

## ABSTRACT

In Singapore and worldwide, large numbers of people live with disabling illness. In the first part of this paper, we address the assessment of activities of daily living (ADL). Disability charting is important as a clinical tool to document functional recovery as well as to assess the effectiveness of medical and rehabilitation interventions. Disability assessment is also important epidemiologically, in developing social policies, planning disability resources and in medical research and education. We review the concepts and general principles of disability assessment with reference to the WHO International Classification of Functioning, Disability and Health (ICF) as well as to local contexts. We also describe in further detail 6 basic ADLs of feeding, dressing, toileting, transfers and mobility used in disability-related national schemes.

In the second part of this article, we introduce how the concepts of frailty have changed the paradigm in which we approach geriatric rehabilitation, through interactive overlaps with the psychosocial, disability and comorbidity domains. We describe the consequences of functional deterioration in the frail elderly, and how to screen for frailty. We also outline therapeutic exercise as a form of prehabilitation to improve the resilience of these vulnerable people and possibly return them to robust health. Family physicians are best equipped in the management of frailty, as they have the holistic and comprehensive medical skill set to treat the associated comorbidity, disability and psychosocial domains in integrative geriatric rehabilitation.

**Keywords:** Functioning, disability and health, disability assessment, disability charting, basic activities of daily living, frailty

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## INTRODUCTION

The World Health Organization (WHO) recently published the World Report on Disability<sup>1</sup>. This landmark paper reports that the burden of global disability is staggering, with an estimated one billion people or 15% of the world's population experiencing mental or physical disabilities<sup>1,2</sup>. Further, 190 million people worldwide have severe disabling illness which impact considerably on survival, daily function, employment and quality of life<sup>2</sup>.

The prevalence of disability in Singapore is rapidly increasing for two major reasons. Advances in acute medical care result in

a larger proportion of patients with chronic diseases surviving with residual impairments and disability. In addition, the ageing of the population also results in the exponential increase of the disability burden due to the direct association of increased chronic disease incidence with the more elderly<sup>3</sup>. However, it is a common misconception that disability only occurs in the elderly and preliminary local data indicate there are large numbers of disabled younger adults as well, particularly with stroke, spinal cord and traumatic brain and musculoskeletal injuries<sup>4</sup>.

Disability results not only in individual loss of self-esteem and quality of life, but also increases tremendously the social and financial burdens of their involved families, society and the country-at-large<sup>5</sup>. Families need to adjust their expectations and care for the disabled, resulting in changes of family routine and activities, as well as often a loss of income as a direct or indirect consequence of loss of time available for remunerative employment<sup>5,6</sup>.

## OVERVIEW AND FRAMEWORK OF DISABILITY ASSESSMENT

The need for accurate determination of disability arose in the early 1900s during the industrial revolution whereby a worker sustaining a work-related injury resulting in a medical impairment which affected his employability could seek redress from the courts<sup>7</sup>. This led to the development of workers' compensation systems in many countries and the Ministry of Labor in Singapore has recently released updated guidelines<sup>8</sup>. Accurate determination of disability became essential because of the direct correlation between the degree of disability and quantum of financial remuneration common in these guidelines.

The further need and development of disability assessment moved in tandem with the exponential increase in medical knowledge as well as a worldwide change in disease profile in developed countries from one of infectious disease and *death*, to chronic disease and *disablement*. Singapore shares a common trend with most developed countries whereby the principle causes of morbidity and mortality (accounting for more than 80%) are non-communicable diseases including cancer, coronary artery disease, stroke, diabetes, hypertension and injuries.<sup>9</sup> This has led to spiraling health care costs for health-care systems and governments for managing both the disease itself, and the costly burden of managing the consequence of disability. The current urgent need for disability assessment could be summarised thus<sup>1,10</sup>:

1. Epidemiologic data in population studies and to establish the extent of disability burden.
2. Clinical tool both to measure baseline disability, the natural recovery of chronic disabling illnesses, as well as to assess the effects of the wide array of medical and rehabilitation interventions available on disablement.

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3. Research tool for outcome measurement and factors that impact on disability.
4. Social policy instrument in planning for health care funding, insurance systems and formulation of health-care policies
5. Educational tool in medical school curriculum design as well as for advocacy and the raising of social awareness of the disabled.
6. In the local context, disability assessment is required for many insurance and funding schemes. Family Physicians may be involved in certifying disability in the ElderShield/ Interim Disability Assistance Programme for the Elderly (IDAPE), Disability Protection Scheme (DPS), Primary Care Partnership Scheme (PCPS), the Foreign Domestic Worker (FDW) Levy Concession, handicapped parking labels and claims for Handicapped-Related Tax Reliefs. In the near future, many other initiatives such as transport subsidies for the disabled administered through the Ministry of Social and Family Development also require disability assessment.

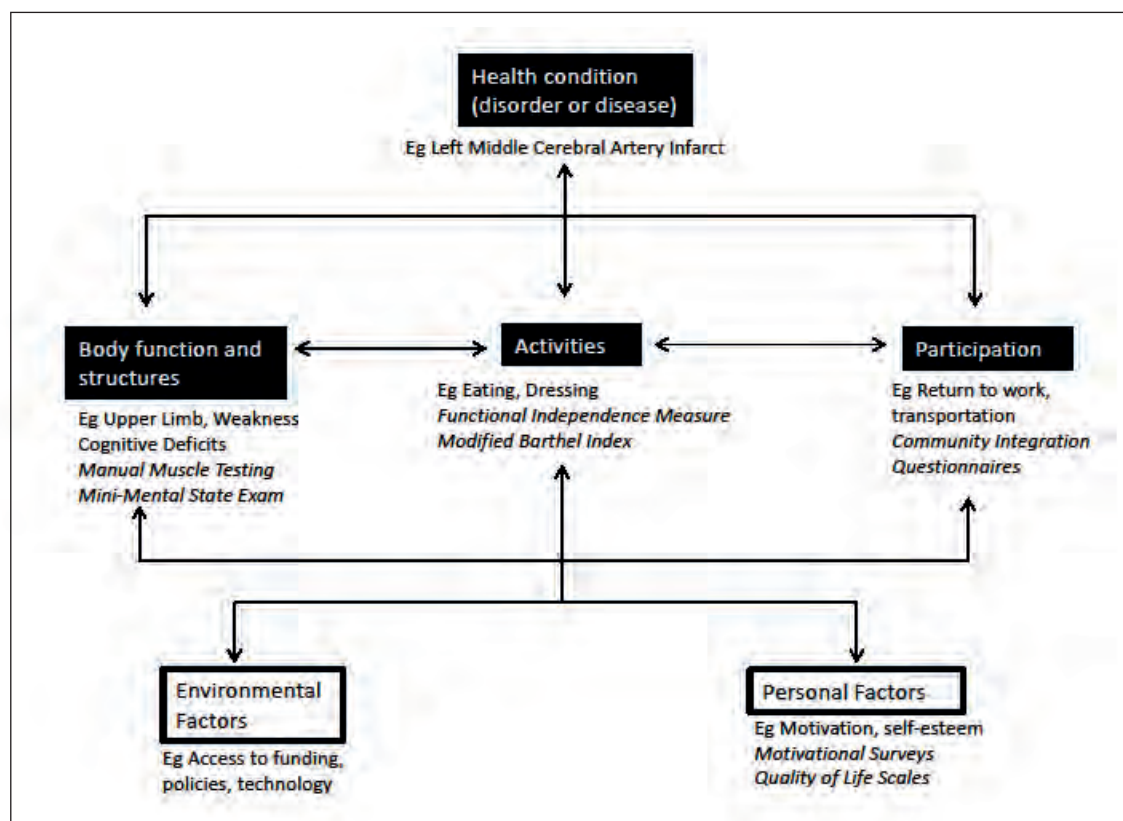
The World Health Organization (WHO) has recognised this need and continually develops conceptual disablement models for international acceptance and use and these frameworks are employed in the development of various disability measures. The International Classification of Impairments, Disabilities and Handicaps (ICIDH) developed by WHO in 1980 describes consequences of disease and disablements and is still used in the American Medical Association Guides to the Evaluation of Permanent Impairment (AMA guides)<sup>2,11</sup>. The International Classification of Functioning, Disability and Health (ICF) developed in 2001 and detailed in the World Report on

