

Buyers' guide

Specialist seating for stroke patients in the acute hospital setting

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CEP buyers' guides are intended to provide prospective purchasers of healthcare products on the UK market with general guidance on the technical, operational, and economic considerations to be taken into account in selecting the most appropriate product where a range of similar products exists. They do not include product-specific information, which is published separately via market reviews (which contain product specifications only) or evaluation reports (which contain additional technical and / or user evaluation data).

Scope

This guide to specialist seating for stroke patients is restricted to equipment primarily intended for use in the acute hospital setting. As defined by the North of England Cardiovascular Network Stroke Pathway, this can include services provided to both inpatients and outpatients in a hospital ward, gym or rehabilitation suite [1]. Seating intended primarily for community-based care or early supported discharge is excluded, although it is acknowledged that there may be some considerable overlap between such equipment and that in scope.

Simple fireside chairs and basic recliner or rise and recline arm chairs are excluded as they offer no specialist functions appropriate for stroke patients such as postural support and pressure relief. Positioning aids, cushions and supports for existing chairs are also excluded.

Background

The National Institute for Health and Clinical Excellence (NICE) defines stroke as '*an acute neurological event presumed to be vascular in origin and causing cerebral ischaemia, cerebral infarction or cerebral haemorrhage. This includes first and recurrent events, thrombotic and embolic events and primary intracerebral haemorrhage of any cause, including venous thrombosis*' [2].

Ischaemic strokes, which account for around 85% of all strokes [3], are caused when blood flowing to the brain is blocked by a clot or stenosis. Less commonly a haemorrhagic stroke occurs when a blood vessel supplying the brain bursts. In both cases, the disruption of the blood supply to the brain causes brain cells to be disturbed or to die. Cell death in the brain can leave lasting damage, affecting mobility, cognition, sight or communication. Stroke has a broad spectrum of severity, ranging from symptoms resolving within 24 hours, known as a transient ischaemic attack (TIA) or a 'mini stroke', to a stroke which may cause severe brain damage or death. The impact will vary depending on which part of the brain is affected, how many brain cells have died, the number of damaged cells able to recover, and whether other parts of the brain can take over from the areas that have died.

Stroke can have a devastating and lasting impact on the lives of those affected and their families. Effects can include aphasia (impairment of language skills – written and/or spoken), physical disability, loss of cognitive skills, depression and other mental health problems.

Approximately 110,000 strokes occur in England every year [4] and stroke accounts for 11 per cent of deaths in England and Wales each year [3]. Around two-thirds of people will survive their stroke, and half of these will be left with a long-term disability and dependent on others for their care. The average length of stay for a stroke patient in hospital is 25.5 days [5] (2007-8 data) and stroke is a contributing factor for entry into a care home for between 20 and 40 per cent of residents [3]. Around one in four people can expect to have a stroke if they live to 85 years of age [3].

Historically, stroke has been seen as an inevitable risk of growing old, with little to be done for those who suffer a stroke other than trying to make them comfortable. However, recent clinical, technological and organisational developments in acute stroke care mean that patients who, a few years ago, would have died or been seriously disabled after their stroke, now have a much better chance of making a good recovery, provided they receive fast and effective access to appropriate care.

Stroke costs the NHS and the economy about £7 billion a year [4] (2007 figures): £2.8 billion in direct costs to the NHS; £2.4 billion in informal care costs (eg the costs of home nursing borne by patients' families) and £1.8 billion in lost productivity.

In 2008, 96 per cent of English hospitals offered specialist acute stroke care [6]. At the time of the 2008 National Sentinel Audit for stroke there were over 5800 stroke unit beds and more than 6100 stroke patients on-site in an acute stroke unit, a rehabilitation unit or a combined unit [6].

The majority of stroke patients will require high-dependency care on an acute stroke unit for the first 24 hours of the illness [4]. Most symptomatic developments occur within the first 24 hours and so prompt access to an acute stroke unit is needed. Effective early management of stroke will reduce, but not always remove, the need for intensive care beds.

Failure to provide appropriate equipment can not only delay recovery, leading to unnecessary and costly extended hospital stays, but also limit the final level of independence [4].

Sitting and stroke

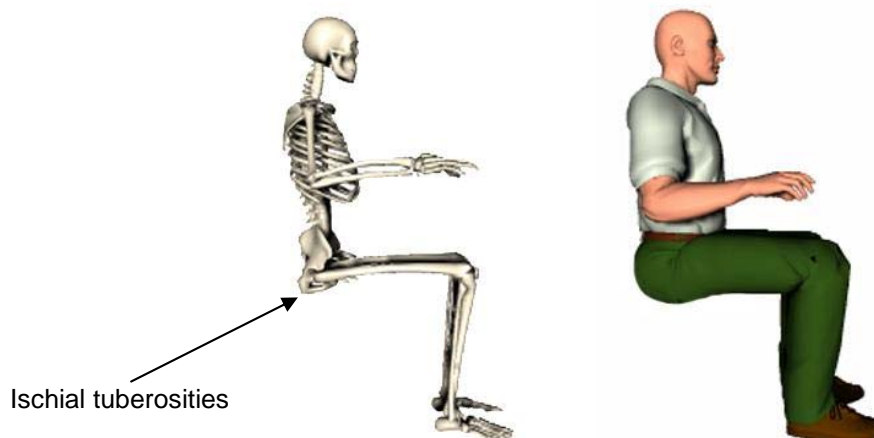
Sitting cannot be described as a passive activity; most healthy individuals change positions regularly throughout the day if they are seated for extended periods. The

healthy population are also able to stand up and walk around for a while, helping to relieve the interface pressure between the body and the supporting surface of the chair. The correct seated posture for an individual is one that does not impede mobility or the ability to carry out normal activities [7].

