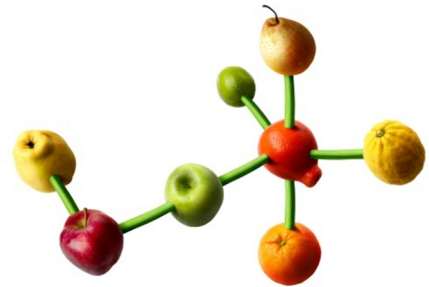


## Chapter 5 Nutrition in the Science of Wound Healing

### Objectives

1. Discuss the role of nutrition in preventing pressure ulcers
2. Describe the impact of inflammation on nutrition status
3. Discuss the nutrition recommendations in the *Prevention and Treatment of Pressure Ulcers: Clinical Practice Guidelines*.
4. Examine the similarities and differences in the *Prevention and Treatment of Pressure Ulcers: Clinical Practice Guidelines* and other evidence-based nutrition recommendations.



### I. Power of Nutrition in the Preventive Healthcare Model

WHO defines health as ‘a state of complete physical, mental and social well-being and merely the absence of disease or infirmity.’ Good health is the essence of a productive life and is central to quality of life.

Practicing prevention is any activity which decreases the burden of mortality or morbidity from disease. The preventive healthcare model is based on the theory that health beliefs, dietary habits, food practices, and health behaviors typically influence lifestyle choices. Lifelong dietary habits play a major role in achieving and maintaining good health and reducing the risk of numerous chronic diseases. Changes in nutrition status may precede or follow illness or injury. The consequence of declining nutrition status may contribute to loss of skin integrity and ultimately a pressure ulcer. Set a goal to incorporate prevention strategies specific to skin health in your clinical practice.

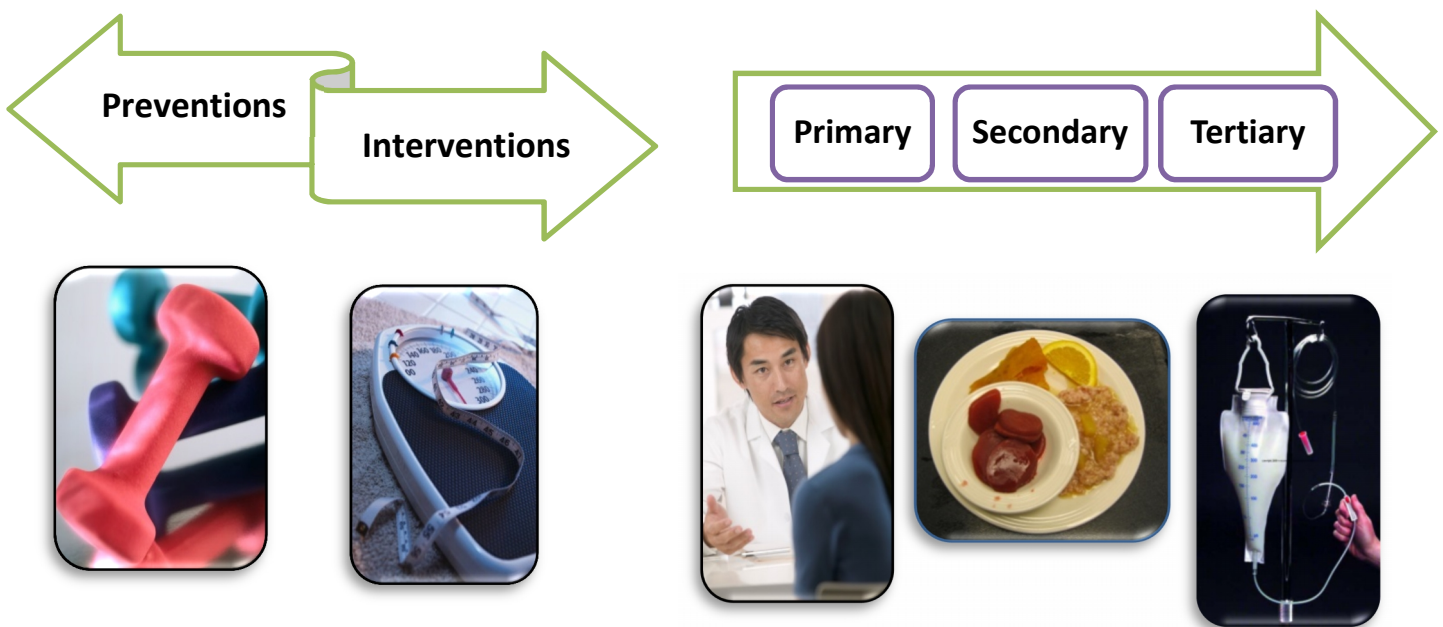
### Health & Nutrition Preventions vs. Interventions

