The ravages of prolonged bed rest

An update on multidisciplinary care for the deconditioned patient

STEPHANIE LAM BAppSc(Phty), MB BS, FAFRM
BELINDA THOMPSON BEx&SportSci, MClinExPhys, PhD
STEVEN G. FAUX MB BS, BA, FRACGP, FAFRM, FFPMANZCA

Deconditioning describes functional decline, progressive weakness and physiological changes that result from prolonged bed rest and inactivity. Frailty is a syndrome in which age-related physiological changes are accelerated or exacerbated in multiple systems. Deconditioning is more likely in patients who experience frailty. Due to the complexities of these conditions, optimal management involves a multidisciplinary team comprised of GPs, specialists and allied health professionals.

KEY POINTS

- Deconditioning is used to describe the physical and physiological changes that result from prolonged inactivity, immobility and bed rest associated with acute or chronic illness, injury and social isolation.
- Multisystem changes can occur within 24 hours of bed rest; these changes worsen with prolonged inactivity, potentially requiring more time to reverse (where possible).
- GPs play an important role in identifying, diagnosing and managing deconditioning.
- Adequately managing the complex changes associated with deconditioning requires a multidisciplinary approach with the involvement of various allied health specialists. Areas on which to focus include exercise, nutrition and psychosocial supports.

Deconditioning is a term used to describe functional decline, progressive physical weakness and associated physiological changes resulting from inactivity and prolonged bed rest after illness and injury. Deconditioning may occur acutely (due to new illness or hospitalisation and associated bed rest), progressively (due to chronic illness and progressive decline in activity), or both acutely and progressively.

Deconditioning can affect people of any age but is more common in those who experience frailty, as they are more vulnerable to the negative effects of bed rest. Additionally, deconditioning is one of the contributors to frailty. Older people and those with multiple chronic comorbidities are at higher risk of developing frailty, which is characterised by a decline in function across multiple physical and physiological systems and an increased vulnerability to psychosocial stressors.[1] As such, it is recommended that medical care be complemented by a multidisciplinary team of nurses, psychologists and allied health specialists.

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Dr Lam is a Consultant Rehabilitation Physician at Orange Health Services, Orange, and at Australian Lymphoedema Education, Research and Treatment (ALERT) at Macquarie University, Sydney; and Director of Rehabilitation at Lakeview Private Hospital, Sydney, NSW. Dr Thompson is an Accredited Exercise Physiologist and Research Fellow at ALERT at Macquarie University, Sydney, NSW. Professor Faux is a Senior Rehabilitation Physician and Director of Pain Medicine at St Vincent's Hospital, Sydney, NSW.

TABLE 1. PHYSIOLOGICAL EFFECTS OF DECONDITIONING AND PROLONGED BED REST[6-10]

System	Physiological effects
Musculoskeletal	• Sarcopenia (loss of muscle mass and strength) – within 24 hours: muscle power is reduced by 2 to 5% – within one week: 5 to 20% of baseline strength lost – within six weeks: up to 40% loss of baseline strength – it can take up to 18 weeks to regain baseline strength • Contractures occur during immobility, bed rest and fixed positioning of joints. Collagen crosslinks increase in number in the connective tissue around joints and muscles shorten. This process can start to occur after one week and is eventually irreversible • Osteoporosis due to a lack of weight bearing, with reduction in bone density of up to 45% after 12 weeks of bed rest
Cardiovascular	• Reduced blood volume leading to reduced stroke volume – within 24 hours: reduced circulatory volume by up to 5% – within three days: postural hypotension, contributing to falls risk – plasma volume decreases with relative increase in haematocrit and blood viscosity, increasing venous thrombosis risk • Reduced cardiovascular fitness resulting in poorer aerobic fitness; patient fatigues more easily with exertion – within one week: reduced maximum exercise capacity by up to 15% • Tachycardia, with an increase in resting heart rate by about one beat/min every two days for up to four weeks
Respiratory	• Atelectasis – within one week: reduced functional residual capacity by up to 30% • Impaired cough reflex due to weakened abdominal muscles and ineffective mucociliary clearing mechanisms • Overall increased risk of pneumonia
Dermatological	• Reduced skin integrity • Increased pressure area risk (increase in capillary pressure over bony prominences [i.e. heels, sacrum, occiput and greater trochanter]) – the risk is greater in combination with other factors (e.g. sensory impairment, malnutrition, incontinence, being underweight) • Dependent oedema with associated risk of cellulitis
Endocrinological	• Relative reduction in lean muscle mass and increase in fat mass – impaired glucose tolerance due to reduced insulin sensitivity in peripheral muscle – reduced antioxidant capacity and fat-free mass with greater fat deposition in muscle • Metabolic inflexibility (decreased ability to switch from fat to carbohydrate oxidation when transitioning from fasted to fed states)
Psychiatric and cognitive	• Fear of falling • Depression and anxiety • Poor sleep or sleep disturbance • Cognitive changes • Reduced dignity and independence
Gastrointestinal	• Constipation due to reduced mobility, fluid intake, peristalsis and incomplete bowel evacuation when on bed rest
Genitourinary	• Increased risk of urinary tract infection due to urinary stasis; it is more difficult for patients to fully empty their bladder while supine • Incontinence due to disorientation, confusion and decreased mobility
Neurological	• Pressure neuropathies (especially the ulnar and peroneal nerves) and critical illness neuromyopathy

