide concentrations
  • Leads to Hypoxia
    • Acute confusion
    • Can develop quickly over a number of hours
    • Symptoms can fluctuate during the day and worsen at night
• The Effects of Immobility – Hematological
  • 13% of patients in bed for long periods may develop deep vein thrombosis (DVT)
  • Increases risk for emboli
    • In the lungs – pulmonary embolism
    • Cerebral circulation within the brain – Stroke
    • Coronary circulation of the heart – myocardial infarction

• The Effects of Immobility – Gastrointestinal
  • Reduced sense of taste, smell and loss of appetite
  • Difficulty swallowing
  • Constipation
  • Fecal impaction

• The Effects of Immobility – Endocrine System
  • Decrease in metabolic rate
    • In as little as 10 hours
  • Insulin resistance, impaired glucose tolerance and the subsequent development of type 2 diabetes
• The Effects of Immobility – Renal System
  • Kidney stones
  • Urinary retention (overflow)
  • Urinary tract infection
  • Urosepsis

• The Effects of Immobility – Nervous System
  • Sensory deprivation
  • Depression
  • Disorientation
  • Confusion
  • Restlessness
  • Agitation/aggression
  • Anxiety
  • Reduced pain threshold
  • Difficulty problem solving
  • Loss of motivation

• The Effects of Immobility – Nervous System
  • Insomnia
  • For normal function we need:
    • 16 hours of activity
    • 7-8 hours of sleep
  • Consistently sleeping for more then 9 hours or fewer than eight hours has a negative impact on physiological, psychological and cognitive functions
So,

How Do We Sleep?

How Do We Wake?

Etiology of sleep and wake . . .

Circadian Rhythms: are the body’s internal time keepers

Circadian rhythms;

• An inborn, internal, 24-hour cycle of change that affects the body’s electrical, hormonal, muscular, and circulatory systems

• cause internal reactions in an organism (human, animal, plant, bacteria) to the length of day and the length of night by waking up and falling asleep in response to light and darkness

• set clear patterns of body temperatures, brain wave activity, hormone production, cell regeneration immune functions, digestive activities healing, growth, emotional reactions and other biological activities.

Human Biological Clock: Ideal 24 Hours
The human body has evolved to function optimally in the upright position for about 16 hours a day. Average adult sleeps 7 to 8 hours a day, usually in a supine position.

Consistently sleeping for more than 9 hours or fewer than 8 hours a day has a negative impact on physiological, psychological and cognitive functions. (Van Dongen et al, 2003)

| Dehydration, increased anxiety, confusion and depression, impaired memory function |
|----------------------------------|---------------------|
| Progressive cardiac de-conditioning, postural hypotension | Progressive slowing down of metabolic rate, reduction in insulin sensitivity |
| Urinary retention, increased susceptibility to respiratory infection | Gastric reflux and constipation |
| Venous stasis and blood vessel damage | Reduced lung function, increased susceptibility to respiratory infections |
| Osteoporosis | Loss of muscle strength and endurance |

**Sleep Requirements: Signs & Symptoms of Sleep Deprivation**

- Adult humans require an average of 7 – 8 hours of uninterrupted sleep each night
- When this requirement is not met, all or some of the following symptoms can appear:
  - Excessive tiredness during the day
  - Decreased alertness
  - Memory loss
  - Disorganized thinking
  - Problems with processing things that you see and/or hear
  - Increased irritability
  - Loss of emotional control, e.g. anger management
  - Increased behavioral expressions of discontent – loss of social appropriateness

**Inappropriate Use of Antipsychotics: Treating Sleep Deprivation – Not Psychosis**

- Using antipsychotics to treat the incorrectly identified symptoms of psychosis, when actually it was sleep deprivation:
  - Disorganized thinking
  - Problems with processing things that you see and/or hear
  - Increased irritability
  - Loss of emotional control, e.g. anger management
  - Increased behavioral expressions of discontent – loss of social appropriateness
Sleep: Cycles & Stages

- In humans, an average 7 – 8 hour night’s sleep should contain 4 – 5 sleep cycles.
- Each cycle should last 90 to 120 minutes.
- Each cycle has 3 Non-REM stages and 1 REM stage of sleep.
- Each stage provides distinct physiological benefits for the body.

