



A New Model to Identify Shared Risk Factors for Pressure Ulcers and Frailty in Older Adults

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KEY WORDS

frailty
International Classification of Functioning, Disability, and Health
pressure ulcers
shared risk factors

Pressure ulcers substantially affect frail older adults, as well as their family caregivers, nurses, and the healthcare system at large. This article uses the World Health Organization's International Classification of Functioning, Disability and Health as a framework to discuss pressure ulcers in frail older adults. Pressure ulcers and frailty are defined and prevalence and incidence figures are reviewed. The connection is made between pressure ulcers and frailty using a model of shared risk factors and these medical syndromes are described as a synergistic relationship. In addition, the relevance to practice is discussed.

The objective of this article is to discuss the association of pressure ulcers (PUs) with frailty. Much work and research have been done on PU and frailty as separate conditions, although minimal connections between the two conditions have been made in literature. The conditions, however, are conceptually linked, and in clinical practice many people with PU are also frail. This article examines the two conditions, focusing on the shared risk factors of PU and frail older adults and uses the World Health Organization's (WHO) International Classification of Functioning, Disability and Health (ICF) as a framework.

Frail Older Adults

Clinicians recognize *frailty* in older adults as a condition with many possible manifestations consistent with the definition of a medical syndrome (Fried et al., 2001). Moreover, frailty has been defined by many authors (Fried et al.; Woods et al., 2005) as a medical syndrome of a physiological state of increased risks for negative outcomes that result from decreased physiological reserves and dysregulation of many systems (Fried et al.). Individuals who are frail have difficulty maintaining homeostasis in the face of a range of stressors. Frailty is a combined expression of risk resulting from age or disease-related effects on multiple physical systems with no single system contributing to the status of frailty. Individuals can be frail but have no disease present (Fried et al.; Mitnitski, Song, & Rockwood, 2004). In older adults, frailty has long been associated with negative outcomes, including disability, dependency, hospitalization, falls, need for long-term care (LTC), and death

(Fried et al.; Rockwood, Mitnitski, Song, Steen, & Skoog, 2006). Furthermore, frailty in older adults occurs along a continuum ranging from *not frail* to *very frail*, and individuals can move back and forth along this continuum. On one extreme are people who are not frail, have no disease present, and are considered healthy; on the opposite extreme are people who are considered very frail, disabled, and seriously ill with multiple comorbidities.

Although there are various measures of frailty, the Cardiovascular Health Survey (Frail-CHS) is commonly used. It proposes five criteria: weight loss, exhaustion, weakness, slow walking speed, and low levels of physical activity. An individual is considered *frail* when three or more criteria are present, *prefrail* when only one or two criteria are present, and *robust* when none are present (Fried et al., 2001).

Prevalence and Incidence of Frailty

Prevalence of frailty in the United States is estimated at 7%–16% in the population of community-based, older individuals living in their own homes (Fried et al., 2001; Woods et al., 2005). Estimates of frailty in the United States are even higher in more vulnerable groups (people older than 80 years of age, and those who are hospitalized or living in LTC). Estimates of the prevalence of frailty in these groups can be as high as 40% (Winograd, Gerety, Chung, Goldstein, Dominguez, & Vallone, 1991).

The incidence of frailty in American women age 65–79 living in the community is estimated to be 15% after 3 years of community living (Woods et al., 2005). In the Netherlands, the prevalence is almost twice as high in women (10%) as in men (6.9%; Puts, Lips, & Deeg, 2005).

Pressure Ulcers

Definition

The National Pressure Ulcer Advisory Panel (NPUAP, 2007) defines a *pressure ulcer* as a “localized injury to the skin and/or underlying tissue usually over a bony prominence, as a result of pressure, or pressure in combination with shear and/or friction. A number of contributing or confounding factors are also associated with pressure ulcers; the significance of these factors is yet to be elucidated” (p. 1).

PU are best understood as a geriatric medical syndrome. Coexisting impairments in mobility, nutrition, and skin health synergistically produce ulcers and require multifactorial interventions that are interdisciplinary to prevent PUs (Reddy, Gill, & Rochon, 2006).

Prevalence and Incidence of PUs

The prevalence of PUs varies within specific patient populations, with certain populations being at higher risk, such as those with spinal cord injuries; older adults; and patients who are critically ill, have hip fractures, or have had cardiovascular surgery. Many researchers have found an association between advancing age and PUs (Bours, Halfens, Berger, Huijter Abu-Saad, & Grol, 2003; Fisher, Wells, & Harrison, 2004; Lindgren, Unosson, Fredrikson, & Ek, 2004; Russo & Elixhauser, 2006; Young, Nikoletti, McCaul, Twigg, & Morey, 2002).

