Profile of individuals who use wheelchairs as either their primary or secondary means of mobility. Some use 2 wheelchairs a manual inside and power outside.
Wheelchair importance and production (Kirby et al., 2002; Dudgeon, 2000)

Competitive half-billion dollar field (Russell et al., 1997)

Chronic conditions are currently responsible for 60% of the global disease burden—WHO. Chronic Care Team, *Innovative Care for Chronic Conditions*, WHO, 2002

Fortunately, advances in biomedical and behavioral management have increased the ability to effectively prevent and/or control chronic conditions; complications of chronic conditions (secondary conditions) can also be prevented. In fact, growing evidence from around the world suggests that persons with chronic conditions improve when they receive effective treatments, regular follow-up, and self-management support in their living and working environments.
SB has a prevalence of over 70,000 and an incidence of 7 out of every 10,000 live births in the U.S.

Chronic conditions are currently responsible for 60% of the global disease burden. Fortunately, advances in biomedical and behavioral management have increased the ability to effectively prevent and/or control chronic conditions; complications of chronic conditions (secondary conditions) can also be prevented. In fact, growing evidence from around the world suggests that persons with chronic conditions improve when they receive effective treatments, regular follow-up, and self-management support in their living and working environments.
Tissue Integrity Management (TIM) Principles

1. Optimize health status
2. Screen for risks to tissue integrity
3. Treat the underlying conditions/risks
4. Optimize wound care when wounding occurs
5. Prevent loss of function and disability
6. Address patient and family concerns

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1. Optimize health status
   - Nutritional support or weight loss
   - Adequate hydration
   - Smoking cessation
   - Moderate alcohol intake
   - Stress management
   - Exercise
   - Hygiene & skin care
   - Optimal control of co-morbid diseases
   - Glycemic control

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VA PRAT Grand Rounds, June 14, 2010
Peripheral Arterial Insufficiency: Signs and Symptoms

There are distinct characteristics of peripheral artery disease that enable the clinician to distinguish arterial ulcers from other etiologies.

The clinical presentation of arterial disease is the result of a decrease in delivery of oxygen to the tissues.

These include:

- Impaired Circulation evidenced by: decreased pulses, temperature changes, delayed capillary and venous filling times, pallor on elevation, and dependent rubor.

Due to decrease perfusion the inflow of blood to the lower extremity is influenced/enhanced with gravity. When the leg is elevated the influence of gravity is removed and results in a decrease delivery of blood thus pallor develops.

Additionally, when the capillaries dilate in a compensatory attempt to increase the delivery of blood resulting there is a
The third sign is Ischemic Skin Changes which account for atrophy of subcutaneous tissue, shiny, taut epidermis, thickened toe nails and hair loss. Each of these can be attributed in part to a decrease in delivery and availability of oxygen to the tissue.

Additional examples:
Note the lack of hair growth and classic punched out appearance of the ulcer on the right.

The ankle-brachial index is a bedside test that can be performed to provide an approximate value for the adequacy of arterial perfusion. It compares the ankle blood pressure to the brachial blood pressure.
Chronic Edema/Lymphoedema
High pressure alone is not sufficient to cause tissue injury.

Tissues can withstand higher loads for only short periods of time.

Effects depend on Magnitude, Duration (including number of times applied & rate of application) and Direction of stress either perpendicular or parallel (shear stress).

Pressure Gradient: change in pressure over a distance. If pressure across a surface is plotted on a graph, the slope of the curve is the pressure gradient= change in pressure over square cm or inches. Several investigators hypothesize that interstitial fluid flow caused by pressure gradients is the primary factor in development of pressure.

Biomechanical properties linked to physiological and biochemical responses may be predictive of tissue loading tolerance.
Pressure Gradient: change in pressure over a distance. If pressure across a surface is plotted on a graph, the slope of the curve is the pressure gradient = Change in pressure over square cm or inches. Several investigators hypothesize that interstitial fluid flow caused by pressure gradients is the primary factor in development of pressure ulcers. This theory is consistent with work of Kosiak, Dinsdale, Reswick & Rogers.

Despite significant gradients, boundary areas (e.g., edge of low pressure surface) are typically areas of lower risk for pressure ulcers. This suggests that pressure gradient only becomes an important factor when combined with high pressure.