Normal sitting position is where the body is positioned in a symmetrical, stable and functional position; illustrated in figure 1 and defined as follows [8, 9]:

- pelvis upright and level or tilted slightly forward, and the weight taken evenly on both ischial tuberosities
- hips flexed to 90° , and the body weight shared evenly on both thighs
- knees flexed to 90°
- ankles flexed to 90° , feet flat on the floor or supported on a foot rest
- head directly over the pelvis and neutral spinal alignment with the three natural curves of the spine in the cervical, thoracic and lumbar regions
- legs separated $5-8^\circ$ from midline.

Figure 1. Normal seated posture*



*Image supplied by ESRI, Loughborough University,
courtesy of Ergoweb Ergonomics Image Library

It is acknowledged that this position may not always be possible to achieve in an older population; however the priority is to maintain the pelvis in a slight anterior tilt, with weight placed evenly on both ischial tuberosities. This will help to maintain a neutral spinal alignment.

The ability to maintain a normal sitting posture can be affected by any restriction in function. For example, a neurological deficit can result in reduced, absent or altered

skin sensations, reducing movement and therefore potentially increasing the risk of skin damage.

Poor sitting ability is a common problem after stroke. Effective sitting involves not only the ability to maintain the seated posture, but also the ability to reach for a variety of objects located both within and beyond arms length [10]. Recovery of trunk controls and balance in sitting post-stroke is important for individuals since it is a skill that is critical for independent living and has been shown to be a useful prognostic indicator for this population [10].

A patient's sitting posture is primarily determined by the position of the pelvis in the chair. A posterior pelvic tilt will result in the patient being 'slumped' in the chair, so that the bony sacrum takes the pressure, with horizontal shear forces arising because of this poor sitting position. A slumped sitting position occurs quite easily when the seat is too deep (long), or too high for patients, who adopt this position so their feet can reach the floor to help support them. Slumping in the chair is also a consequential posture in people who have poor sitting balance and who fatigue easily such as those that have suffered a stroke.

Often, poor sitting posture and discomfort are caused by an incorrectly sized seat [11]. Postural comfort can be described as the absence of discomfort or a state where the need to change positions is not present. The frequency of postural shifts may be correlated to the level of discomfort [12]. Many factors are known to influence comfort, including posture, temperature, interface pressure, health and environment, along with physiological, psychological and task factors. A *tool for assessing wheelchair discomfort* could be used as a basis for future development of a tool to determine the comfort of other seating applications [12]. Meanwhile, Collins suggests that it is impossible to determine whether an armchair is comfortable in a few minutes; potentially suitable armchairs should be tested for several days [13].

It is reported that good seating conditions can lead to improvements in respiratory function, oral intake, digestion, motor skills, expiratory volume, expiratory time and intelligibility of speech [14]. Clearly these can benefit the user physiologically and socially.

A patient's long-term seating needs will change over time, particularly in those with changing neurological conditions who may have absent or partial sensation [9].

A tilt-in-space armchair offers the ability to tilt the whole body back in the chair, while maintaining an optimum bodily alignment (based on the angles of the hips, knees and ankles, as described earlier) and redistributing pressure. This type of chair is designed for use by a person who has poor sitting stability and difficulty in maintaining an upright position within the chair [15].

Stroke unit care

NICE recommends that all people with suspected stroke should be admitted directly to a specialist acute stroke unit following initial assessment, either from the community or from the A&E department [2]. NICE defines an acute stroke unit as a discrete area in the hospital that is staffed by a specialist stroke multidisciplinary team having access to equipment for monitoring and rehabilitating patients. Regular multidisciplinary team meetings occur in the unit for goal setting.

Most stroke patients benefit in some way from the expertise of a stroke unit since 96 per cent of English hospitals offer specialist acute stroke care [6] (2008 data). Even those who are likely to require continuing institutional care could benefit from interventions that may improve their longer term quality of life such as the provision of appropriate seating.

Organised stroke care reduces disability. However, uncertainty prevails regarding which components of stroke rehabilitation strategies are effective, as most were developed through clinical intuition rather than research evidence [16].

The Stroke Unit Trialists' Collaboration (SUTC) found that stroke patients who did receive organised inpatient care in a stroke unit are more likely to be alive, independent, and living at home one year after the stroke [17]. The benefits were most apparent in units based in a discrete ward. The SUTC also found that stroke unit care can be characterised by:

- co-ordinated multidisciplinary rehabilitation
- staff with a specialist interest in stroke or rehabilitation
- routine involvement of carers in the rehabilitation process
- regular programmes of education and training.

It was postulated by the SUTC that better stroke unit outcomes could be due to better diagnostic procedures, better nursing care, early mobilisation, prevention of complications or a more effective rehabilitation programme [17]. Govan *et al* did find that a reduction in the development of complications associated with immobility, along with reductions in stroke progression and recurrence, were significant factors in stroke unit care that led to improved outcomes [18]. However, the authors also acknowledged that other components of stroke unit care (*eg* prompt use of thrombolytic drugs and improved monitoring) could also contribute to the improved outcomes, but could not be statistically measured.

Rehabilitation after stroke

Impairment of motor control after stroke reduces the ability of a patient to change their position and posture, and in the early stages this can be severe. The consequent risks include skin pressure ulceration, limb swelling, subluxation (partial dislocation) or other joint damage, the development of contractures and pain, all of which could lead to an extended hospital stay and associated extra costs. Patients need careful handling and positioning to reduce harm, particularly in the acute phase after stroke and also to maximise independence and function. For those with more severe stroke this requirement may be ongoing. The National Service Framework (NSF) for Older People requires every general hospital that cares for stroke patients to have a specialist stroke service [19].