The outcomes of deconditioning and frailty after hospitalisation are common and well recognised. Evidence suggests that addressing nutrition and increasing activity and exercise during hospitalisation may reduce deconditioning and the risk of frailty associated with hospitalisation.[2,3] In community settings, the impacts of COVID-19 and associated social isolation during lockdown inadvertently created a secondary pandemic of deconditioning and frailty; this serves to highlight the significant role played by primary health-care professionals in diagnosing and managing patients with deconditioning and

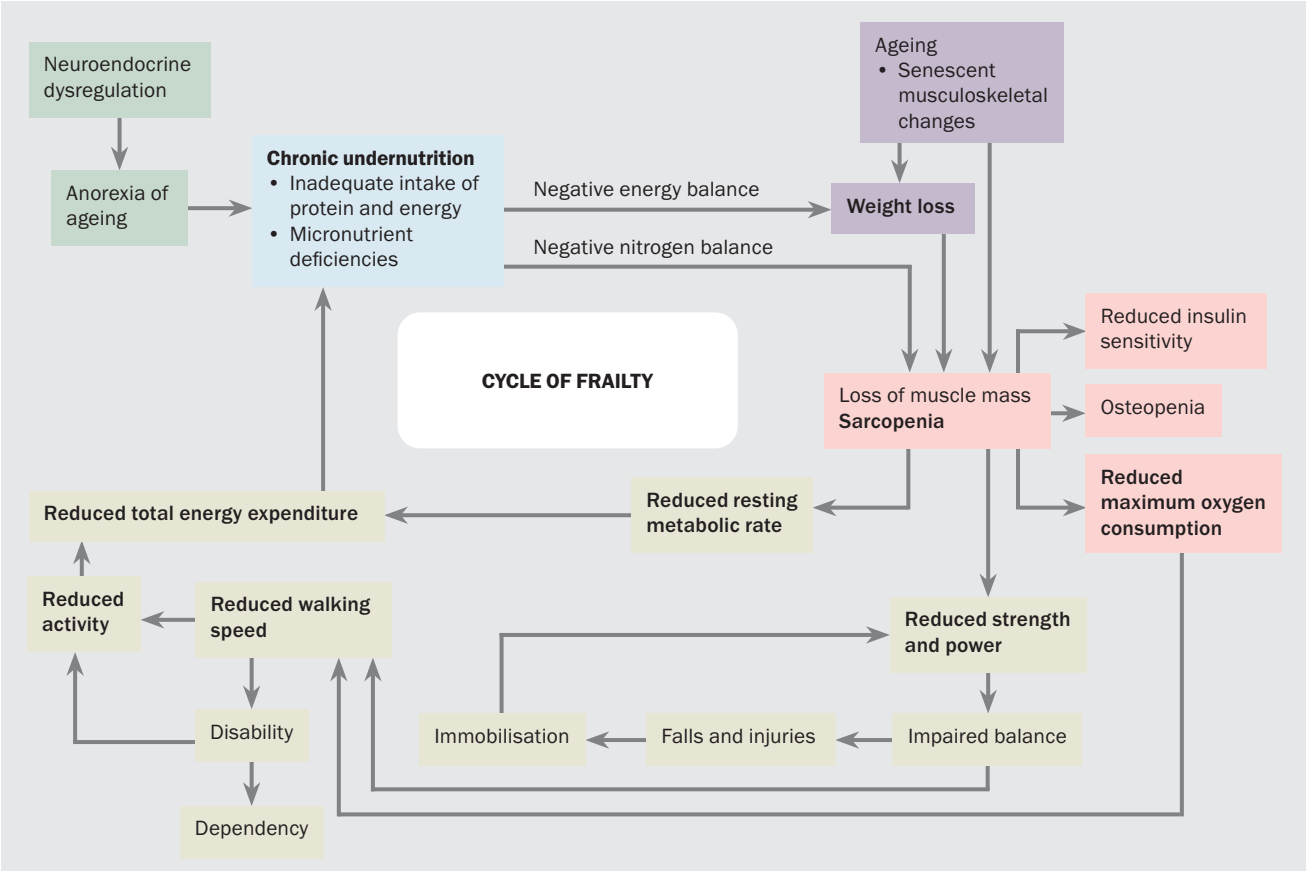

Figure. The cycle of frailty and its interlinked consequences.
Adapted from Fried LP, Tangen CM, Walston J, et al. Cardiovascular Health Study. J Gerontol A Biol Sci Med Sci 2001; 56: 146-156.[17]

frailty.[4] Deconditioning can also mimic long COVID, particularly in older patients and people living with disability.[5]

This article provides recommendations for screening and diagnosis in general practice and highlights the role of multidisciplinary rehabilitation as an important adjunct to medical management for the rehabilitation of patients who experience deconditioning.

What is deconditioning?

Deconditioning is an umbrella term that describes the physical, physiological and functional changes following a period of inactivity and bed rest, usually in the setting of illness or injury.[6] These changes can cause functional decline and contribute to, or exacerbate, disability (Table 1).[6-10] The onset of physiological changes can occur after as little as two days of inactivity, with an association between its severity and the duration of inactivity. A longer duration of inactivity is also associated with a longer than expected recovery period. Deconditioning can be reversed by an increase in activity. Severity and recovery are associated with a patient's premorbid levels of fitness (or frailty) and the degree of superimposed inactivity.[6]