Sleep: Stage 1

- Stage N1 lasts 5-15 minutes. N1 is the transition stage of the brain from fast active brain waves (as in the awake state) to slower brain waves.
- Muscles begin to relax and lose tonicity sometimes sudden twitches and jerking may occur.
- Eyes move more slowly, the heart begins to slow down, breathing becomes deeper and slower.
- The person is still easily aroused and easily reacts to environmental noise.

Sleep: Stage 2

- Stage N2 occupies 45–55% of total sleep for adults.
- Muscular activity decreases more, eye activity stops or rarely moves, heart rate significantly slows and conscious awareness of the external environment disappears.
- Brain waves continue to slow down.
- The person is not as easily aroused from this level of sleep and usually only reacts to loud or selected noises in the environment.
- This stage has brief image dreams that the brain works to: save, file, trash.
Sleep: Stage 3

- Stage N3 is deep sleep or slow-wave sleep. The brain is completely at rest. All eye movement and muscle activity ceases.
- Stage N3 is where the greatest amount of skin, deep tissue and overall healing and regeneration of the human body occurs.
- The greatest amount of healing occurs at this stage due to the greatest formation of white blood cells, T4 cells, red blood cell re-oxygenation and cellular repair and regeneration.
- It is very difficult to wake someone from this deep sleep stage.

REM sleep: (Dreaming)
Rapid eye movement sleep

- Rapid eye movement sleep, or REM sleep, accounts for 20–25% of total sleep time in most human adults.
- Respirations become very rapid, irregular and shallow. The heart rate increases and the blood pressure rises.
- REM sleep includes rapid eye movements as well as a very rapid brain wave activity similar to being awake.
- This stage is associated with healing the emotional and psychological health of the body. Episodic dreams and long stories, relieve stress, process emotions, detox our feelings of: fear, anger, happy and sad. It also cements memories.
- Muscular paralysis occurs to protect organisms from self-damage through physically acting out the often vivid dreams that can occur during this stage.

← One night of 7 – 8 hours of sleep →
The elderly adult: ← One night of 9 – 11 hours of sleep →

Biochemical & Hormonal Properties of the Sleep/Wake Cycle

Melatonin = hormone

Serotonin = biochemical

Melatonin

- Melatonin is a hormone. It is secreted by the pineal endocrine gland in the brain. Its shape is a tiny pine cone.
- The pineal gland receives electrical messages to secrete melatonin which then sends information about the lighting levels to other parts of the body to either induce sleep (more melatonin) or to wake up (less melatonin).
- Melatonin is triggered by darkness.
  - > Darkness = more melatonin produced; heart rate slows, body temperature drops, eyes stop moving, brain waves slow, blood pressure lowers, peristalsis relaxes, muscles relax, etc.
  - > Lighter = less melatonin produced; reversal occurs
- Some foods contain small amounts of Melatonin.
Serotonin

• Serotonin is the “happy, feel good” biochemical.

• Approximately 90% of the human body’s total serotonin is located in the gastrointestinal tract, where it regulates intestinal movements and digestion.

• The remaining 10% is stored in the brain where it regulates mood and provides a sense of well-being and happiness.

• It also helps to regulate appetite, wakefulness, sleep, and the cognitive functions of memory and learning.

• Serotonin is also a growth factor for some cells, which gives it a role in healing, especially wound and skin healing.

• Serotonin is triggered by the presence of bright light. More light = more serotonin produced. Less light = less serotonin produced.

How does the body sleep & wake?

Light & Color:

But it’s not just the brightness or intensity of light that affects sleep and wake, it’s also the color of the light!
Light & Color:

We perceive color depending upon the speed and wavelength of each color. Our eyes are sensitive to the color of light in a very small region of the electromagnetic spectrum.

Violet light has a shorter, more rapid wavelength than the longer, slower wavelength of red light.