Most researchers agree that prolonged exposure to...
Nutritional Needs

- Assess nutritional needs for at-risk patients on a regular basis
- Weight loss and low albumin are significant risk factors for tissue breakdown
- Provide supplements as needed

Additional considerations . . .

- ability to perform self-care
- cognitive function
- vision
- risk of lower limb injury with difficult transfers
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3. Treat underlying conditions

1. Improve blood flow and tissue perfusion
2. Apply compression for edema/lymphedema in the absence of arterial disease
3. Use pressure redistributing technologies and other methods to reduce friction and shear

Improve blood flow, tissue perfusion

- Exercise
- Revascularization
Apply compression for edema/lymphedema in the absence of arterial disease

- Bandages, garments, wraps

Use pressure redistributing technologies and other methods to reduce friction and shear

- Support surfaces
- Therapeutic footwear and shoe orthotics
- Surgical intervention to correct deformities
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Assess the WHOLE patient

Before you evaluate the HOLE in the patient

4. Optimize wound care
   Once the causes of tissue damage are removed, MANAGE the wound

G: Identify the GOAL of care
A: Take evidence-based ACTIONS
P: Measure PROGRESS toward the goal

Hermans MHE, Bolson LL, Establishing a skin integrity program. Remington Report, 2001; 9(6) Suppl. 1:6-8
By using evidence-based practice to supplement your expertise, you can move forward from traditional “caring for wounds” to accomplishing the goals of care, for example healing them or relieving wound pain.

Sometimes it is a challenge to diagnose what you are looking at....

But once you know what you are dealing with, the course of action becomes clear.
To diagnose and remove the cause of tissue breakdown, start by looking up from the wound(s) to assess the whole patient.

The topical care you apply will work only if the cause of tissue breakdown has been removed.

To do this you may need to consult with a vascular lab or surgeon or a check blood metabolites to explore need for a nutritional consult or check for diabetes or thyroid deficiencies, working with endocrinology or explore the possibility of immunological complications of disease or the patient’s anti-inflammatory medications which inhibit

If you can only make two measurements, measure the length (longest ulcer axis—not body axis) and width as the longest perpendicular to the length.
Wound bed ratings or colorimetric measurements can provide validated reliable quantitative assessments of wound surface, necrotic tissue, epithelization or granulation.

Reliable (i.e. repeatable), valid (i.e. measure what they say they measure) clinical assessments of the skin surrounding a wound can alert professionals to wound infection or scarring. Erythema or edema around the wound can also mean that the tissue is at risk of further breakdown due to the same factors that caused the chronic wound in the first place, so these assessments can alert you to ulcers at risk of further breakdown or recurrence. These measures are described in detail in Barbara Bates-Jensen’s Pressure Sore Status Tool (PSST) or its adaptation for all wounds, the Bates-Jensen Wound Assessment Tool (BWAT) available free online with her permission.

Remember the patient and wound assessments we just covered? These are the patient and wound’s only opportunity to tell you what they need: the GOALS to meet. If you found a PU on the patient, a goal may be to heal it. Or if the patient complained of pain, identify the source (e.g. infection or inappropriate dressing or materials etc.) and alleviate it. If the patient can’t perform activities of daily living and wants to, have a PT or OT consult to help them achieve their goals—they’ll move more and prevent PU from occurring or recurring. These GOALS of care lead straight to your ACTION plan. For example, …next slide.
### ACTIONS (EXAMPLES)

<table>
<thead>
<tr>
<th>If the GOAL is . . .</th>
<th>The ACTION is . . .</th>
</tr>
</thead>
<tbody>
<tr>
<td>Debride necrotic tissue</td>
<td>Hydrogel + moisture retention (autolytic)</td>
</tr>
<tr>
<td>Clean the wound</td>
<td>Safe, effective cleanser</td>
</tr>
<tr>
<td>Absorb excess exudate</td>
<td>Hydrofiber dressing</td>
</tr>
<tr>
<td>Control bleeding</td>
<td>Alginate</td>
</tr>
<tr>
<td>Hydrate a dry wound</td>
<td>Hydrogel + moisture retention</td>
</tr>
</tbody>
</table>

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### EB ACTION: Wound Cleansing

- 4 to 15 pounds of pressure per square inch
- Safe non-toxic wound cleanser
- Do not use a *skin* cleanser or sterilizing agent

AHCPR Pressure Ulcer Treatment Guideline, 1994.