The deleterious effects of hospitalisation and bed rest on older adults have been described in the literature since the 1980's, with 30 to 60% of affected patients requiring assistance with activities of daily living during admission. More than 50% of patients aged 75 years and older require assistance even after hospitalisation and only half of those patients are able to resume their usual functional activities three months after discharge.[11-14] In 2021, deconditioning was the most common diagnosis in those requiring inpatient rehabilitation in Australia and it remains the most common cause of people requiring community rehabilitation services.[15]

What is frailty?

Frailty is a syndrome in which age-related physiological changes are accelerated or exacerbated in multiple body systems, resulting in a loss of functional homeostatic reserve and a reduced resilience to minor stress events. Individuals with frailty are predisposed to adverse health consequences, including sarcopenia, osteoporosis, anorexia, fatigue, and a higher falls risk.[16] These interlinked consequences and the cycle of frailty is best summarised in the Figure.[17]

1. Frailty criteriA

Abnormalities

- Involuntary weight loss of 4.5 kg or more in the last six months
- Reduced grip strength
- Difficulty initiating movements
- Reduced walking speed

Categories of frailty

Fit: 0 abnormalities

Prefrail: 1–2 abnormalities

Frail: 3–4 abnormalities

Adapted from Fried LP, Tangen CM, Walston J, et al. J Gerontol A Biol Sci Med Sci 2001; 56: 146-156.[17]

TABLE 2. ROCKWOOD CLINICAL FRAILTY SCALE[23]