The visible colors from longest to shortest wavelengths are: red → orange → yellow → green → blue → violet → violet →...
Research indicates that slower wave length light (red, amber, yellow) creates a gentle, gradual lowering of the central nervous system activity and a lowering of brain wave activity.

Red, amber, yellow light would be more effective in a bedroom or a similar environment where it is desirable to lower physiological and mental activity.

The popular treatments for sleep disorders today focuses on “blue light in the morning.”

Research consensus includes “avoiding blue light within two hours of sleep.”

Researchers agree that the more rapid wave length of blue light can delay the onset of sleep because it suppresses the production of melatonin, increases cardiac output, increases all vital signs and increases brain wave activity.
Human Body is like a Rechargeable Battery

Manufacturers’ recommendation on rechargeable battery:
“To extend the life of the battery: fully exhaust or run down the battery prior to recharging."

- When we sleep we recharge our cells, but we need to run down the cells during the day, to get the best charge at night.
- The more physically active we are during the day, the better we sleep at night.

Empira

Empira is a collaborative and cooperative effort of 27 Skilled Nursing Facilities and over 40 Assisted Living providers in Minnesota working together to integrate clinical excellence and best practices across the care continuum. These member organizations are striving to enhance the older adults’ quality of care and quality of life while empowering staff to continuously improve the services provided.

www.empire.org

Background & Process

- Empira awarded 3-year MN DHS PIPP grant, began 10/1/11 – Restorative Sleep Vitality Program (RSVP)
  - A project implementing best practices from evidence based studies from sleep medicine and sleep research clinics and centers
  - Reduce baseline average for 5 CMS QI/QMs & Vital Research QOL
- 23 SNFs, 4 companies participate in PIPP, RSVP project
- RSVP Leader assigned to each SNF, reports to administrator who oversees the program – it’s not a nursing program!
- Project completion date: 10/1/14
**Restorative Sleep Vitality Program: Goals**

**Undisturbed sleep at night**

![Image of a sleeping puppy]

**Fully engaged, awake during the day**

![Image of two dogs playing on the beach]

**NAPS**

- **Naps rob the sleep bank**
  - Not more than one 30 – 40 minute, daytime nap
- **Instead:**
  - Consolidate the sleep experience so residents sleeps undisturbed at night and are awake and engaged during the day

![Image of a monkey sitting on a branch]
**Disturbances of Sleep:**
What disturbs sleep the most?

*Do not Disturb!*
Top Disturbances to Sleep

1. Noise
2. Light
3. Sleeping Environment: surface, temp, bedding, aroma
4. Napping
5. Medications
6. Continence Needs
7. Pain
8. Positioning
9. Inactivity/activity
10. Diet

Circadian Rhythm

Harvard Sleep Study, Harvard Medical School, 2011

• Promoting of sleep hygiene
  • Appropriate lighting (amber tones at night)
  • No Noise
  • Appropriate bed surface to prevent pressure ulcers
  • Heel floating or heel lift devices
  • Appropriate overnight incontinence products
  • Adjusting medications administration times
  • Diet and liquids – type and timing
  • Allowing at least 4 hours or more of sleep

Did the Restorative Sleep Vitality Program help to reduce falls even more?

WHO WOKE ME UP????
IMPLEMENTING SLEEP STRATEGIES RESULTS:
NO FALLS AT NIGHT AND REDUCED FALLS DURING DAY

65 bed SNF

December 2012
17 falls

December 2013
9 falls

102 bed SNF

25 falls

Oct. 2013
13 falls

Empira Program Information

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• Overall End Goal
  • Keep residents active during the day
  • Promote sleep at night

— Mahatma Gandhi
“How to initiate change.”

“First they ignore you,
Then they laugh at you,
Then they attack you,
Then you win.”

References
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  • CDC Hip Fractures Among Older Adults: Downloaded 7/14/2015 from: http://www.cdc.gov/homeandrecreationalsafety/falls/adulthipfx.html
References


Thanks for your participation!!!

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