Estimates for prevalence of PUs for all individuals in Canada receiving health care in a hospital, LTC facility, or home vary from 15% to almost 30%, with the overall prevalence being 26% (Woodbury & Houghton, 2004). The Agency for Healthcare Policy and Research in the United States reported there were 455,000 hospital stays in which PUs were noted, a 63% increase from 1993 to 2005. The study did not indicate why the increase occurred, although it did note that during the same time period the number of hospitalizations increased by 11% and the numbers of stays for people 65 years and older increased by 14% (Russo & Elixhauser, 2006). Patients 65 years and older accounted for 72.3% of all hospitalizations in which PUs were noted. Those age 45–64 years accounted for 19% of PUs (Russo & Elixhauser).

Link Between Frailty and PUs

In a survey of academic geriatricians, 50% cited the following characteristics of frailty evident in individuals (listed in descending order of frequency): undernutrition, functional decline, prolonged bed rest, PU, gait disorders, generalized weakness, older than 90 years of age, weight loss, anorexia, fear of falling, dementia, hip fracture, delirium, confusion,

Key Practice Points

1. Pressures ulcers (PUs) are best understood as a geriatric medical syndrome. Coexisting impairments in mobility, nutrition, and skin health all contribute to producing ulcers and require multifactorial, interdisciplinary interventions to prevent PUs.
2. Five distinct geriatric syndromes have been identified that share common risk factors: incontinence, falls, PUs, delirium, and functional decline. It is suggested that the five geriatric syndromes are linked to the broader syndrome of frailty.
3. Rehabilitation nurses working with older adults should identify the risks of frailty for older patients with PUs and the risks of PUs for those who are frail.

going outdoors infrequently, and polypharmacy (Fried, Ferrucci, Darer, Williamson, & Anderson, 2004). Many geriatricians feel that frailty can be defined by common, old-age-related conditions, including confusion, incontinence, pressure sores, falls, and immobility (Winograd, Gerety, Brown, & Kolodny, 1988). Yet the exact connection between PUs and frailty is not known.

Five distinct geriatric syndromes have been identified that share a set of common risk factors. These geriatric giants or geriatric syndromes include incontinence, falls, PUs, delirium, and functional decline. It is further suggested (Inouye, Studenski, Tinetti, & Kuchel, 2007) that these five geriatric syndromes link to the broader syndrome of frailty (**Figure 1**). It is interesting to note that although PUs are listed as one of the syndromes, some of the other syndromes (incontinence, delirium, and functional decline) are specific risk factors for PUs. Common risk factors for all five syndromes have been identified by a systematic review and include advancing age, impaired mobility, cognitive impairment (including sensory impairment), and functional impairment (Inouye et al.). Three of the four shared risk factors are modifiable with interventions actively used by rehabilitation nurses for prevention. Impaired mobility can be actively modified by rehabilitation nurses; exercise, walking, proper positioning, strengthening, and increased range of motion all play a role in prevention of PUs (Paralyzed Veterans of America, 2000; U.S. Department of Health and Human Services, 1992). Cognitive impairment is potentially modifiable; for example, in the case of delirium, the rehabilitation nurse works with the interdisciplinary team to identify and treat the underlying cause. Because the cause of delirium is usually multifactorial, the treatment is

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Figure 1. Unified Model Demonstrating Shared Risk Factors for Geriatric Syndromes and Frailty