Category	Description
1. Very fit	People who are robust, active, energetic and motivated. These people commonly exercise regularly. They are among the fittest for their age.
2. Well	People who have no active disease symptoms but are less fit than category 1. Often they exercise or are very active occasionally, e.g. seasonally.
3. Managing well	People whose medical problems are well controlled but who are not regularly active beyond routine walking.
4. Vulnerable	People who are not dependent on others for daily help, but whose activities are often limited by their symptoms. A common complaint is being 'slowed up' or being tired during the day.
5. Mildly frail	People who have more evident slowing and need help in high order activities of daily living (e.g. finances, transportation, heavy housework, medications). Typically, mild frailty progressively impairs shopping and walking outside alone, meal preparation and housework.
6. Moderately frail	People who need help with all outside activities and with housekeeping. Inside, they often have problems with navigating stairs and need help with bathing. They might need minimal assistance (cueing, standby) with dressing.
7. Severely frail	People who are completely dependent for personal care, from whatever cause (physical or cognitive). Even so, they seem stable and not at high risk of dying (within approximately six months).
8. Very severely frail	People who are completely dependent, approaching the end of life. Typically, these people cannot recover from even a minor illness.
9. Terminally ill	People who are approaching the end of life. This category applies to people with a life expectancy of less than six months, who are not otherwise evidently frail.

A frailty continuum exists with a significant difference in the level of dependency and disability in the robust (not at risk), prefrail (at risk, exhibiting some frailty characteristics) or frail older adult.[17] Early detection of a patient in the prefrail state reduces risk of progression to frailty and associated dependency and disability.[18] Due to a lower premorbid level of fitness, the prefrail or frail patient is also at increased risk of experiencing deconditioning.

It was estimated in 2018 that about 20% of Australians aged 65 years and older experienced frailty, with a further 48% qualifying as prefrail. Women were found to be twice as likely to experience frailty compared with men and incidence was found to increase with advancing age.[19] In 2019, about 50% of patients who accessed reconditioning programs in Australia were classed as having mild to severe frailty.[15] Australian statistics were higher than global reports, with global incidence of frailty and prefrailty being reported as 43.4%.[20]

Frailty was found to affect almost 40% of patients aged 80 years and older in intensive care units, with most requiring high level residential care (even after recovery from an acute illness). It was also associated with increased morbidity and mortality in this age group.[21]

Studies have shown that older Australians living in residential aged care facilities appear to have higher levels of frailty, with increased time in facilities and age being predictive factors for physical frailty; this suggests that the condition is not being adequately addressed.[22]

Assessment and diagnosis of frailty and deconditioning

Frailty

No single biomarker exists to predict or diagnose frailty, which remains a clinical diagnosis. Several frailty screening and diagnostic tools exist, which vary in length and format (questionnaire *vs* physical assessment). There is no consensus on a gold standard assessment tool.

One of the earliest tools (developed in 2001) defines a frailty phenotype and provides diagnostic criteria, including weight loss, exhaustion, weakness, slowness and low physical activity (Box 1).[17] The Clinical Frailty Index (developed in 2005 and further modified in 2012) is another well-established tool that provides additional grading of the severity of frailty (Table 2).[23] A reported drawback of using these diagnostic tools for frailty screening in clinical practice is the time and labour required for their completion. The FRAIL Scale (developed in 2017) is a validated, shortened questionnaire, which may be a more practical alternative in the primary care setting (Box 2).[24]

Frailty assessment is performed by different clinical specialities for risk stratification and the identification of high-risk patients. Active screening of a person in the prefrail state identifies those in need of further multidisciplinary care, with the aim of reversing the early physical and physiological changes to reduce their risk

2. Frailty Screening tool

Fatigue – Are you fatigued?

Resistance – Are you unable to walk up one flight of stairs?

Aerobic – Are you unable to walk one street block?

Illnesses – Do you have more than five comorbidities?

Loss of weight – Have you lost more than 5% of your body weight in the last six months?

Score: fit = 0; prefrail = 1–2; frail = 3–5.

Adapted from Gleason LJ, Benton EA, Alvarez-Nebreda ML, et al. J Am Med Dir Assoc 2017; 18: 1082-1086.[24]

of progression to established frailty. Once frailty is established, reversal of changes with treatment is slower and patients may not return to their premorbid baseline; however, a prevention of further decline is still achievable.