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### The Old Adage.....

"Don’t put into a wound what you wouldn’t put into your eye"

- Acetic Acid
- Iodine
Autolytic:
Advantages: safe, physiologic, noninvasive. Uses body's own wound fluid as deriding agent (WBC's enzymes, etc). Must have a retention layer of wound fluid in contact with the wound surface and a host with adequate WBC's.
Disadvantages: slow process, must monitor for infection. Not appropriate for a leukopenic patient or for patient with an ischemic wound due to poor blood flow and deceased WBC's.
We'll address wound infection here because diabetic foot ulcers are at high risk of infection, due to impaired function of the host immune cells. In fact, Rubenstein reported in 1983 that infection is 5 times more likely in DFU than in non-diabetic chronic wounds. However, these principles apply to all types of infected wounds. Passive mechanisms that minimize wound infections include isolating and protecting wounds. For example during an outbreak of Methycillin-resistant *Staphylococcus aureus* (MRSA) at their United Kingdom hospital, isolation rooms were all being used, so Wilson and Dunn isolated MRSA-contaminated venous ulcers by dressing them with a hydrocolloid dressing.
Hutchinson and McGuckin published a retrospective review of published literature from 1960 to 1990, comparing rates of clinical infections reported using different categories of dressings. Clinical infection was defined by the presence of classical clinical signs and symptoms of infection: edema, erythema, pain, odor, purulent exudate and unexplained fever.

The highest infection rate, 7.1%, was observed for wounds dressed with gauze or impregnated gauze dressings, and the lowest infection rate, 1.3%, was observed in wounds for which the moist environment was provided with hydrocolloid dressings.

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Moreover, Lawrence and Lilly showed that about 1/3 the level of airborne organisms are released when changing a hydrocolloid dressing than when changing a gauze dressing. Moreover these levels stay high in the treatment room where the dressing was changed for up to 30 minutes, increasing the potential for cross-contamination with gauze.
Published evidence supports using moist wound healing on a variety of acute and chronic wounds. So far it has not been sufficient for certain EB websites to endorse moist wound healing with film or hydrocolloid dressings, but clinicians who need to make wound dressing decisions may benefit from knowing that these two kinds of dressings have the best available evidence in controlled studies.
Once you have used research-based patient and wound assessment to identify the Goals of care, applied research-based Action plans or Algorithms to meet those goals of care, now its time to reap your rewards and measure the Progress toward the goal! You've heard of Pilgrims Progress--this is Patient's Progress! This is the fun part if you are using good research-based assessment tools to develop your goals and as action plans, because you'll thrill your patients, your management and yourself with the results. You can use these results to support your care decisions and convince authorities or prescribing physicians to allow you to do quality wound care.
And because there will always be some...
5. Prevent loss of function & disability

- Scar management
- Progressive tissue loading
- Exercise
- Assistive technology
- Protect and prevent recurrence

Tissue Integrity Management Principles

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6.0 Address patient & family concerns

- Provide education for self-care
- Address patient/client concerns
  - Pain management
  - Anxiety/depression
- Provide good follow-up care
  - Monitor adherence to treatment
  - Monitor for signs of infection
Recognizing Infection: Wound Bioburden Spectrum

**Contaminated**: bacteria present on a surface; no proliferation

**Colonized**: bacteria attached to surface and proliferates; balanced response from host (no symptoms); healing can occur

**Infected**: bacteria invades the healthy tissue and elicits response from the host; healing is hindered
Signs of Critical Colonization
- Granulation tissue
  - Color
  - Friability
  - Absent or abnormal
- Odor
  - Subtle or dramatic change
- Increased/high exudate levels in the presence of granulation tissue
  - Wounds attempt to “flush out” foreign particles or chemicals

Infection: Clinical Picture
- Swelling
- Induration
- Erythema
- Warmth
- Pain
- Odor

Infection: Definition

“The presence of replicating microorganisms within a wound with subsequent host injury”.

Wound infection is far less common than wound colonization and contamination”.

Gordon Dow, MD: Chronic Wound Care 3rd Edition (8)