Some of the primary goals of rehabilitation in the acute (early) phase post stroke include prevention of muscle contractures* and pressure ulcers and limitation of deconditioning [16, 20]. These could be passive interventions that require little active participation by the patient. Some degree of deconditioning due to non-use is inevitable and is more pronounced in the elderly. Weaknesses of the muscular system due to disuse progresses at 10%-15% per week for complete bed rest and are in addition to any effects of hemiplegia caused by the stroke [20].

The Bobath concept is the primary stroke physiotherapy approach in the UK. In a survey by Tyson and Selley, 98% of the physiotherapists surveyed described their practice as based on or strongly based on the Bobath concept with occasional or regular use of other methods [21]. The Bobath concept aims to stress the muscular and central nervous systems to create, maintain, and reinforce the sensorimotor pathways enabling efficient motor control in the desired environment [22].

We found very little evidence supporting stroke rehabilitation techniques, confirming other findings [23]. Physiotherapy interventions are aimed at normalising muscle tone, promoting normal movement patterns and preventing complications. Occupational therapy (OT) is also vital in early stroke intervention to improve positioning in the chair and maximise function. The choice of technique is largely a matter of clinical preference.

Although there is little direct clinical guidance, Rowat found that the majority of physiotherapists surveyed felt that the best position for a conscious stroke patient was sitting in a chair, but that was inappropriate for an unconscious stroke patient. In these circumstances, it was thought that lying on the unaffected side was the best position [24]. In sitting positions, hip and trunk alignment were considered to be amongst the most important components of positioning [16].

* Caused by immobilisation of muscles in a shortened position

Although NICE states that early mobilisation is considered a key element of acute stroke care [2], Bernhardt found, as part of a Cochrane review published in 2009, that the impact of very early mobilisation (VEM[†]) on recovery after stroke is not clear; concluding that there is insufficient evidence to suggest the practice be discontinued where it is widely used or to suggest it is more widely adopted [25]. One of the aims of an early mobilisation strategy is to help patients to adopt a seated position, as soon as they are able.

Musicco *et al* found that patients that started the rehabilitation programme early (less than 7 days post stroke) had better long-term outcomes than those started after 1 month [26]. They also showed that patients with pressure ulcers on admission were also more likely to die, or suffer some form of failure of the rehabilitation regimen. This failure could be due to the rehabilitation programme being interrupted, delayed or reduced by the need to treat the pressure ulcers.

Following stroke, the control of trunk muscles used for the maintenance of a sitting posture (and also in more complex activities such as reaching and standing) can be severely impaired. Independent sitting of patients with stroke is generally disturbed although this improves with rehabilitation interventions [27].

After a stroke, the ability to control balance in the sitting (and standing) position is a fundamental skill in achieving independent and safe performance of activities of daily living (ADL). In the initial phase of stroke, the status of sitting balance and trunk control has been shown to be an important predictor of long-term outcome [28, 29]. It can therefore be used to enable clinicians to agree suitable rehabilitation objectives and goals for an individual.

Another rehabilitation goal is the recovery of the sit-to-stand movement. This is one of the most frequently performed functional tasks and is an essential pre-requisite to walking.

There is no absolute end to recovery from stroke. However, most functional improvement occurs within the first six months [30].

Complications

Up to an estimated 85% of stroke patients develop complications of some form during their hospitals stay [31]. Impairment of motor control after a stroke naturally reduces the ability of a patient to change their position and posture, and in the early stages this can be quite marked [30]. The risks associated with this impairment include skin pressure ulceration, limb swelling, joint problems, the development of

[†] VEM is defined here to be within 48h of stroke onset

contractures and pain. Patients need careful handling and positioning to reduce these risks.

There is no uniform consensus on the prevalence of pressure ulcers in the stroke patient population – one author reports an incidence of 1.5% amongst in-patients [32], whilst another reports a frequency of 21% across the whole of post-stroke care, including out-patient follow-ups at up to 30 months [33]. The annual cost to the NHS of pressure ulcer management and treatment is estimated to be between £1.4 billion and £2.1 billion [34].

During the course of a day, a healthy, mobile person will sit on several different seats and adopt different positions at different times on each of them. However, this is not the case for people with restricted mobility who need to spend large parts of the day seated. For these, inadequate seating adjustments can lead to a poor seated posture that can increase their vulnerability to pressure ulcers. It can also increase muscle spasm, spasticity and pain. Positioning strategies to reduce these risks should consider postural alignment and supporting the feet to minimise the damaging effects of pressure and shear forces when sitting [34].

Disabled patients that sit for extended periods may be at greater risk of developing pressure ulcers than those who are in bed, since a very small surface area of the body supports a large proportion of the body weight. Appropriate seating aims to minimise interface pressures over bony prominences such as the ischial tuberosities while loading less vulnerable surfaces such as the thighs.

Acute stroke patients are at high risk of pressure ulcers [20]. They are usually older, may have some degree of paralysis and are therefore immobile and unable to reposition themselves. They may have impaired sensory perception and be less aware of the need to change position.

The causes and classification of pressure ulcers are well documented and have been discussed in previous CEP work on pressure redistribution mattresses and overlays [35].

Pressure ulcers are associated with lying or sitting in the same position for long periods with inadequate provision of pressure reducing surfaces and are a largely avoidable complication [36]. When they do occur, they can be painful, slow the patients' recovery and may sometimes be fatal. Prevention relies on an early assessment of the risk, expert nursing care and the well judged use of specialised pressure redistributing surfaces. The key aspects in the prevention of pressure ulcers are relief of pressure, reduction of shear forces and friction, and maintenance of clean, dry skin. Repositioning frequency should be determined by the patient's individual needs [37], although it is still necessary to inspect the skin regularly [20].

Alternatively, if a patient is able, they should perform a lift to relieve the pressure themselves for at least 1 minute each hour [38]. Other options for directly relieving the pressure include a tilt-in-space (TiS) action or a forward lean (with the elbows or chest on the knees requiring little effort) [39].