Primary, secondary and tertiary nutrition preventions play a pivotal role in maintaining skin integrity. Within each category of preventions are specific interventions. Health prevention that occurs prior to the presence of a disease diagnosis is primary.<sup>1</sup> Primary nutrition preventive strategies focus on lifestyle modification, healthy eating, patterns of physical activity and disease prevention. Secondary preventive strategies are implemented once a diagnosis



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is made, i.e. skin integrity is compromised. Nutrition-related secondary preventive strategies involve reducing risk for worsening pressure ulcers and slowing the progression of chronic diseases that negatively impact skin integrity. For example, consuming sufficient amounts of high quality protein and energy to maintain desirable weight and medical nutrition therapy for management of chronic conditions as needed. Tertiary preventive strategies consists of preventing further skin breakdown, preventing infection in wounds and reducing the attendant suffering after a pressure ulcer is established. These preventive strategies are a component of rehabilitation of disabling conditions. Examples of nutrition-related tertiary preventive strategies include chewing and appetite issues, texture modified diets, adaptive equipment to compensate for functional disabilities that restrict chewing, swallowing and self-feeding and assistance during mealtimes.<sup>2</sup> In some instances, liberalization of therapeutic diets may be beneficial to increase dietary intake.



### II. History of Guidelines for Prevention & Treatment of Pressure Ulcers

Wounds have been documented in medical writings since ancient times. Evidence of pressure ulcers has been found on Egyptian mummies. The most common approach to wound healing has been to alter the wound surface as a way to enhance healing. However the role of diet was noted in the 16<sup>th</sup> century by the

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French surgeon Ambrose Pare who described pressure ulcers as an ‘incurable malady’, which could be helped only with ‘rest, exercise and a good diet.’ However, the benefits of nutrition are not recognized until the 1990s.<sup>3-4</sup> Table 5.1 summarizes different treatment methods used throughout history.



**Table 5.1. Historic Treatments for Pressure Ulcers**

<b>Time in History</b>	<b>Method</b>
<b>Ancient Greece</b>	<b>cleanse, apply animal fat and wrap</b>
<b>Roman Empire</b>	<b>cleanse, apply ashes, oil and herbs, then wrap</b>
<b>Ancient China</b>	<b>gunpowder</b>
<b>Middle Ages</b>	<b>wax plus herbs or boiling oil</b>
<b>France, 1700s</b>	<b>rest, exercise and good diet</b>
<b>Europe, 1800s</b>	<b>heat or ice</b>
<b>Early 1900s</b>	<b>expose wound, apply tannic acid or variety of pigments to dry wound, apply alcohol to wound, apply sugar to wound, apply sugar to wound, use maggots to débride wound</b>
<b>1950s to present</b>	<b>use to topical antibiotics</b>
<b>1960s to present</b>	<b>rapid wound closure with surgery using skin or skin substitutes</b>
<b>1990s to present</b>	<b>use of nutritional supplements to prevent or correct malnutrition; use of anabolic agents to improve lean body reserves</b>
<b>1994</b>	<b>Agency on Health Care Policy &amp; Research published Clinical Practice Guidelines on Treatment of Pressure Ulcers</b>
<b>2009</b>	<b>National Pressure Ulcer Advisory Panel and European Pressure Ulcer Advisory Panel published Pressure Ulcer Prevention &amp; Treatment Guidelines</b>
<b>2014</b>	<b>National Pressure Ulcer Advisory Panel, European Pressure Ulcer Advisory Panel, and Pan Pacific Pressure Injury Alliance published Pressure Ulcer Prevention &amp; Treatment Guidelines</b>

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### III. Nutrition for Prevention of Pressure Ulcers