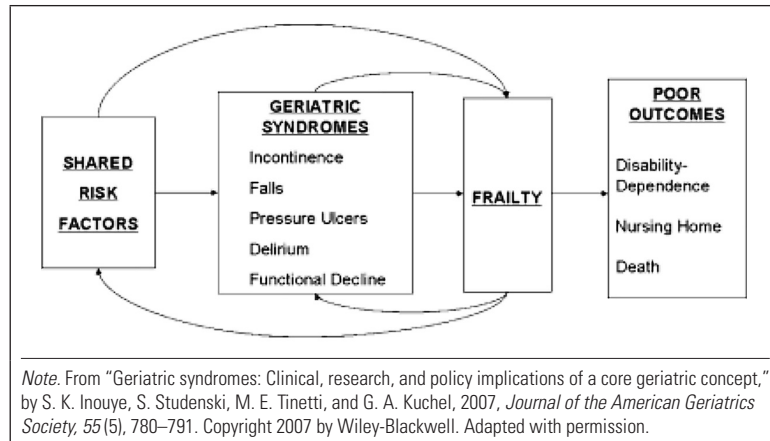
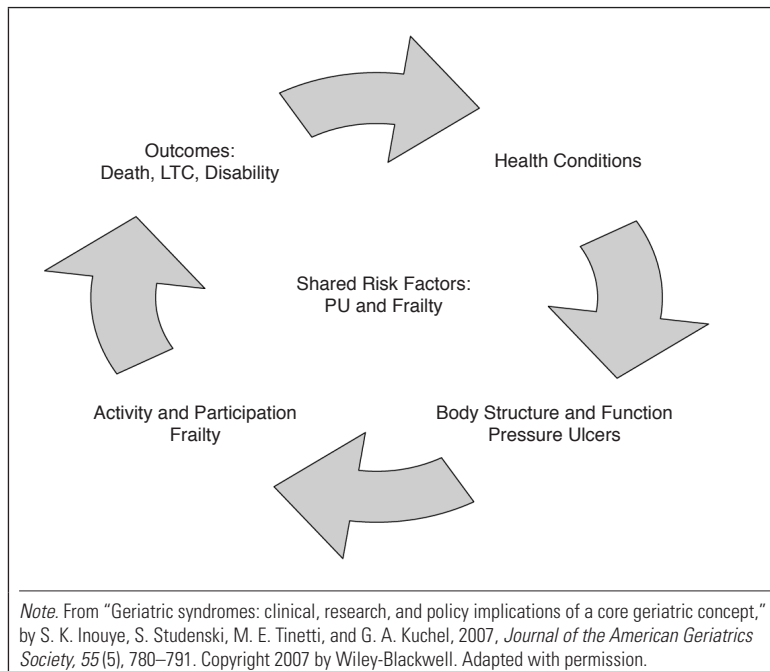


Figure 2. Shared Risk Factors for PU and Frailty



as well (Cole, Primeau, & Elie, 1998; Cole, Primeau, & McCusker, 2003). Rehabilitation efforts by the interdisciplinary team focus on functional impairment by maintaining, improving, and optimizing function and preventing complications. Focusing only on the shared risk factors between PUs and frailty, the factors expand to include anorexia, malnutrition, weight loss, incontinence, low albumin, low hemoglobin, cardiac disease, chronic obstructive lung disease, cancer, and diabetes mellitus. Health outcomes of disability, placement in LTC, and increased risk of death are similar for PUs and frailty. **Figure 2** depicts Inouye's model, simplified with IFC and focused on PUs and frailty.

International Classification of Functioning, Disability, and Health

The ICF is the WHO's biopsychosocial model of health and functioning (**Figure 3**) used for measuring health and disability from the perspectives of individuals and health systems (WHO, 2001): "It is a classification of health and health-related domains, domains that help describe changes in body structure and function, what a person with a health condition can do in a standard environment (capacity), as well as what they can actually do in their usual environment (performance). The domains are classified from body, individual and societal perspective by means of two lists: a list of body structure and function, and a list of domains of activity and participation" (p. 2).

The ICF focuses on health and functioning rather than disability. Functioning in the ICF refers to all body functions, activities, and participation; disability is the overriding term for impairments, activity limitations, and participation restrictions. In the ICF framework shown in **Figure 3**, functioning and disability are considered the outcome of the interaction between health condition(s) and contextual factors (WHO, 2001). Contextual factors of the WHO ICF include both environmental and personal factors (WHO).

Risk Factors for Pressure Ulcers and Frailty

The combination of extrinsic and intrinsic factors contributes to patients' susceptibilities or risks of developing PU, illustrates the interaction between environmental and individual influences, and shows the impact on health and disability. Once a frail older person has developed a PU, the same risk factors become barriers to healing if they are not addressed and corrected. *Modifiable factors* can be corrected, while others cannot. These risk factors have been studied extensively.

Environmental or Extrinsic Risk Factors for PUs

Environmental or extrinsic risk factors for PUs include pressure, friction, shear, moisture, heat, stay in the intensive care unit, length of stay, length of surgical procedure, and wait time for surgery (Baumgarten et al., 2003; Bours et al., 2003; Eachempati, Hydo, & Barie, 2001; Fisher et al., 2004; Pieper, Sugrue, Weiland, Sprague, & Heiman, 1998).