Sitting and pressure ulcers

In the seated position, almost half of the body weight is supported by only 8% of the sitting area, at or near the ischial tuberosities [8]. For a patient in a neutral sitting position as described, the weight distribution is as follows: buttocks and thighs 75%, feet 19%, arms 2% and back 4% [11].

While the ischial tuberosities are the prime sites for pressure ulcer development in seated people, other potential sites having sustained contact with the chair are: the sacrum; greater trochanter (outer edges of the hips); popliteal fossa (at the back of the knee); bony prominences of the spine; and scapula [34]. The heels are also at risk of developing pressure ulcers if the patient adopts a poor sitting position caused by an unsuitable chair, or is required to sit for long periods of time. The heels can become highly loaded if they are being used as an anchor to prevent the occupant from sliding out of their seat. Some of the most difficult to heal wounds occur over the buttocks with the size and curvature of the ischial tuberosities contributing to the amount of damage in the gluteus muscles [9].

Patients who are most at risk of developing pressure ulcers in the seated position are those who are physically debilitated and unable to reposition themselves and those with a neurological impairment, therefore having a reduced awareness of the need to reposition themselves. Poor chair design significantly increases this risk, as it will ultimately cause negative postural changes. Correct chair sizing may reduce the need for pressure-reducing cushions since the occupant is placed in an optimal position to start with. However, it is good practice, for preventative purposes, to incorporate a pressure reducing cushion in all chairs for high risk users.

Sitting also requires the body to cope with the effects of gravity – patients who sit for long periods without being repositioned or restrained will slide down in the chair, generating shear forces. The effect of shear is to rub and distort the internal tissues; the capillaries become kinked, preventing blood flow to the surrounding tissues. The combination of shear forces and pressure causes the most significant tissue damage.

A seating system tailored to a patient's needs can go a long way toward preventing pressure damage by ensuring the patient is supported in the correct posture. A variety of support surfaces, such as pressure reducing foam, air, and gel, are available.

There are many different types of pressure redistributing cushions and there is little evidence that one is better than any other [7].

National guidance

There is very little formal guidance relating to specialist seating and positioning for stroke patients. The guidance documents for stroke care in general, and seating for disabled people in general, are summarised in table 1.

Table 1. Summary of key guidance documents applicable to stroke and specialist seating

Origin	Title	Key points from guidance document
Department of Health (DH)	National Stroke Strategy (NSS) [4]	<p>Stroke care in hospital requires an appropriate environment that includes:</p> <ul style="list-style-type: none"> • adequate hoisting facilities for those with a physical disability • sufficient space and equipment for rehabilitation on the ward • easy access to aids for rehabilitation, such as manual and electric wheelchairs, chairs of the correct height and providing appropriate postural support, pressure-relieving equipment, etc. <p>Warns that premature discharge to inadequate community facilities is likely to increase individuals' long-term dependency.</p>
Department of Health (DH)	National Service Framework (NSF) for older people, Standard five: stroke [19]	<ul style="list-style-type: none"> • Every general hospital that cares for stroke patients is to have a specialist stroke service. • Stroke patients should be offered a multidisciplinary programme of secondary prevention and rehabilitation. • An integrated stroke service should involve: <ul style="list-style-type: none"> ◦ stroke prevention for those at risk of first or further stroke ◦ specialist stroke services providing acute care and rehabilitation ◦ long-term support for stroke patients and their carers.
National Institute for Health and Clinical Excellence (NICE)	NICE clinical guide 68: Stroke [2]	<ul style="list-style-type: none"> • People with acute stroke should be helped to sit up as soon as possible (when their clinical condition permits). • Sitting up will help to maintain oxygen saturation and reduce the likelihood of hypostatic pneumonia. • Early mobilisation is a key element of acute stroke care. • People with acute stroke should be mobilised as soon as possible (when their clinical condition permits) as part of an active management programme in a specialist stroke unit.

Origin	Title	Key points from guidance document
Intercollegiate Stroke Working Party (ISWP)	National clinical guidelines for stroke [30]	<p>These guidelines were also used for the development of the NICE guidelines above.</p> <ul style="list-style-type: none"> • Every patient with mobility limitation should be assessed by a specialist to determine the most appropriate and safe methods of transfer and mobilisation. • All patients should be assessed within a few hours of admission for their immediate needs in relation to positioning, mobilisation, moving and handling. • All patients should be assessed for their risk of developing pressure ulcers. • When lying and sitting, patients should be put in positions that minimise the risk of complications such as aspiration and other respiratory complications, shoulder pain, contractures and skin pressure ulceration.
European Stroke Organisation (ESO)	Guidelines for stroke management [40]	<ul style="list-style-type: none"> • Patients should be encouraged to practice their skills beyond working hours when they are safe and able. • Greater intensity of rehabilitation, especially time spent working on Activities of Daily Living (ADL) is associated with improved functional outcomes.
NICE	NICE Clinical Guideline 29: The prevention and treatment of pressure ulcers. Quick reference guide [37]	<ul style="list-style-type: none"> • Provides an overview of the background, risk assessments, prevention, assessments and treatment of pressure ulcers.
European Pressure Ulcer Advisory Panel (EPUAP) and National Pressure Ulcer Advisory Panel (NPUAP)	Treatment of pressure ulcers: quick reference guide [41]	<ul style="list-style-type: none"> • Defines pressure ulcer classifications. • Provides general guidance on risk assessments, skin assessments and pressure ulcer prevention strategies. • Provides specific guidance on the use of support surfaces to prevent pressure ulcers while seated.