Disability focuses on the components of health rather than the consequence of disease. It also further recognises the important role of the contextual environmental and personal factors which may include human and technological social support systems which impact on health (Figure 1)<sup>1,12</sup>. In addition, a comprehensive hierarchical coding system which includes codes for body structures and functions, various ADLs and the severity of the disablement are described, and these codes can be expanded to great detail allowing for further development. The ICF has been adopted by more than 190 countries throughout the world and its key elements have been incorporated into various disability assessment scales for use by clinicians and administrators involved in health-care. Importantly the concept of disability has changed from simply an inability to perform ADLs, to a paradigm that includes impairment of body structure and function, activity limitation and participation restrictions<sup>1,12</sup>.

## CURRENT DISABILITY ASSESSMENT TOOLS

Using definitions from the ICIDH and ICF models, the assessment of disability involves *strictly* the assessment of the severity of activity limitation including ADLs, and *not* the assessment of the severity of loss of body structure or function (or termed impairment in the older ICIDH model)<sup>12-3</sup>. For example, in the common scenario of a patient who has a left middle cerebral artery stroke resulting in a right hemiparesis, it is not an assessment of degree of loss of strength of the right arm (loss of body structure/function), but an assessment of the

**FIGURE 1. THE WORLD HEALTH ORGANIZATION (WHO) INTERNATIONAL CLASSIFICATION OF FUNCTIONING, DISABILITY AND HEALTH (ICF)**



amount of assistance a subject requires to dress himself or groom himself *because* of the loss of strength in the right arm (activity limitation). This is important conceptually because the loss of body structure/function or impairment may *not* correlate to disability and activity limitation and it is the severity of disability that is far more important in the determination of caregiver and societal burden<sup>14</sup>.

Unfortunately, there is no consensus in the rehabilitation or geriatric literature as to what constitutes the core group of ADLs that need to be measured. However most authorities and texts agree that ADLs can be divided into the following<sup>15</sup>:

1. Basic ADLs (BADL). These can include some or all of these activities deemed critical to basic self-care:

- i. *Self-care*: Eating, Grooming, Bathing, Dressing, Toileting.
- ii. *Continence*: Bladder and Bowel Continence
- iii. *Mobility*: Transfers (for example bed to chair, chair to toilet seat), Walking or Wheelchair Use, Climbing Stairs
- iv. *Cognition*: Communication including Comprehension, Expression, Memory and Simple Problem Solving.

2. Instrumental ADLs (IADL) or Extended ADLs (EADL)

This list is long but generally involves more complex activities such as food preparation, medication use, telephone use, transportation use, housekeeping and laundry.

3. Community Reintegration and Participation Activities

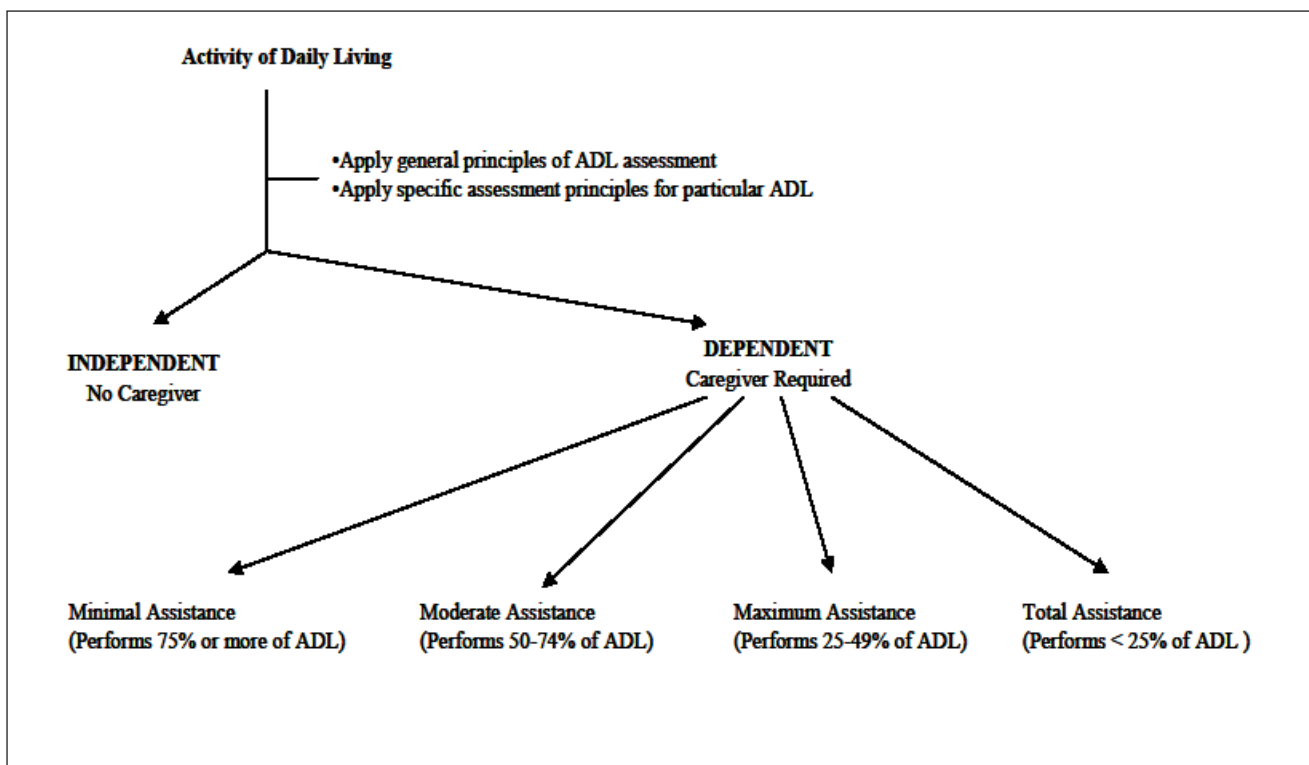
These form the highest tier of activities in daily living and include employment, leisure activities and various recreational activities.