Deconditioning

A recent systematic review found that no single assessment tool exists that adequately includes all the components needed for a diagnosis of hospital-acquired deconditioning. However, the review outlined the relevant body systems and areas of physical examination to assess in patients who are suspected of having deconditioning.[25] These findings have been adapted with recommendations to GPs on the screening and assessment of deconditioning (Table 3).[25-28]

Implications of walking speed

Walking relies on a combination of functioning musculoskeletal, sensory, neural, cognitive and nutritional factors. The speed of walking has been correlated with functional ability, physiological changes and balance confidence. Therefore, walking speed may be a key clinical indicator of deconditioning and frailty.[29]

TABLE 3. CONSIDERATIONS IN THE ASSESSMENT OF DECONDITIONING [25-28]

Clinical aspects of deconditioning	Assessment of change from usual baseline function
Muscle strength	• Difficulties standing up with folded arms from a chair • Difficulties climbing stairs • Difficulties opening jars (basic indicator of grip strength) • Difficulties lifting or carrying a bag (≥5 kg)
Mobility	• Changes in ability to walk (e.g. need for aids or assistance) • Reductions in walking speed: – ≥1.0 m/sec: associated with independence – ≥0.8 m/sec: associated with community ambulation – <0.8 m/sec: associated with increased disability and mortality • Reductions in walking distance • Changes in walking quality (e.g. leaning or lumbering, hitching hip)
Vasomotor stability/balance	• Increases in the number of falls or fear of falling • Increases in the need to 'furniture surf' to maintain balance • Increases in the need for aids or assistance • Changes in walking quality (e.g. wider base of support, or leaning)
Aerobic capacity/fitness/ respiratory function	• Reductions in exercise tolerance (e.g. shortness of breath on exertion) • Reductions in capacity to perform activities of daily living
Activities of daily living	• Reductions in ability to participate in or complete usual activities of daily living, including personal, domestic, occupational or recreational
Anthropometrics	• Changes in weight • Changes in body mass index • Changes in waist and hip circumference
Skin integrity	• Changes in skin turgor, integrity and fragility • Development of pressure areas • Development of skin tears
Appetite and nutritional status	• Reductions in appetite or oral intake • Changes in ability to meet standard protein intake: – adult females: 0.75 g/kg of body weight/day – adult males: 0.84 g/kg of body weight/day – pregnant or >70 years of age: 1 to 1.3 g/kg of body weight/day
Incontinence	• New incontinence, particularly urge incontinence (i.e. being unable to mobilise to the bathroom in time)
Cognition and psychological health	• Changes in usual cognitive function • Changes in mood, anxiety or sleep pattern

Management

Deconditioning and frailty are both complex multisystem conditions. Clinical practice guidelines for frailty outline the strong and conditional recommendations for its management.[30] Although the management of frailty is beyond the scope of this article, there are key concepts of managing frailty that also apply in the prevention of physical and physiological changes associated with deconditioning. These concepts include multidisciplinary care, exercise, nutrition and adequate supports.

3. ROLES OF MULTIDISCIPLINARY TEAM MEMBERS FOR THE MANAGEMENT OF DECONDITIONING AND FRAILTY*

GP and specialists
- Screening and diagnosis of deconditioning and frailty
- Assessment and management of underlying or contributing medical conditions
- Medication review in the setting of polypharmacy
- Screening for cognitive changes
- Symptom management to enable participation in exercise
- Referral to appropriate multidisciplinary team and allied health specialists

Physiotherapist
- Assessment and management of specific physical impairments as a result of illness (e.g. muscle strength, balance, sensory loss, contractures and mobility)
- Gait retraining, including appropriate prescription of motility aids as required
- Falls prevention strategies in the community and home
- Individualised graded exercise program targeting strength, balance, flexibility and aerobic capacity

Exercise physiologist
- Individualised graded exercise program targeting strength, balance, flexibility and aerobic capacity
- Falls prevention strategies in the community and home

Occupational therapist
- Assessment and management of functional deficits in ability to perform activities of daily living
- Falls prevention strategies in the community and home
- Pressure injury prevention and care
- Cognitive rehabilitation (cognitive retraining, or compensatory and adaptive cognitive strategies)