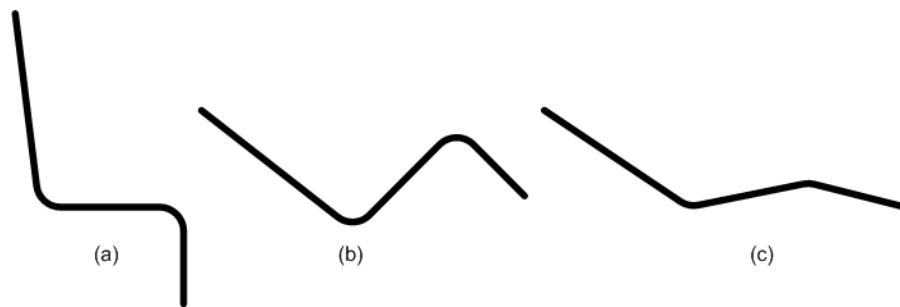
Origin	Title	Key points from guidance document
Scottish Intercollegiate Guidance Network (SIGN)	Management of patients with stroke [42]	<ul style="list-style-type: none"> • Pre-dates NICE and ISWP guidance but offers similar guidance: <ul style="list-style-type: none"> ◦ stroke patients should be mobilised as early as possible after stroke ◦ hospitals should have up-to-date policies on risk assessment, pressure ulcer prevention and treatment ◦ therapeutic positioning of patients should be practised by nurses and therapists to prevent complications such as contractures, pain, abnormal tone, respiratory problems and pressure sores, or to assist functional recovery. • Key elements of the physiotherapy assessment include body alignments, range of joint motion, balance, and mobility. • A key intervention of occupational therapy is to assess for and provide appropriate seating and to advise on positioning.
North West Stroke Task Force (NWSTF)	Acute care stroke standards [43]	<ul style="list-style-type: none"> • The majority of patients should be out of bed within 24 hours, with exceptions including unconscious patients.
Disabled Living Foundation (DLF)	Choosing a chair and chair accessories [44]	<ul style="list-style-type: none"> • Offers a broad range of guidance on choosing appropriately sized chair. • Advice on the different types of chairs available.
DLF	Choosing pressure relief equipment [45]	<ul style="list-style-type: none"> • Gives advice for people who need pressure relief whilst sitting in an armchair.

Primary functions of seating

There are many different types of pressure relief (PR) systems available for seating applications. There is little evidence that one is better than another [7], but each has advantages and disadvantages.

A tilt-in-space (TiS) system can provide a change of position, while maintaining fixed hip, knee, and ankle angles and redistributing pressure from one area to another (eg from the buttocks and thighs in an upright position to the posterior trunk and head in a tilted position) [46]. Recline systems provide a change in position by opening the seat-to-back angle and, if combined with elevating leg rests, open the knee angle as well. This is illustrated in figure 2 below.

Figure 2. Seat positions: (a) normal, (b) tilt-in-space, (c) recline



It is established that seat height can have a significant effect on performance of sit to stand (STS) movements due to the forces and moments at lower limb joints [47]. Raising seat height enables an individual with weak muscles to practice STS and sitting down (SIT). The preferred foot position to assist STS is with the ankle approximately 10cm behind the knee [47]. The ability to independently execute STS is vital and has a direct impact on the potential of a stroke patient to regain independence [48]. The use of a seat-raiser mechanism that can both lift the chair and tilt it forward may help the occupant to stand more easily [49].

A foot rest that can be moved out of the way or removed altogether will help the occupant stand up out of the chair. If the patient attempts to stand on a foot rest that is not in direct contact with the floor itself, it could cause the chair to become unstable and there is a risk of the whole chair tipping forward and causing injury.

The presence of arm rests that can be removed will aid side transfers of the patient (eg into a wheelchair) and may also improve access to the patient for therapy interventions.

Seat sizing

It is recommended that specialist seating used in an acute hospital environment should have adjustments for seat height, width and depth, and that adjustment be made by staff trained to make these changes [7]. This suggests that there should be no need for supplementary cushions if the integral cushion is in a good condition and the seat is adjusted correctly.

Table 2 shows the seat sizing guidelines adapted from Collins [13, 50]. Further details are given in the ergonomics section in *Operational considerations*. The required dimensions of a chair (seat width, depth, height, backrest height and armrest height) should be determined by a trained therapist and can directly affect the ability of a person to remain in a normal seated position.

Table 2. Preferred seating dimensions – adapted from Collins [13, 50]

Seat dimension	Description and explanation
Seat width	<ul style="list-style-type: none"> • Allow 2cm of clearance on either side of the buttocks. • If the chair is too narrow, it will prevent the occupant sitting back and distributing weight over the whole of the buttocks and thighs. When the occupant leans back from a forward position, it places the pelvis into a posterior pelvic tilt, transferring a large proportion of the body weight to the sacrum and increasing the risk of pressure ulcers in the sacral and thigh areas. • If the chair is too wide, the occupant may have a tendency to lie across the chair so that the weight is not supported evenly on both halves of the body. This can also increase the risk of pressure ulcers, particularly over one ischial tuberosity and one trochanter. The elbow on the supporting side can also develop pressure trauma. • In the short term, the width of a chair can be reduced using pillows on either side of the occupant to increase support and stability.
Seat depth	<ul style="list-style-type: none"> • Should support the buttocks and thighs, allowing a 2cm gap behind the knee. • If the seat depth is too short, it will result in increased interface pressure at the buttocks and supported length of the thighs. • Too long a seat depth can cause discomfort behind the knee and cause the occupant to slide forward resulting in posterior pelvic tilt. • Both of these situations can increase the risk of pressure ulcers.
Seat height	<ul style="list-style-type: none"> • Seat height is determined by measuring from the back of the knee to the floor (or foot support) with the user wearing normal footwear. • If the seat is too low, the thighs lose contact with the seat surface, increasing interface pressure under the buttocks. • If the seat is too high, the occupant's feet will not reach the floor and the weight that should have been taken by the feet will be transferred to the thighs and buttocks. • If the patient's feet do not reach the floor, the patient may slide forwards in an attempt to correct the situation and gain stability. Part of the thighs will lose contact with the seat surface and the pelvis will adopt a posterior tilt, increasing the pressure on the sacrum, spine and heels. Friction and shear forces will also