Instruments exist that measure any or all of these three categories

of ADLs. For the purposes of this discussion, we focus only on tools that measure BADL as these have the most direct and significant impact on caregiver burden. BADL assessment is also directly relevant in the disability assessment for the disability-related national schemes (DRNS).

There are only two major general BADLs scales of disability used consistently throughout the world presently and these are the Barthel Index (BI) and the Functional Independence Measure (FIM), both of whom have undergone modifications and revisions over time<sup>16-9</sup>. Both these scales also have good test-retest and interrater reliability, content validity for the measurement of activity limitation and are sensitive to changes over time<sup>19</sup>. Importantly, there is a direct correlation between the severity of activity limitation and ADL performed and the amount of care required<sup>5, 14-20</sup>. The BI has the following items: eating, grooming, bathing, dressing, toileting, maintenance of bowel and bladder continence, transfers and locomotion. The more recently developed FIM has similar items to the BI but further include items on cognitive BADLs such as communication skills, problem solving and memory. This reflects principles explored in the ICF that these cognitive BADLs are not only essential to everyday living and can impact on the better-known physical BADLs<sup>1,18</sup>. The BI and the FIM have shortened versions which are also valid and reliable in measuring BADLs<sup>21</sup>. Similarly, the current DRNS including ElderShield/ IDAPE, DPS, PCPS and the FDW levy concession and claims for handicapped-related tax reliefs employ<sup>6</sup> selected BADL items in *bathing, dressing, feeding, toileting, transferring* and *mobility* these items are essentially part of the BI and FIM.

**FIGURE 2. GENERAL SCHEMA OF DISABILITY ASSESSMENT FOR EACH ADL FOR THIS ARTICLE TEXT**



## DISABILITY ASSESSMENT: GENERAL PRINCIPLES OF DISABILITY ASSESSMENT

(In the subsequent discussion that follows, ADL is synonymous with BADL)

We provide a general applicable framework for the subsequent discussion on disability assessment (Figure 2 and Table 1). Our aim is to illustrate the key concepts of disability assessment rather than follow any particular disability scale. Throughout, we advocate the use of the terms *dependence* and amount of *assistance* rather than terms indicating the amount of *ability* in each ADL (Table 1). This is because the aims of disability assessment used in the original (including the WHO-ICF, BI and FIM instruments) and usual contexts is to correlate to the burden of care required<sup>1, 14-20</sup>.

Each ADL is first categorised into an independent versus dependent group (Figure 2). This dichotomisation is critical and this distinction is consistent in the disability assessment literature<sup>14-20</sup>. **Independence** is the performance of an ADL *without* the need for a helper *regardless* of whether aids (such as modified eating utensils or walking frames) are used. **Dependency** is defined as the need for assistance from a helper and so indicates presence of caregiver burden.

Total assistance or disability is clearly distinct in disability assessment. The degree of disability and the categorisation of amount of assistance between the two extremes of independence and total dependence however is subjective. The continual refinement and advancements in disability assessment aim to improve the objectivity in assessing these shades of grey<sup>22</sup>.

In this paper, we group each ADL into 4 generally accepted dependent categories for ease of discussion.

In summary then, we have 1 independent and 4 dependent categories (Figure 2 and Table 1) for the discussion that follows<sup>14-20</sup>. These are:

1. Independence: No helper or assistance required.
2. Dependent: Minimal Assistance: Subject does 75% or more of the ADL.
3. Dependent: Moderate Assistance: Subject does 50 to 74% of the ADL.
4. Dependent: Maximal Assistance: Subject does 25 to 49% of the ADL.
5. Dependent: Total Assistance: Subject does less than 25% of the ADL

**General principles** follow:

1. Assess and score what the subject actually does and *not* what the subject can do.

It is important to differentiate between *capacity* (what the subject can do) and *performance* (what the subject actually does). This is because performance and *not* capacity determines caregiver burden.

Examples are:

- i) *Both* cognitive/mental and physical impairments should be taken in consideration for each ADLs. In patients with dementia, they may be able to wear a shirt independently in

front of an assessor (capacity), but are fully unable to do so at home because of memory impairment, severe apraxia or significant depression (performance). The subject should be scored as maximal or total assistance (performance).

- ii) A spinal cord injured patient with complete paraplegia may be able to propel a wheelchair more than 50 meters in a gym or a straight well-paved corridor. However, he is unable and does not want to do so at home because of multiple steps, small doorways or cramped confines of a single-room flat. He should be scored as maximal or total assistance (performance) because of the large caregiver burden required for household ambulation as part of his ADL.

2. Score the lowest or maximal assistance for that particular ADL if the performance on that ADL fluctuates<sup>16-8</sup>.

This is to ensure a fair appraisal of the subject's performance and to reflect caregiver burden. Examples include:

- (i) In a patient has severely impaired vision due to advanced diabetic retinopathy or cataracts, he may be able to transfer from bed to chair with minimal assistance in the daytime but requires maximal assistance at night because of the high risk of falls. He should be scored as maximal assistance required for transfers.
- (ii) If a patient has advanced rheumatoid arthritis of the hands and requiring maximal assistance in the morning in eating because of early-morning stiffness or fatigue but subsequently performs better in the evening, he should be scored as requiring maximal assistance in eating.

3. If an ADL has more than one component, the lowest or maximum assistance required for a particular component is the score for the ADL. Examples include:

- (i) If a patient with a stroke requires only minimal assistance with dressing of the upper body such as wearing a shirt but requires moderate assistance in dressing of the lower body such as wearing of trousers, then the score should be moderate assistance in dressing.
- (ii) Likewise if a subject needs only minimal assistance to move from bed to chair, but moderate assistance from chair to bed, he should be scored as moderate assistance for transfers.

4. Supervision (no contact required) is considered minimal assistance. If two persons are required for a ADL, this automatically is scored total assistance.

5. If there is doubt in the scoring of a particular ADL, it is helpful to rephrase the question from 'how much can the subject perform' in that ADL to 'how much assistance from the caregiver' is required, as the major goal of the disability assessment is to determine caregiver burden.

## PRACTICAL ADMINISTRATION OF DISABILITY ASSESSMENT: ASSESSMENT OF THE SIX ITEMS OF BASIC ACTIVITIES OF DAILY LIVING IN DETAIL

In this article, we focus on 6 core ADLs of *bathing, dressing, feeding, toileting, transferring* and *mobility* as they form the main



TABLE 1. SUMMARY AND COMPARISON CHART OF INDICES OF DISABILITY ASSESSMENT IN ADULTS

Terms and Definitions used in this Article Text		Detailed Definition based on Amount of Assistance*	Definition based on Ability*	Arranged from latest → earliest time of development**				
Percentage of ADL Performed	Definition based on Amount of Assistance*			FIM†	MBI‡	BI§	BI	Katz#
All	Independent	Independent	Able <i>Independent</i>	7	5	3	2	Independent
		Modified Independence		6				
All	Minimal Assistance	Supervision	Partially Able <i>Some help or Supervision is needed</i>	5	4	2	1	Dependent
75% or More		Minimal Assistance		4				
50 to 74%		Moderate Assistance		3	3			
25 to 49%	Maximal Assistance	Maximal Assistance	As Good As Not Able <i>Need someone to help most of the time</i>	2	2	1		
Less than 25%	Total Assistance	Total Assistance	Not Able <i>Not able to do at all</i>	1	1			

\* In general, definitions based on the amount of assistance are preferable compared to definitions based on ability. This is because the amount of assistance better reflects the amount of caregiver burden required and had been the original aims of most of the disability scales. This does not follow the Eldershield categorization strictly as it is intended rather to provide a conceptual correlation to other scales. Words in italics in this column indicated suggested categories as in Eldershield.