Intrinsic or Personal Factors for PUs

Intrinsic factors are internal and are related to body structure and function and personal factors. They include malnutrition, diabetes mellitus, prior

PU, stage I PUs, bladder and fecal incontinence, advanced age, cardiovascular disease, pulmonary disease, impaired sensory perception, low serum albumin, low hemoglobin, decreased mental status, gender, fractured bone, edema, critical illness, reduced blood flow, stroke, impaired mobility, and weight and body mass (Braden & Bergstrom, 1987; Brandeis, Ooi, Hossain, Morris, & Lipsitz, 1994; Bergstrom, Braden, Kemp, Champagne, & Ruby, 1996; Berlowitz, Young, Brandeis, Kader, & Anderson, 2001; Bours et al., 2003; Eachempati et al., 2001; Fisher et al., 2004; Lindgren, Unosson, Krantz, & Ek, 2005; Lindgren et al., 2004; Meraviglia, Becker, Grobe, & King, 2002; Perneger, Hélot, Raë, Borst, & Gaspoz, 1998; Pieper et al., 1998; Reed, Hepburn, Adelson, Center, & McKnight, 2003; Russo & Elixhauser, 2006; van Marum et al., 2001; Young et al., 2002).

Risk-Assessment Tool for PUs

There has been much effort to develop valid and reliable risk-assessment tools for preventing PUs. In a meta-analysis, the Braden Scale (Braden & Bergstrom, 1987) was determined to provide the best overall balance between sensitivity and specificity (Pancorbo-Hidalgo, Garcia-Fernandez, Lopez-Medina, & Alvarez-Nietro, 2006) and is used extensively in North America to identify the risk for developing a PU. Other commonly used scales include the Norton (Norton, McLaren, & Extton-Smith, 1962), Gosnell (Gosnell, 1989), and the Waterlow (Waterlow, 1985), as well as many others developed by local jurisdictions. The Braden Scale includes six risk factors for developing PUs: sensory perception, moisture, activity, mobility, nutrition, friction, and shear. The scale is a paper and pencil task that takes approximately 2 minutes to complete and yields a score between 5 and 23 that indicates three levels of risk (low, moderate, and high; Braden & Bergstrom, 1987).

Intrinsic Risk Factors for Frailty

Intrinsic risk factors for frailty include cardiovascular disease; pulmonary disease; diabetes mellitus; anorexia; aging; age-related sarcopenia; chronic conditions and comorbidities; gender (female); lower extremity functional limitation; low physical activity; cognitive impairment; smoking; depressive symptoms; being underweight, overweight, or obese; high inflammatory markers (IL-6, C-reactive protein, low albumin); and low hemoglobin (Ferrucci et al., 2002; Fried et al., 2004; Leng, Chares, Koenig, & Walston, 2002; Mitnitski et al., 2004; Reuben et al., 2002; Walston et al., 2002; Woods et al., 2005).

Shared intrinsic risk factors for both PU and frailty include advancing age, anorexia, malnutrition,