Seat dimension	Description and explanation
	<p>occur in the buttocks. If the patient is allowed to maintain this position over long periods, these postural changes will become fixed, and a kyphosis will develop.</p> <ul style="list-style-type: none"> Altering the height of a chair can have a significant effect on the performance of STS [47].
Backrest height	<ul style="list-style-type: none"> The backrest should be high enough to support the head and shoulders. If it is too low, the occupant will feel unstable and tend to slide down resulting in a posterior pelvic tilt with the associated problems previously described.
Arm rest	<ul style="list-style-type: none"> Arm rests should be height-adjustable. The most effective armrest height should enable the shoulder girdle to rest in a neutral position without elevation or depression. An arm rest that can be removed may aid transfers in and out of the chair, while also allowing access to the patient during therapy sessions.
Occupant security	<ul style="list-style-type: none"> The presence of some form of occupant security, eg lap belt or harness, can aid positioning, and prevent the occupant from slipping in the chair, reducing the risk of complications. Any belt or harness present is primarily intended to provide optimal postural support.

Key standards

There are several British and European standards applicable to seating and furniture in general (table 3). Data were extracted from the Furniture Industry Research Association (FIRA)[†] and BSI Group[§] websites in February 2010.

Table 3. Summary of key standards applicable to furniture, seating and disability aids

Standard number	Description	Overview
BS 4875-1:2007 [51]	Strength and stability of furniture: Requirements for the strength and durability of the structure of domestic seating	Specifies performance requirements for the strength and durability of the structure of domestic and contract seating, including swivel/pedestal chairs intended for use in an office in the home, and pouffes and stools.
BS 8474:2006 [52]	Furniture: Requirements for chairs with electrically operated support surfaces.	Specifies the strength, durability and stability of electrically operated reclining chairs, and rise/recliners for domestic and non-domestic applications

[†] <http://www.fira.co.uk>

[§] <http://www.bsigroup.co.uk>

Standard number	Description	Overview
BS 8480:2006 [53]	Medical devices: Requirements for chairs with electrically operated support surfaces.	Electrically-operated devices designed to assist manufacturers of chairs that would be considered medical devices to meet the requirements of the Medical Devices Directive (MDD)
BS 5852:2006 [54]	Assessment of the ignitability of upholstered seating by smouldering and flaming ignition sources	Methods of test for assessment of the ignitability of upholstered seating by smouldering and flaming ignition sources
BS EN 60601-1:2006 [55]	Medical electrical equipment. General requirements for basic safety and essential performance	Applies to medical electrical equipment intended to be used in the diagnosis, treatment, or monitoring of a patient or for compensation or alleviation of disease, injury or disability. This standard focuses on the basic safety and essential performance of medical electrical equipment and medical electrical systems.
BS EN 12182:1999 [56]	Technical aids for disabled persons. General requirements and test methods	Specifies general requirements and test methods for technical aids for disabled persons which are intended by the manufacturer to be medical devices for the purposes of the MDD.

Clinical impact

There is little published evidence on the clinical effectiveness or impact of seating for stroke patients.

It is recommended that an assessment of a patient's risk of developing pressure ulcers be made within 6 hours of admission for their first episode of care and with regular re-assessments [37]. There are several risk assessment scales in use providing a risk score on which to base the selection of appropriate pressure-relieving surfaces [35].

Stroke care pathways

As part of a Cochrane review in 2004, Kwan concluded that there was not enough evidence to justify the widespread introduction of a stroke care pathway; but noted that patients treated within a stroke care pathway were more likely to have certain tests, such as brain scans, and less likely to suffer some complications such as urinary tract infection [57].

The *NHS Choices Map of Medicine* for stroke, does not specifically mention seating or postural support and, although it indicates that early mobilisation should be considered, it offers no guidance on this topic [58].

Accessories and storage considerations

The manufacturers of specialist seating offer a varied range of standard or optional accessories. If particular accessories, such as a tray or additional positioning aids are required, care should be exercised over the choice of chair to ensure availability or compatibility.

Since these products can be quite large, consideration needs to be given to where they will be used and how they will be stored when not in use.

- Are they to be used or left at a bedside? Is there space?
- Will they be stored in a ward side-room or cupboard?
- Will they be left ready to use in a rehabilitation suite?
- Should they be sent to a central storage location within the hospital? Is there a cost implication?
- Are they to be part of a ward, hospital, local or regional pool of chairs that are loaned or rented?

Seating assessment

Assessing the patient's seating needs (table 4) should be performed by trained staff [7]. An inadequate assessment may lead to inappropriate chair provision.

Table 4. Seating assessment considerations (adapted from Collins [15] and Kirton [59])

Pressure risk	<ul style="list-style-type: none"> What is the patient's level of pressure damage risk?
Setting	<ul style="list-style-type: none"> Is the requirement for rehabilitation seating for use in hospitals?
Duration of use	<ul style="list-style-type: none"> For how long is the patient expected to sit?
Transfers	<ul style="list-style-type: none"> What transfer method is used with this patient? Does the user require a rise facility?
Sitting posture	<ul style="list-style-type: none"> Is the patient in a normal sitting posture? Can the patient sit in an upright position unsupported? If not, why not? Is any additional postural support required (eg head rest, lateral supports <i>etc</i>)?
Postural issues	<ul style="list-style-type: none"> Does the patient have any flexible or fixed postural changes, for example, a posterior pelvic tilt or contractures at the knee or hip? Is the user coming out of the chair due to chorea movements^{**}, pelvic extensions or other (non-slipping) reason?
Discomfort	<ul style="list-style-type: none"> Can the patient change position within the chair independently? Does the patient currently complain of discomfort and if so, where?
Sizing	<ul style="list-style-type: none"> Is the existing chair the correct size? What dimensions are required of a new chair?