\*\* Various widely-used disability scales arranged from latest to earliest time of development. Note that the numbers in the columns do not refer to the points scored, but the grouping of disability categories.

† FIM: Functional Independence Measure. Note that the FIM categories correspond to the column 'detailed definition based on amount of assistance'. Each ADL is scored from 1 to 7.

‡ MBI: Modified Barthel Index. Each ADL is grouped in 5 disability groups, however the weightage is different for the ADLs. For example, eating and toileting points range from 0 to 10 points (0,2,5,8,10 points respectively) whereas transfers and ambulation range from 0 to 15 points (0,3,8,12,15 points).

§BI: Barthel Index. ADLs for eating, toileting, dressing, bladder, bowel and stair climbing are grouped into 3 groups (0,5,10 points).

||BI: Barthel Index ADLs for toileting, bathing, and locomotion are grouped into 2 groups (0,5 points)

# Katz Index of Independence in ADLs. The Katz Index simply dichotomizes ADLs into independency or dependency and then groups all ADLs to give a summary group of A to G to determine the degree of disability.

items required in DRNS. We use Figure 2 and the first 2 columns in Table 1 as the basis of the discussion that follows. We also arrange the 6 ADLs in order of difficulty consistent with prior disability assessment scales<sup>14,20</sup>.

In each ADL, decide firstly whether the subject performs the task independently or is dependent, and then determine the level of dependence.

## FEEDING

**Definition:** Ability to feed oneself food after it has been prepared and made available. The assessment begins when someone places the food within the reach of the patient<sup>16,18</sup>. It involves the following subcomponents: cutting up the into bite-size portions, bringing food to the mouth with the use of utensils, chewing and swallowing it safely. If a subject relies on other means of feeding, usually a nasogastric tube, then the

assessment is how the subject administers the feeding himself.

**Practical Points:** First decide whether a helper needs to be present at all during the actual eating process to decide between independence and dependence. Amongst the 6 ADLs discussed, the amount of assistance is probably the most subjective for feeding. The final score needs to take into account the subcomponent with the most assistance needed.

**Independence** is then the ability to cut food, bring food to mouth, chew and swallow without a helper needing to be present. This is regardless if adaptive cutlery (for example long handled or built up forks and spoons) is used. If a subject feeds via a nasogastric tube, he must be able to pour the enteral feed down the tube independently. This usually requires an additional funnel to guide the feed down to the tube and he

should hold the funnel independently together with the nasogastric tube.

**Dependence** means a helper needs to be present during the feeding process. The following are some useful guides. Minimum assistance implies that set-up in the eating process is required. This includes the helper opening containers, cutting meat, pouring liquids or helping the subject wear a cuff to hold utensils. The need for preparation of modified food consistencies such as a pureed or thickened diet would be considered minimum assistance. We would consider maximal assistance if the helper needs to scoop food onto a spoon repeatedly before the subject brings the spoon to his mouth. Examples of total assistance include the need to manually feed every mouthful or the need to check the mouth for residual food with each mouthful or the need to prompt safe swallowing with each swallow to prevent choking (for example the need to remind the patient to chin tuck and do a double swallow with each swallow).

**Example:** A patient has severe rheumatoid arthritis of hands. She needs assistance in cutting up food and opening containers due to restriction in hand dexterity. However she can bring the food to her mouth by herself, chew and swallow safely any consistency of food. This would be considered minimal assistance. If however she has temporo-mandibular joint involvement and has a lot of pain in chewing and requires checking at every mouthful for residual food to prevent choking, this would be total assistance.

**Other Points:** Some texts consider independence of eating regardless of food consistency so long as the subject does not require a helper present<sup>18</sup>. We disagree as this represents a limitation of the swallowing component of eating and caregiver burden is present.

## DRESSING

**Definition:** Ability to put on, take off, secure and unfasten upper and lower body garments. Garments will include prostheses (artificial limbs), orthoses (braces such as a thoracolumbar corset), and specialised garments which are deemed necessary for the patient such as compression stockings for lower limb oedema. The patient should be assessed on clothing that he wears on a regular basis and of appropriate decency if he appears in public. We do not recommend that the wearing of undergarments and of footwear be considered as this complicates the assessment.

**Practical Points:** Divide the task first into upper and lower body dressing and score the amount of assistance required for each. Subsequently score the lower of the two scores as the ADL score for dressing. Lower body dressing is usually more difficult<sup>18,19</sup>.

**Independence** is then the ability to dress the upper and lower body completely without the need for an assistant. The subject may use aids such as a long-handled reacher to pull up his trousers if he is unable to bend his trunk.

**Dependence** means that a helper is required and may range from minimal assistance whereby a helper instructs verbally the steps required to put on clothes or total assistance. If the degree of assistance becomes difficult to assess, we suggest dividing the

garments in parts:

**T-shirt:** 3 parts: (1) thread the right sleeve, (2) left sleeve and (3) pull it down the head and body.

**Buttoned shirt:** 4 parts: (1) thread the right sleeve, (2) left sleeve, (3) pull the shirt across the body and (4) fasten (or unfasten) the buttons.

**Shorts:** 3 parts: (1) thread through the right leg, (2) left leg and (3) pull the shorts up over the pelvis.

**Buttoned or zipped trousers/pants:** 4 parts: (1) thread through the right leg, (2) left leg, (3) pull the trousers/pants up over the pelvis and (4) fasten (or unfasten) the buttons or zips.

Example: The stroke patient with a left hemiparesis wears a T-shirt and a pair of zipped pajama pants at home and in public. He is able to thread the left sleeve of the T-shirt with his good arm, but not the right sleeve of his T-shirt. He is however to pull the T-shirt over the head and down the body once the helper threads the right sleeve of his T-shirt for him. So for upper body dressing he performs in 2 out of 3 parts = 66.6% of the ADL = *moderate* assistance.

He is however not able to reach and thread the shorts through his right leg and left leg, but is able to pull up the pants over his trunk once it is threaded. He also needs help to pull up his zipper. For upper body dressing he performs only 1 out of 4 parts = does only 25% of the ADL = *maximal* assistance.

His score for dressing would then be *maximal* assistance based on the lower score.

**Other points:** Garments, which are deemed necessary for the patient's condition, are best scored as an able or not able situation. For example, a patient has been prescribed a rigid thoraco-lumbar orthosis for severe osteoporosis of the spine with compression fractures for prevention of further deterioration and is instructed to wear it. If he is unable to put it on himself, then this should be scored as total assistance and the score for dressing will be total assistance *regardless* as to the score for wearing of the clothing.