The National Pressure Ulcer Long Term Care Study<sup>6</sup> reported that oral eating problems and weight loss were associated with a higher risk of developing pressure ulcers. Moreover, insufficient nutrient intake and low body weight are associated with slow and chronic non-healing wounds.<sup>7-12</sup> Preexisting malnutrition and/or weight loss was a positive predictive variable for all undesirable surgery-related hospital acquired conditions (i.e. CMS 'never events') including pressure ulcers.<sup>13</sup> The prevalence of malnutrition in acute care settings internationally is estimated to be 40%<sup>14</sup> and up to 30% in long term care and nursing facilities.<sup>15</sup> Historically, the diagnosis of malnutrition has been loosely defined using a range of criterion including biochemical test results, anthropometric benchmarks, and physical assessment findings.<sup>16-18</sup> However, in 2012 the Academy/ASPEN published defined Characteristics of Adult Malnutrition<sup>19</sup> and these characteristics are discussed in the *Prevention and Treatment of Pressure Ulcers:CPG*<sup>5</sup>



**Renew your knowledge of the National Pressure Ulcer Long Term Care Study**

<http://www.medscape.com/viewarticle/470370>

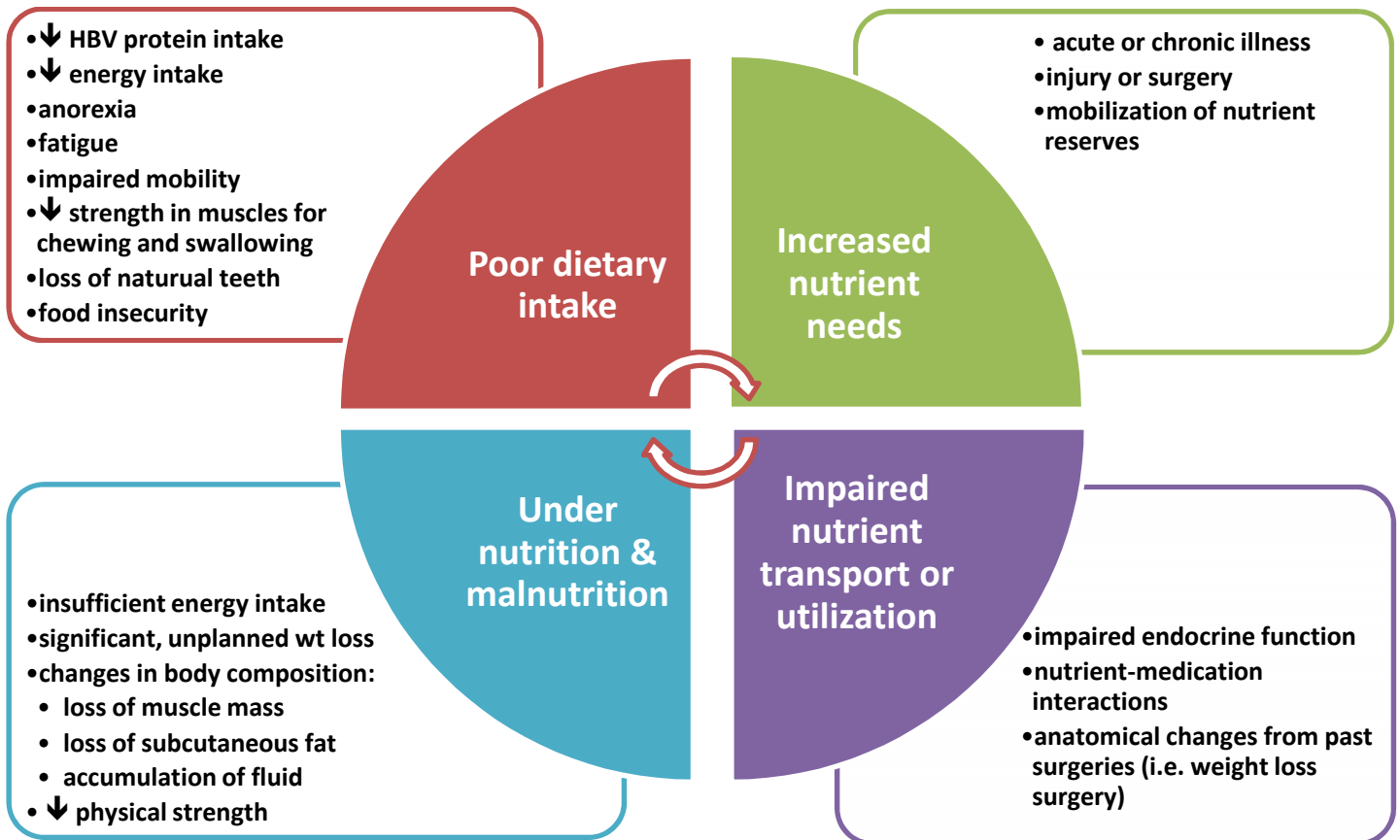
**Renew your knowledge of Hospital Acquired Conditions**