Seating selection

Products must be matched to users' needs and the seating assessment described in table 4 will help to identify these needs. Table 5 outlines further operational considerations which affect product selection.

Care must be taken when selecting specialist seating, since a poorly selected chair may be used infrequently, inappropriately, or not at all.

^{**} Brief, quasi-purposeful, irregular contractions that are not repetitive or rhythmic, but appear to flow from one muscle to the next.

Table 5. Operational considerations

Model sub-types	Some products may be available in several differently sized sub-types or with an option of extra width. Bariatric options are used for heavier patients and petite or paediatric variants may be suitable for the smaller person. A bespoke seat may also be available and made to individual specifications.
Chair size	The overall (external) chair size must fit the available space.
Adjustment	A chair that can be adjusted is better for a hospital-based environment where it is likely to be used by more than one patient.
User weight	The weight of the intended user is crucial when choosing a chair. Some specialist seating may have a maximum user weight of 80 to 100kg.
Portability	The presence of wheels will aid the portability of chairs around the ward; however, it does not guarantee the ability to move a patient seated in the chair.
Infection control	Covers that can be removed for washing or are suitable for cleaning with a disinfectant solution are better for infection control.
Purchasing	Some suppliers may offer rental or leasing options that may, or may not include service, cleaning and maintenance as part of a contracted service alongside outright purchase options. See <i>Purchasing</i> for details.
Demonstration and training	Suppliers may be able to provide demonstrations of their products or specific training in their use. This is particularly important for adjustable chairs to ensure they are used correctly.
Maintenance	A chair may need regular maintenance as part of the warranty conditions. Such chairs generally come with the option of a maintenance contract or network of approved service agents.

Ergonomics

It is conventional to approach human-technology interactions from a user centred perspective. This places users at the centre of the design assessment process, anticipating their needs and demands and hence quantifying the quality of the product features required.

The initial step in this process is the identification of appropriate user groups, the environments in which those users will interact with the product, and the task which is being undertaken. For stroke seating, these parameters are set out below.

Primary user

The primary users have been identified as UK adults over the age of 18 years who have suffered a stroke. These individuals may, or may not, have additional clinical conditions and may be at any stage of management of their illness. Users who are significantly below the age of 18 years are likely to have access to bespoke

paediatric equipment, whilst elderly users are reasonably represented within the normal spread of adult population data.

Secondary user

The secondary users have been identified primarily as caregivers. They may be professionals in a clinical or residential environment, but may also include partners, parents, siblings or others within the family unit who may have limited clinical knowledge.

Tertiary users

Tertiary users rarely come into contact with the product and may do so only in a professional capacity. They may include service personnel, maintenance contractors and those who manage the end of the product's life cycle.

Environment

The environments in which stroke seating may be used are numerous, including hospitals and clinics, day centres and recovery institutions, residential care homes, schools, workplaces, public places, and private houses. The design of the seat should not prohibit access to these locations.

Task

The task which stroke seating is intended to accomplish can be broken into four hierarchical elements:

- postural control
- pressure control
- comfort
- conservation of energy.

These elements must, as far as possible, be maintained during a range of routine activities such as:

- transfers to and from wheelchairs, other mobility devices, vehicles or other furniture
- self care (including washing, feeding, drinking etc.)
- mobility (auto propulsion, self propulsion or assisted propulsion)
- communication (direct or via assistive communication technology)
- bowel and bladder function
- interaction with other equipment [14].

The design of the chair should help the user to sit down and stand up unaided where this is physically possible. Where assistance is required, the caregiver should not be hindered by the design of the chair, nor forced to engage in excessive manual handling, increasing the risk of injury to both parties.

In a domestic setting, there may be only one caregiver, who will not necessarily be trained in the use of the chair, and may struggle to understand how it works and how it should be used. Chairs used in the domestic environment should therefore be as simple as possible. They should also minimise risks to the user and others of mechanical hazards arising from the functionality of the seat (eg entrapment, strangulation, scissoring).

Recommendations for seat dimensions based on human anthropometry

Ideally, any seat for this application should be fully adjustable in every dimension in order to fit the target population. That adjustability must be carefully matched to the anthropometry of the users such that the range of adjustment is appropriate. However, in practice it is likely that many seats will be of fixed dimensions. In this case it is possible to specify a seat that will be suitable for a range of users by integrating the most appropriate anthropometry for each variable. For instance, the seat base should cater for the shortest leg length since longer legged individuals will also be able to find a comfortable fit. However, the seat back should be suitable for individuals with the longest torso since smaller users will also enjoy support. Table 6 gives recommendations for fixed seating dimensions for an ambulant disabled user [60], which may be considered representative of those suffering mild to moderate stroke but who retain mobility.

Table 6. Seating guidelines for general seating of ambulant disabled individuals [60]

Variable	Guideline
Seat height	430mm from floor at leading edge for greatest comfort, 500mm from floor at leading edge for easier sitting and rising.
Seat width	500mm
Seat depth	400mm.
Seat back height	645mm (without head rest).
Clearance between rows of seats	At least 230mm if seats are in rows.
Handgrip design	Should possess a horizontal member which should extend 230 to 300mm in front of the foremost edge of the seat cushion to aid sitting and standing. Vertical members are desirable.
Handgrip height	850mm to 1100mm above the floor.
Handgrip diameter	25mm – 35mm in diameter and well rounded off.
Armrests	Should be 200mm to 250mm above the seat and should be removable to allow unimpeded access to the seat.