Garments that are *not* absolutely necessary for the patient's condition, for example a sports-type knee brace that the patient wears for warmth and comfort for osteoarthritis of the knee should not then be taken into consideration in the assessment for dressing.

## BATHING

**Definition:** Ability to wash or bathe in a bathtub, shower or sponge/bed bath. This has the 3 subcomponents of washing, rinsing and drying. For practical purposes, it is reasonable to assess bathing below the neck only.

**Practical Points:** *Independence* is then the ability to *wash, rinse and dry* the body without the need for a helper. This is regardless of whether the subject bathes himself in a tub, showers or does a bed-bath.

**Dependence** indicates the need for a helper. If the amount of assistance proves difficult to establish, we suggest dividing the

body into ten parts. The 10 parts are the left arm, the right arm, the chest, the abdomen, the front perineal area including the genitalia, the back perineal area including the buttocks, the left upper leg, the right upper leg, the left lower leg/foot and the right lower leg/foot. Note that portions of a body part will be considered as unable, so the ability to wash only half the chest is considered as the chest is not washed.

**Example:** A patient who has a dense left hemiparesis can only wash, rinse and dry his left arm and chest with his right arm. He is unable to wash his right arm, abdomen, perineal region and unable to reach both the lower limbs. He performs only 2 out of 10 required steps = 20% of the ADL performed = *total* assistance

**Other Points:** The back is excluded from bathing because healthy non-disabled people may be scored as disabled! Many people do not wash their back every day or use an assistive device like a long-handled sponge. A clearer picture of disability will result if the back is not included.

The face and neck is excluded because of two reasons. Firstly, in many of the ADL scales including the BI and FIM, washing the face and neck is a separate ADL assessment in *grooming*, and grooming may further include brushing the teeth, shaving and washing the hair. Secondly, washing the neck and the face has a fairly strong functional overlap with eating and the functional scores generally correlate. The aim of this particular ADL assessment is to assess the disability in bathing in isolation.

Note that the definition of bathing includes *wash, rinse and dry*. The amount of assistance is often under-estimated because a subject may be able to wash, but has difficulty manipulating a towel to dry. This should be scored as unable to bathe in accordance to the general principles described above.

## TOILETING

**Definition:** Ability to use the lavatory and manage bowel and bladder hygiene. It consists of 4 steps: (1) maintenance of balance, (2) adjusting clothing before using a toilet, (3) maintaining perineal hygiene and flushing the toilet and subsequently (4) adjusting clothing after using the toilet. The definition remains the same if a bedpan or commode is used. If a bedpan or commode is used, then step (3) would be the need to clear the bedpan and commode as well.

By strict definition, do *not* take into account other aspects of toileting. This includes:

- Transferring from a bed or chair onto the toilet seat. This would be assessed under transfers.
- The actual bladder or bowel function including whether the subject is continent, leaks, soils the bed or uses a catheter. This is more correctly assessed under bladder and bowel continence.

By definition, it *includes* however:

- Maintaining the balance during clothing adjustment and the actual act of urination and defaecation.
- Perineal hygiene issues including using toilet paper to clean

the perineum and the ability to flush the toilet or clear the bedpan.

If a subject uses a diaper, then the assessment includes the entire process of removing the diapers, perineal hygiene, putting on a new diaper and discarding the old diapers.

If a subject is on a long-term indwelling catheter, do not assess the component of changing the catheter under toileting, as there is usually no caregiver burden involved. If a subject is on self intermittent catheterisation, then he should be assessed as per the definition of toileting given above.

**Practical Points:** To determine the level of assistance, required, it is often useful to divide the ADL into 4 steps listed above. For ease of assessment, a part of a component that is not performed should be scored as not performed.

**Independence:** No helper required to perform all 4 steps.

**Dependence:** Minimal, moderate, maximal and total assistance would then be the inability to do 1, 2, 3 or all 4 steps described in the practical points above.

**Examples:** A bedbound severe stroke patient who requires a helper to change his diapers is assessed as total assistance. Another stroke patient who uses a bedpan can remove and put on his clothing but requires a helper to lift his pelvis onto a bedpan (balance), and clean his perineum and carry the bedpan away after use. This implies that he can do 2 out of 4 steps and this would be considered moderate assistance. If the same latter subject can only thread one leg during the removal and putting on of his pants, he would be considered as unable to do these steps as well. This would imply that he can do none of the 4 steps and this would then fall under the total assistance category.

**Other Points:** Not all disability assessment scales require the ability to flush the toilet or clear a bedpan<sup>18</sup>. We believe that this should be included in the definition for hygiene reasons!

## TRANSFERS

**Definition:** All aspects of transferring from bed to a chair or wheelchair and back to a bed. This tests several skills including doing first a sit-up from a lying position, a sit to standing position, a weight or pivot shift and a controlled descent to a sitting position in another location.

**Practical Points:** The heights of the bed and chair are often different and the assessment should score the direction of transfer that comprises the most difficulty. In a hospital, the bed is often higher than the chair and it is more difficult to get back to the bed from a chair. In homes where mattresses are often placed directly on the ground (futon-styled beds) the opposite occurs.

**Independence:** To transfer from bed to chair and vice versa without the need of a helper. If in a wheelchair, then approaches, locks brakes, removes foot and arm rests and does a

transfer often with a sliding board. Regardless, all these are done independently.

**Dependence:** Minimal assistance means requiring only coaxing, cuing or at most steadying assistance to guide the subject to transfer. If the body requires support during transfer, this indicates moderate assistance. If a lot of weight is required to support to body or the legs need to be supported as well, this would indicate maximal assistance. Total assistance means that one helper is insufficient to do the transfer or the subject is unable to transfer regardless of assistance.

**Other Points:** The act of transferring is basic and critical in ADL. Many of the other basic ADLs such as eating, bathing, toileting require an initial act of transfer to a sitting position prior to ADL performance. This importance is recognised in many scales including the BI and its modifications whereby a higher weightage is given to transfers compared to the ADLs<sup>16-7</sup>. In other instruments such as the FIM, there are three types of transfers including the transfer from bed to chair, transfer to a shower or a bathtub and transfer to a toilet and hence the ADL 'transfer' is triple the weightage of other ADLs<sup>18</sup>. Transfer from bed to chair or wheelchair is often the most important, common and difficult, and hence this particular transfer forms the definition for this article.

## MOBILITY

**Definition:** The act of walking, once in a standing position. If a wheelchair is used for locomotion, assessment commences only from a seated position on a level surface. The distance that is considered significant is controversial (see *other points* below). For this article, we use a distance of 8 meters as significant. This would be approximately the end-to-end distance between 2 HBD apartment rooms, or twice the length of an average size GP clinic.

**Practical Points:** Record the score with the mode of locomotion that the subject uses most often, either walking or wheelchair. The distance that is considered significant is the same for walking or wheelchair mobility. The discussion that follows applies for both forms of locomotion.