<http://cms.gov/Outreach-and-Education/Medicare-Learning-Network-MLN/MLNProducts/Downloads/wPOAFactSheet.pdf>

Malnutrition occurs on a continuum starting with sub-optimal intakes of one or more nutrients to undernutrition with subclinical deficiencies to malnutrition with documented nutrient deficiencies. There are many factors that contribute to declining nutrition status as illustrated in Figure 5.1.<sup>20</sup>

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Figure 5.1. Adult Undernutrition and Malnutrition Continuum.



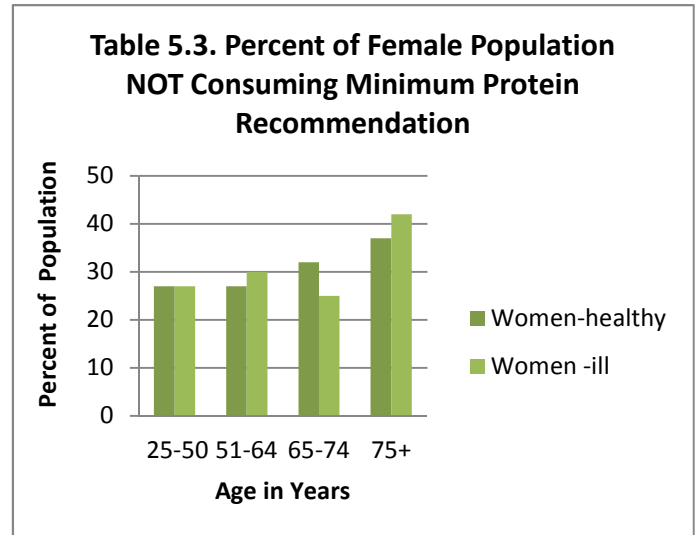
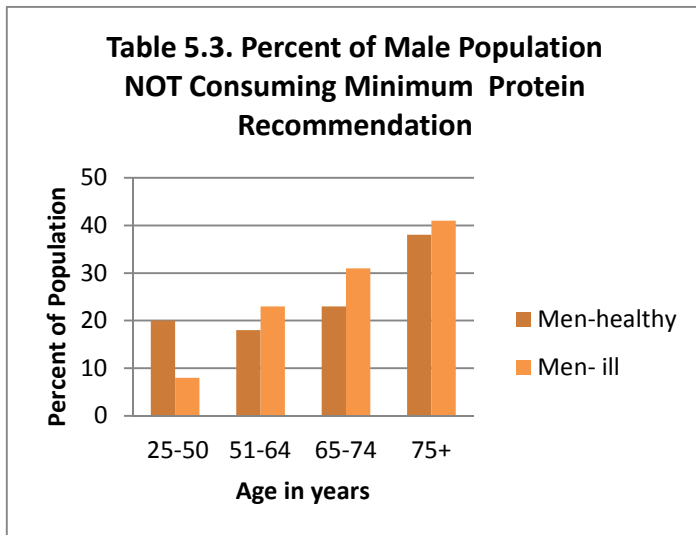
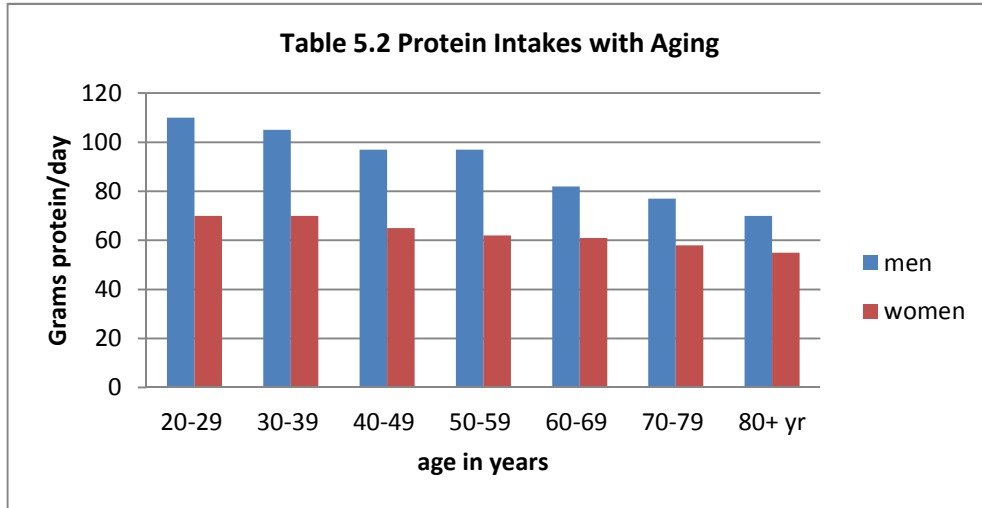
Key: HBV- high biological value