Dietitian or nutritionist
- Assessment and management of existing nutritional deficits with particular attention to adequate daily protein and caloric intake, adequate micro- and macronutrients, wound healing and management of constipation
- More than standard recommended daily protein intake may be required for patients in catabolic states (e.g. acute illness, wound healing, cancer) or if aiming to increase muscle mass (i.e. resistance training)

Clinical psychologist
- In-depth assessment to address possible associated mood changes or adjustment difficulties with deconditioning and frailty and its impact on independence
- Strategies to manage sleep disturbances

Social worker
- Counselling support and adjustment
- Provision of social, domestic, transport or personal support services, where appropriate

Nurse
- Wound management
- Clinical support and advice for incontinence management

* This list includes commonly referred to disciplines but does not include all possible allied health specialists.

Multidisciplinary care

Deconditioning and frailty are complex multisystem conditions that require patient-centred multidisciplinary care to address the systemic changes involved (Box 3). GPs are experts in co-ordinating and overseeing this style of healthcare, with the provision of screening, routine healthcare, chronic disease management plans, care plans and referrals.

Exercise

The reintroduction of activity and exercise is important. Exercise should be individually prescribed, graded and progressive to ensure it is safe and approachable. For example, lower limb strengthening and balance exercises combined with walking can improve physical performance and quality of life in older patients in hospital, compared with standard care.[31]

Although exercise involves a combination of flexibility, balance, resistance and aerobic training, some guidelines suggest resistance and balance training should precede aerobic training.[29,32] An allied health professional (e.g. physiotherapist or exercise physiologist) can provide an individualised, graded exercise program that is monitored and adapted based on the patient's condition and progress.

Nutrition

Evidence for the benefits of nutritional intervention is mixed due to various confounding factors, such as the duration and type of nutritional intervention and the pretreatment status of participants. Nutritional intervention should be combined with exercise and other multidisciplinary care.[29] Higher levels of daily protein intake are required in the setting of muscle accretion (from 1.6 to 2.2 g/kg/day).[33,34] The International Society of Sports Nutrition suggests even higher levels of daily protein intake (2.3 to 3.1 g/kg/day) are necessary for patients who are exercising during hypocaloric states and should be considered in patients with an underlying catabolic condition.[34]

Multiple nutritional interventions are available, most commonly as nutritional education and counselling, supplementation of micronutrients (e.g. vitamin D, multivitamin or omega-3 fatty acids), daily food fortification with protein supplements and specific nutritional supplemental formulas.[35]

Preliminary research has suggested that leucine (an amino acid found in unprocessed beef, oily and white fish and bread) may play an important role in preventing age-related physical decline, with studies

suggesting higher dietary leucine intake is associated with a reduced risk of frailty and improvements in functional performance and lean muscle mass.[36,37] A dietitian or nutritionist can offer tailored advice and regular monitoring to patients.

Adequate supports

Psychosocial factors should also be considered. Both deconditioning and frailty increase the likelihood of dependency and disability. Patients may struggle with activities of daily living (including self-care and domestic tasks) but not have access to formal (services) or informal (family and friends) supports. Patients may also experience secondary psychological stressors, such as associated mood changes, difficulty with adjustment following illness and loss of independence, as well as new sleep disturbances and insomnia. Cognitive changes can impact a patient's function and their safety in the community should be assessed. If not addressed, these additional factors can affect treatment compliance and outcomes.

Conclusion

Deconditioning results from prolonged inactivity, immobility, or bed rest and is associated with acute or chronic illness and social isolation. It is a complex syndrome involving multiple systems, resulting in physical and physiological changes, functional decline and disability.

The impact of deconditioning following hospitalisation and bed rest is well established, but recent data from the COVID-19 pandemic have highlighted that the risk also extends to people in the community – particularly, older or vulnerable adults and those at risk of frailty. The GP has an important role in identifying and diagnosing deconditioning. Early identification and multidisciplinary management are associated with faster recovery in affected patients. MT

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A list of references is included in the online version of this article (www.medicinetoday.com.au).

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