**Independence:** The ability to walk independently 8 meters. This is regardless of walking aid used and the speed of walking. Common walking aids are a cane (single-point stick), quad (4-point) stick, forearm or elbow crutches, axillary crutches and a walking frame (with or without wheels, the latter termed a rollator frame).

**Dependence:** Minimal, moderate and maximal assistance all indicate that the subject is still able to walk 8 meters but a helper needs to assist. Minimal assistance indicates usually contact guarding and gentle guidance to prevent falls. Moderate and maximal assistance imply that the weight of the patient needs to be supported by the helper. The difference is that maximal assistance means supporting the body weight considerably and with difficulty. Total assistance indicate

either (1) The patient is unable to walk, (2) The patient cannot cover 8 meters regardless of the amount of assistance or (3) Two helpers are required. Points (1) to (3) indicate a very large burden of care.

**Other Points:** The assessment of walking does not usually include the subcomponent of standing up initially from a seated position. This is more accurately assessed under transfers.

The main issue of debate lies in the distance that needs to be covered to be considered significant. Most authorities divide threshold distances into household ambulation and community ambulation. Household ambulation is the distance required generally to move within the home environment and would plausibly cover the distance between a room and a toilet. This is taken as 50 feet (17 meters) in the FIM instrument<sup>18-9</sup>. However, the FIM was based on home sizes in the United States which are probably larger. The average 3-room HDB flat (2 bedrooms, 1 kitchen/dining room and a living room) measures about 64 square meters<sup>23</sup>. A reasonable distance for significant household ambulation would then be 8 meters.

Community ambulation is the distance required to move for IADL purposes such as grocery shopping or to the nearest bus-stop. This is generally taken as one 'block' in Western societies and measures 50 meters in the modified BI and FIM<sup>16-9</sup>. Fifty meters also seems a reasonable distance in the local context: this is the minimum distance between a pedestrian crossing (for example, traffic lights, overhead bridge or zebra crossing) and a point where we can cross the road without using the pedestrian crossing! However we use a household ambulation of 8 meters as our threshold significant distance because we feel that a large majority of disabled patients are house-bound in Singapore and this more accurately reflects burden of care.

Some patients with significant paralysis of the all limbs including patients with high cervical spinal cord injury or multiple sclerosis use a powered or electric wheelchair for mobility. The threshold distances do not change because again, we are measuring the amount of assistance required and not the patient's ability to propel a wheelchair primarily.

## EXPERIENCES, STRENGTHS AND WEAKNESSES OF DISABILITY ASSESSEMENT

We have published local data on more than 1500 patients with various diseases in which we have performed disability assessments on during their rehabilitation course<sup>4</sup>. Our experience is that clinicians often overestimate the capabilities of the patients and consequently underestimate the amount of assistance required, and this has been a common experience in many rehabilitation centers<sup>15</sup>. Some care in assessing disability using the guidelines above will overcome this issue. There are also concerns with regards to false self-reporting of disability among claimants, but because of the high prevalence of



disability locally particularly with evidence of a chronic disease such as stroke or diabetes, it is necessary to apply some common sense for patient beneficence<sup>3,24</sup>.

All scales or instruments whereby disabilities are measured are subject to several weaknesses and the assessor in scoring and interpretation should take these into account during test administration. Major weaknesses include:

1. Disability scales are by nature quantitative and ordinal. Categories of disability severity are not equal. For example, on a scale of 1 (most severe) to 10 (least severe), 2 may not be twice as severe as 1, or 3 twice as severe as 2.
2. There is subjectivity in how each disability item should be measured. What constitutes a certain quantum of assistance cannot be perfectly objectively defined. As such there is continual refinement in the disability assessment literature itself and the focus currently is on refinement of existing scales rather than developing new ones<sup>15</sup>.
3. Content validity. There is no agreement which and how many items need to be included in any disability instrument provide the optimal representation of disability.
4. Inter-rater reliability. Clinicians who administer disability testing on a regular basis will have better inter-rater reliability versus those who perform testing only occasionally or rarely.

In conclusion, accurate disability assessment of the basic activities of daily living is important as a clinical, research, education and epidemiologic tool. It also functions as a social policy tool for health-care funding, directing rehabilitation resources, as well fulfills an important role in advocating for the disabled in Singapore. Disability assessment requires review over time to maintain relevancy and long-term goals could be the development and maintenance of a disability database in Singapore.

## FRAILTY, COMORBIDITY, DISABILITY AND GERIATRIC REHABILITATION

Just prior to a decade ago, approaches to geriatric disability and rehabilitation were non-specific and empirical, largely consisting of the general management of deconditioning and ADL training.

With the advent of frailty concepts and its overlapping interactions with psychosocial issues, disability and co-morbidity (Figure 3); there has been rapid development of geriatric rehabilitation and the medical management of disability in the elderly<sup>25-6</sup>. With rapidly aging populations in developed countries like Singapore with significantly lower health-adjusted life years and increasing burden of disability, geriatric rehabilitation will assume specific prominence in the future of local healthcare<sup>27</sup>.

Frailty is a geriatric syndrome of increased vulnerability due to diminished physiologic reserves in multiple organ systems<sup>122</sup>. The frailty cascade describes a series of sentinel events in the elderly (Figure 4)<sup>28</sup>. The frail state results from physiologic deterioration coupled with comorbidities, poor exercise, nutrition, psychosocial and mental stressors. Unless specifically

screened for, these elderly persons may otherwise appear clinically and functionally normal. With subsequent stressors such as acute infections, illness or falls, the frail elderly are highly susceptible to adverse health outcomes leading to significant disability, hospitalisation, consequent institutionalisation and death<sup>25-6</sup>.