Figure 3. The International Classification of Functioning, Disability and Health

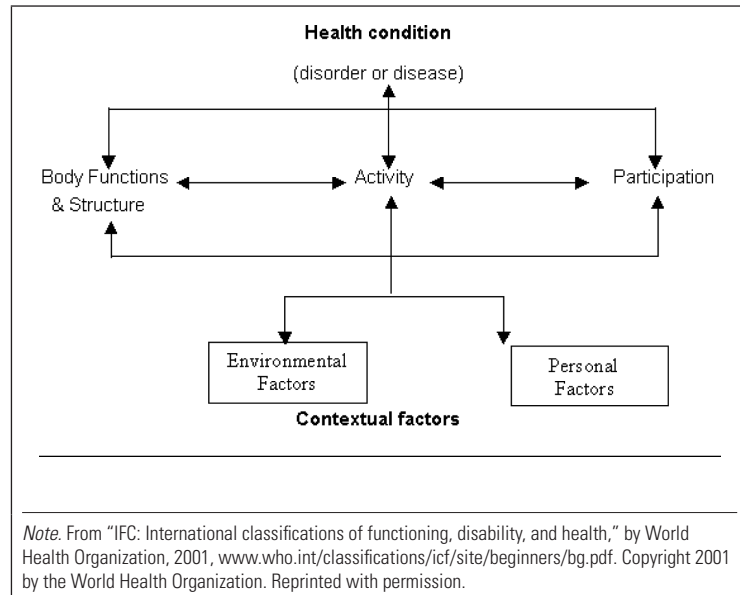
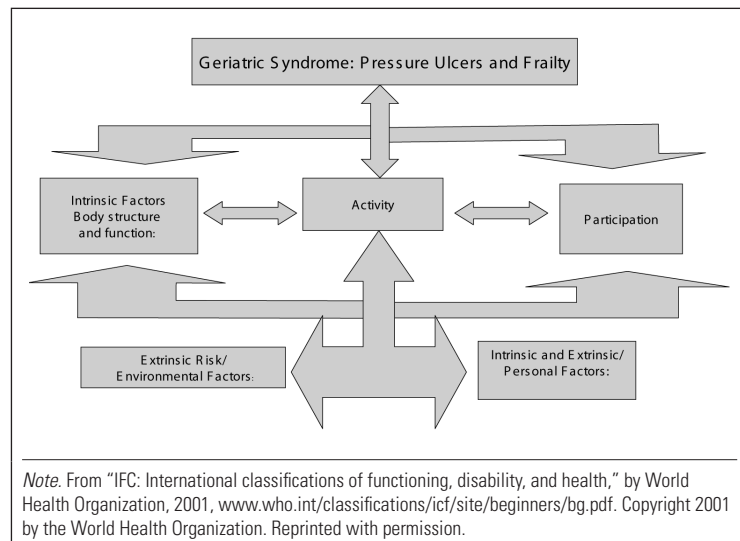


Figure 4. Unifying Model of the Impact of Pressure Ulcers on Frail Older Adults



weight loss, incontinence (related to moisture in pressure ulcers), low albumin, low hemoglobin, cardiovascular and pulmonary disease, diabetes mellitus, cancer, inactivity, and cognitive decline (described as sensory impairment in PUs).

There were no shared extrinsic risk factors for PUs and frailty in the literature that was reviewed. Evidence exists that individuals with declining levels of frailty have fewer PUs that heal (Donini, De Felice, Tagliaccica, De Bernardini, & Cannella, 2005). The approach to both conditions requires multifactorial interventions that are interdisciplinary (Reddy et al., 2006).

Figure 4 is a proposed new model that modifies Inouye and colleagues' model on PUs and frailty

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(2007) and organizes the intrinsic and extrinsic risk factors for PUs and frailty within a biopsychosocial framework using the ICF, rather than the one suggested by Inouye. This requires an established rehabilitation model (ICF) that allows nurses to look at the individual, system, and environment. It identifies intrinsic and extrinsic risk factors that the rehabilitation nurse can potentially modify to reduce risk and prevent PUs and frailty.

Relevance for Rehabilitation Nursing Practice

Rehabilitation nurses working with older adults should identify both the risk of frailty for older adult patients with PUs and the risks of PUs for those who are frail. The Braden Scale is not comprehensive enough to measure the extensive shared risk factors between PU and frailty. Patients, families, and governments agencies expect that PUs will be prevented; this model provides a framework for the rehabilitation nurse to prevent PUs in frail older adults. Identification of shared risk factors and focusing on those that can be modified is essential to reducing the risk of developing either frailty or PUs. Rehabilitation nurses should strive to modify risk factors to prevent both PUs and frailty with every at-risk older adult. For example, nutrition and continence are two risk factors that can potentially be modified by the rehabilitation nurse. Using this model to promote aggressive intervention of these two risk factors could positively affect outcomes.

Assessment for frailty should be just as important to rehabilitation nurses as skin assessment. Nurses need to address modifiable risk factors to prevent frailty and PUs because they could significantly affect and prevent negative outcomes such as disability, dependence, LTC placement, and death for these high-risk groups.

Summary

PUs influence costs—both human and financial. Human costs include death, pain, depression, and reduced quality of life, and financial costs for treating this condition are considerable. Shared risk factors for PUs and frailty have been identified, and it has been suggested by Inouye and colleagues (2007) that shared risk factors for old-age-related syndromes may lead to the overreaching geriatric syndrome of frailty. A biopsychosocial approach is needed for all aspects of care and would be consistent with the ICF model suggested by WHO (2001). This proposed model provides rehabilitation nurse with a framework for looking at external and environmental factors and internal and personal factors that may be modified to reduce the risk of PUs

and frailty. A formal risk-assessment tool for PUs is needed that incorporates frailty into the model suggested by Inouye and colleagues for this specific high-risk patient population.

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