Adapted from . Litchford, MD. Counteracting the Trajectory of Frailty and Sarcopenia in Older Adults. *Nutr Clin Prac.* Aug 2014 29:428-434.<sup>20</sup>

The NHANES data demonstrate a linear decrease in total energy, fat and protein intake in men and women with aging.<sup>21-22</sup> Protein intake of older adults demonstrates that protein intake for both males and females declines after age 60. Women were less likely than men to consume adequate protein throughout life.<sup>23</sup> Wakimoto<sup>22</sup> compared protein intake of healthy vs. sick adults. Over 30 percent of sick men and 25 percent of sick women aged 65-74 did not consume estimated protein needs. Over 40 percent of sick men and over 35 percent of sick women aged 75+ did not consume estimated protein needs. Table 5.2: Older adults are the

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most likely segment of the population to get sick from a poor diet.<sup>21</sup> Refer to Table 5.3 for the difference in protein intake for healthy vs. ill males and females.<sup>22</sup>



The relationship between malnutrition and pressure ulcers is reported in various studies across a range of clinical settings. Lyder<sup>24</sup> reported that 76% of hospitalized adults 65 years or older (n=2425) assessed as being at risk for pressure ulcers were also malnourished. Banks<sup>25</sup> reported the odds ratio of having a pressure ulcer concurrent with malnutrition was 2.6 for acute care and 2.0 for long term care. Iizaka<sup>26</sup> reported that the rate of malnutrition was significantly higher in patients with a pressure ulcer. Verbrugge<sup>27</sup> examined the

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prevalence of malnutrition and risk factors independently associated with malnutrition in 23 nursing homes. The nutritional status was evaluated using the Mini Nutrition Assessment Tool. The researchers determined that over 35 percent of residents (n=1188) were at risk for malnutrition and almost 20 percent were malnourished. Factors that were significantly associated with malnutrition included wound/pressure ulcer, a hospitalization in < 90 days ago, and impaired cognitive state were significantly associated with malnutrition.

### Reading Assignment

Litchford, M, Dorner, B, Posthauer, ME. Malnutrition as a precursor of pressure ulcers. *Adv Wound Care*.3.1.54-63.<sup>26</sup> (Chapter 5 Resource 1 pdf)

### IV. Impact of Inflammation on Nutrition Status

Inflammation is a protective response to infection, toxins, and physical stress by the immune system. It requires communication between different immune cells to coordinate their response. Inflammation does not automatically mean infection. It is the first step in the healing cascade with or without infection.



There are two types of inflammation, acute or innate and chronic. Acute inflammation is a short-term process because inflammatory mediators have short half-lives and are quickly degraded. Chronic, inappropriate inflammation occurs when the response to injury is not extinguished. The persistent immune response acts like a slow burning fire that stimulates the synthesis of proinflammatory cytokines which promote erosion of lean body mass. Chronic inflammation is one of the hallmark characteristics and underlying contributor to many chronic diseases.

In the presences of inflammatory stress, the pro-inflammatory cytokines are responsible for the deteriorating nutrition status. Leukocytes are the major source of cytokines. Cytokines affect numerous organ systems creating an array of physiological responses that contribute to loss of lean body reserves, impaired nutrient utilization and anorexia.<sup>28</sup> Refer to Figure 5.2.

Acute injuries, infections and surgeries contribute to stress-related hyperglycemia. Poor glycemic control is associated with poor wound healing. Elevated blood glucose causes cells walls to become rigid thus impairing microvascular blood flow. Persistently elevated blood glucose levels impair the immune response.