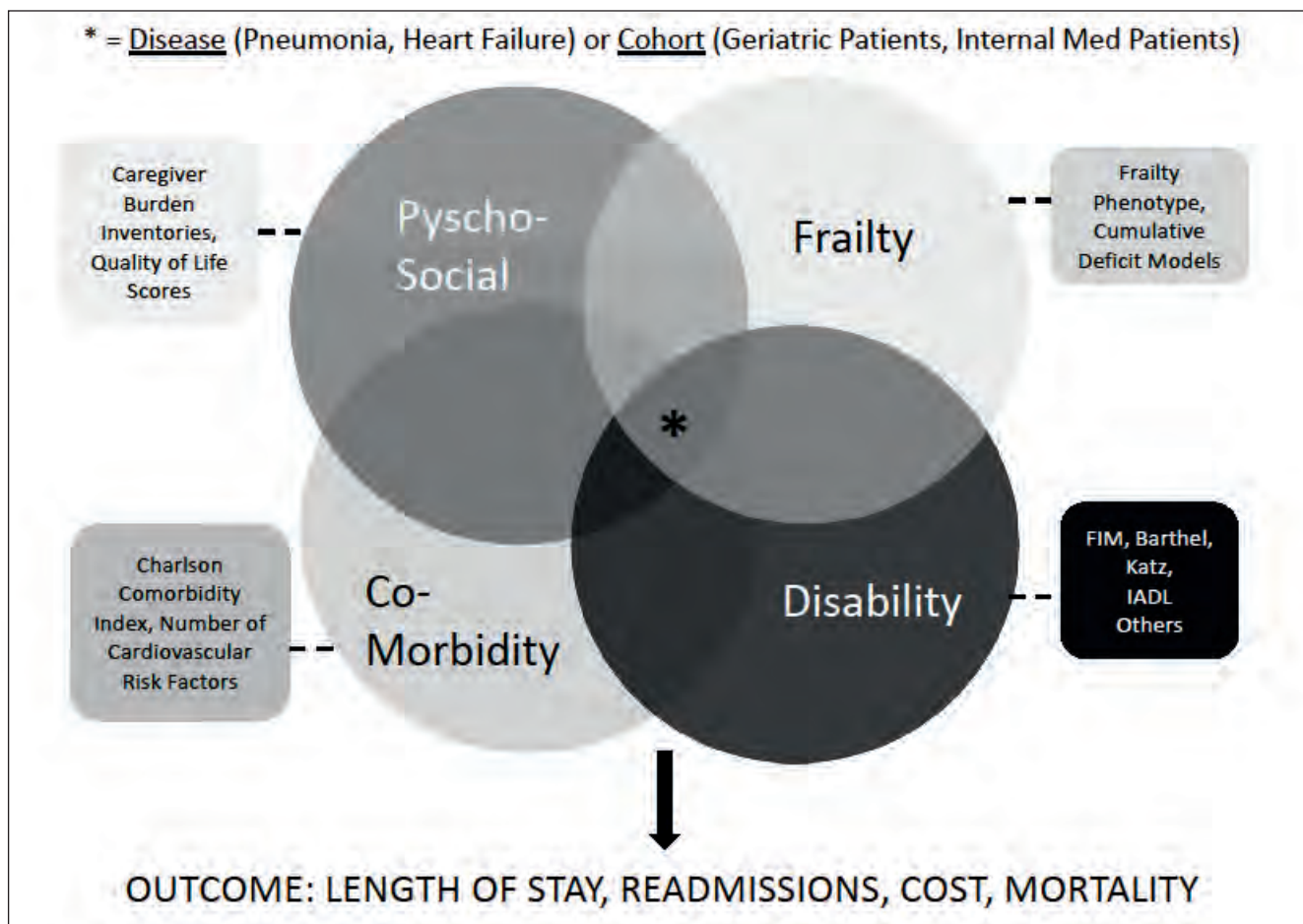
Frailty illustrates a paradigm shift in rehabilitation, which addresses recovery through a holistic multisystem perspective rather than through the traditional approaches of a specific disease<sup>25</sup>. For example, rather than further developments of rehabilitation modalities in traditional areas of stroke, traumatic brain injury, spinal cord injury, hip fracture and amputee rehabilitation, rehabilitation principles of exercise and interdisciplinary care apply across the frailty syndrome without the need to identify a disease that causes it.

This approach is important due to several reasons. Firstly, frailty is interconnected, but can occur independently of a disease state, comorbidity or disability (Figure 2)<sup>29,30</sup>. About a quarter of frail patients may have chronic disease but many are free of comorbidities. As such, valuable resources may be exhausted while searching for causes of falls or generalised weakness where no single cause actually exists, as frailty reflects multisystem failure.

Secondly, frailty is associated with an increased risk of readmission, nursing home admission, worse outcomes after surgery, postoperative complications, as well as higher risks of falls, dementia, general morbidity and mortality<sup>26,31-2</sup>. Targeting frail patients with closer monitoring and psychosocial support can feasibly reduce the risk of complications and adverse outcomes. Thirdly, frailty is potentially reversible with specific interventions, rehabilitation and exercise<sup>31</sup>. This reversibility of the frailty cascade is very promising as it is extremely cost ineffective to treat and manage already disabled and hospitalised patients and interventions need to occur higher up prior to the development of disability. This is often termed prehabilitation. Finally, the presence of frailty is an important consideration in the decision-making process for medical conditions, including risk-benefit decisions in cancer therapeutics or even the triaging of patients for rehabilitation as frail patients have poorer outcomes<sup>31</sup>.

Sarcopenia is a key feature of frailty and is defined as the age-related loss of muscle mass, strength, power, quality and function<sup>33</sup>. There is significant uncoupling of muscle-cross sectional area and fiber strength and loss of type II fast motor units (muscle quality), with fat accumulation in muscle (myosteatosis) resulting in a deterioration of muscle function<sup>28</sup>. Genetic factors and age-related changes in the neurologic and endocrine systems, low-grade inflammation and loss of muscle homeostasis are thought to give rise to sarcopenia<sup>26,33</sup>. Conceptually, sarcopenia is important as many screening tools for frailty indirectly measure for presence of sarcopenia, including lower limb strength, ability to rise from a chair and climb steps<sup>33</sup>.

**FIGURE 3. THE INTERACTION BETWEEN DISABILITY, PSYCHOSOCIAL, CO-MORBIDITY AND FRAILITY DOMAINS IN THE MANAGEMENT OF CHRONIC DISEASE OR A COHORT OF PATIENTS**



## SCREENING FOR FRAILITY

The identification of frail elderly people is key as it is not cost-effective or operationally feasible to deliver rehabilitation to large numbers of people. Clinically, the frailty syndrome can be defined as three or more variables of a phenotype consisting of unintentional weight loss, self-reported exhaustion, low energy expenditure, slow gait speed and weak grip strength<sup>34</sup>. The lowest quintile values are used to define the presence of the frail state. Those with one or two factors are defined as having a pre-frail state. Frailty indices, which are cumulative deficit scores of multiple variables, including symptoms, signs, abnormal laboratory values, diseases and disabilities, are also used to define frailty<sup>29,35</sup>.

Depending on criteria, about 10 percent of people older than 65 years and between a quarter to half of the elderly older than 85 years are estimated to be frail. The risk of frailty is dependent on the setting (frail elders in nursing home >50%), and more likely in females, lower income and less educated elders. Frailty is more common in patients with comorbidities and depressive disorders emphasising the overlap between these domains.

Previously, frailty was grimly associated with the desolation of irreversible ageing. Recent large surveys however indicate that a higher level of physical activity correlate strongly with the development of frailty. Also, groups of elders who engaged in

specific exercise activity of more than 1000kcal/week rather than merely being community ambulant and generally active were three-fold less likely to progress down the frailty cascade and develop severe disability<sup>36</sup>.

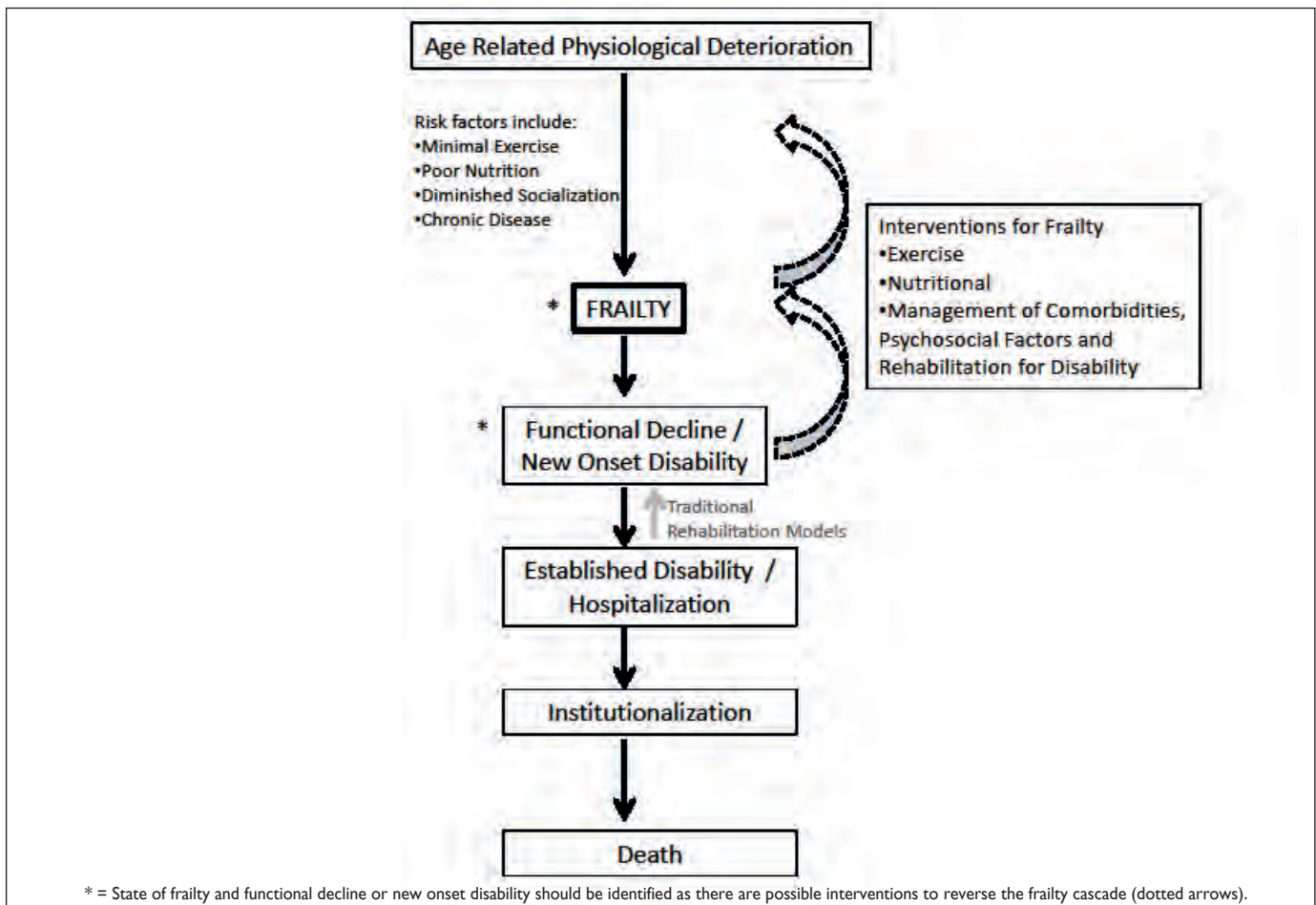
## TREATMENT FOR FRAILITY

Exercise still remains the best proven modality to address frailty and a number of trials on exercise have been conducted<sup>37</sup>. The optimal type of exercise has yet to be established, but general guides indicate multimodal programs comprising strength, endurance, balance and flexibility components are ideal. Most guides indicate that programs performed at least two to three times a week for about an hour for at least 3 months to provide significant benefit<sup>30,37</sup>.

Strength or resistance training has been best studied, and is found to improve muscle strength with consequent better motor performance and gait speed. As such, all multimodal programs include strength training as an integral component<sup>30-1,36</sup>. Strengthening exercises are also easier to commence in previously sedentary older adults and even small gains in strength translate into significant functional gains<sup>25</sup>.

The addition of an endurance programme consisting of moderate aerobic exercise such as jogging or swimming about

FIGURE 4. THE FRAILTY CASCADE



two to three hours weekly improves maximal oxygen uptake and reduces fatigue<sup>31,36</sup>. Balance and flexibility training, particularly incorporated into programs such as Tai-Chi are popular and effective as well<sup>36</sup>. Exercise in general reduces chronic elevations in inflammatory mediators, lessens insulin resistance and stimulates muscle anabolic effects in the presence of amino acids<sup>26,31</sup>.

Nutritional interventions, including systematic nutritional assessments and supplementation with proteins such as leucine, address weight loss in frailty and may prevent falls especially if combined with a well prescribed exercise program<sup>25</sup>. Several pharmacologic agents for the treatment of frailty have been studied. These include the administration of testosterone or selective androgen receptor modulators to improve body composition and muscle strength in the hypogonadal elderly<sup>31</sup>. Myostatin inhibitors, ghrelin, angiotensin converting enzyme inhibitors and vitamin D supplementation may also have beneficial effects on enhancing musculoskeletal system functioning<sup>31</sup>.

Family physicians are well equipped with the medical skills necessary to incorporate the concepts of frailty and its corresponding management of comorbidities, disability and psychosocial domains into the care of their elderly patients. They have the skill set coupled with the mindset of comprehensive, holistic patient care to optimise the health of the aged in our society<sup>29</sup>. By appreciating the complexity of each individual and screening for frailty albeit in a busy clinic, family physicians can make important clinical decisions,

recommendations of exercise, rehabilitation and treatment of frailty and its consequences if not addressed early in the aging process<sup>29</sup>.

#### DISCLAIMER

In this article, we provide a general overview of disability assessment and a possible schema of assessment based on published literature and our experiences in this field. The text will not be applicable to all schemes and policies and the views and opinions expressed are of the authors only.

The ADL definitions and the method in which the severity of disability is categorised vary considerably between the disability-related national schemes and third-party insurers. Similarly the thresholds and disability category whereby the claimant is successful in obtaining claims also vary significantly between the disability-related national schemes and insurers. The author will not be held responsible for any disputes that arise in the claims process and the assessor is advised to check with the particular scheme and insurer for details and updates on the assessment process regularly. The author is currently not affiliated to any disability-related national scheme or third-party insurer.



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**LEARNING POINTS**

- In Singapore and worldwide, large numbers of people live with disabling illness.
  - Using definitions from the ICIDH and ICF models, the assessment of disability involves strictly the assessment of the severity of activity limitation including ADLs, and not the assessment of the severity of loss of body structure or function (or termed impairment in the older ICIDH model)
  - Disability charting is important as a clinical tool to document functional recovery as well as to assess the effectiveness of medical and rehabilitation interventions.
  - The identification of frail elderly people is key as it is not cost-effective or operationally feasible to deliver rehabilitation to large numbers of people.
  - Clinically, the frailty syndrome can be defined as three or more variables of a phenotype consisting of unintentional weight loss, self-reported exhaustion, low energy expenditure, slow gait speed and weak grip strength.
  - Rehabilitation now addresses recovery through a holistic multisystem perspective rather than through the traditional approaches of a specific disease
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