It may be possible to specify more than one fixed seat, with the intention of addressing the needs of the smaller and larger users. This approach should be followed with caution, particularly where seating may be shared, since an incorrect user match can result. Additionally, a correctly specified fixed dimension chair can offer a suitable range of accommodation providing the population data are well understood. When considering the design of seating for more severely disabled individuals the design criteria become more demanding (table 7). This is because of the additional health concerns generated from retaining a static loaded posture for protracted periods. These data represent an idealised solution for the main disabled population, including stroke patients for whom recovery is limited or protracted. A range of adjustments in any of the dimensions will allow for better tailoring of the fit for specific individuals.

Table 7. Seating dimension requirements for users who remain seated for long periods [60]

Feature	Recommended	Minimum	Maximum
Seat height (front)	470mm	470mm	490
Set rake (angle to horizontal)	9 degrees	n/a	n/a
Seat depth	430mm	430mm	450
Seat width	500mm	n/a	n/a
Angle of backrest to seat	102 degrees	n/a	n/a
Armrest height (front)	730mm	720mm	n/k
Armrest height (rear)	250mm	230mm	250
Armrest separation	460mm	n/a	n/a
Armrest protrusion from front seat to edge	120mm	n/a	n/a
Armrest width	120mm	n/a	n/a
Footrest angle	9 degrees	6 degrees	9 degrees

Usability

The usability considerations for appropriate seating choices for people with clinical conditions or disabilities depend on the specific requirements of the user. These are normally assessed via a needs evaluation and a skills evaluation. These are outlined below in table 8 and should be considered to ensure best fit of the seating to the user. It is important to remember that abandonment because of poor matching of the user to the product will lead to no benefit whatsoever, whereas proper use of a somewhat inferior design will still offer at least some benefit. The user's perspective should be considered as part of the clinical assessment of their requirements.

Table 8. Usability evaluation criteria [14]

User evaluation criteria	
Main principles	
Postural issues	Ensuring that the user receives correct and adequate postural support from the seating.
Pressure issues	Ensuring that the user is protected from unnecessary pressure and compression when using the seating in a normal way.
Comfort issues	Ensuring that the user is as comfortable as possible when using the chair.
Energy conservation	By minimising the energy needed for support and stability, the patient is better enabled to engage in physiotherapy, personal tasks and social interaction.
Needs identification	
Setting	Consider the environment in which the seat will be used. It may be used in more than one environment, by a group of users or by a single individual, in a care setting or in the home, workplace etc.
Care-giver support	Will trained and experienced care-givers be available to assist in correct setting up, adjustment and use of the seat?
Physical constraints	Are there any physical constraints which may impact on the selection and use of the seat, such as compatibility with other technologies, fitting with other furniture and architectural features, and support or space for the activities the user wishes or needs to undertake in the seat.
Accessibility	Does the user (and/or care-giver if providing assistance) have unrestricted access to the seat, facilitating sitting and standing? Do unnecessary design features make these movements complex or difficult? Is the chair accessible for occupants that need to be hoisted?
Transportation	Can the seating be transported easily? Are the requirements for transportation compatible with the user's capabilities? Are transportation accessories available? If the seat is to be used during transportation, are specific safety features included in the design to allow this and are they effective?
Skills evaluation	
Physical capabilities	Is the chair compatible with the physical capabilities of the user? Is caregiver support required because the seating does not meet the user's physical needs? If so can a seat be offered which offers a better fit to the user's needs? How forgiving is the seat design to deterioration of the user's physical capabilities?
Sensory skills	Will the user's sensory perception permit the achievement of best value from the functions of the seating? Features such as reclining and tilt in space may cause distress for those with sensory impairment, despite offering more support. Will the user be sufficiently aware of discomfort or pressure to avoid potential problems? Can the user express concerns related to these issues?
Cognitive and behavioural skills	Is the user (or care-giver) able to understand the functionality of the seating and the means of adjustment or operation. Are the ranges of adjustment obvious and intuitive in operation? Will the user be able to redress any errors made in setting up or using the seating?
Safety awareness	Will the user be presented with any hazards they are unable to manage? Are those hazards identified by the supplier of the seating or are they assessed independently in a context and user based scenario?

User evaluation criteria	
Motivation	<p>Is the seating satisfactory for the user? Satisfaction may be expressed as the degree to which the product meets the user's expectations. In order to assess this, the user's expectations must be ascertained and managed before deciding on appropriate products. Incorrect assessment of satisfaction may lead to early abandonment of seating which may be clinically effective but unacceptable to the user for a variety of internal motivational reasons including:</p> <ul style="list-style-type: none"> • the user's tolerance for technology • the user's aesthetic preferences • the user's ability to accept their disability and the value and necessity of specialist seating • the user's perception of comfort • the user's perception of support and stability.
Identification of previously used seating systems	<p>It is important that the user's experience is taken into account since it will impact on the acceptability of the equipment provided. Good experiences may lead to high expectations and acceptance of limitations. Poor experiences may lead to non-acceptance of design restrictions, limited functionality or increased dependency and could result in abandonment.</p>
Identification of goals of user, family members and caregivers	<p>Clarifying and prioritising the user's goals will result in greater acceptance. Use and satisfaction rates will be higher if the function of the seating is in line with the goals of user and carers.</p>

User comfort

Comfort is notoriously difficult to evaluate discomfort scales are more reliable and easier to quantify [61]. Thought should be given to the seating materials; the air exchange, moisture control, breathability, irritation to the skin and temperature regulation properties of the materials should be considered.

Users may need to try the chair for up to 90 minutes to indicate the level of comfort. Firmer seating is also preferable in terms of supporting the body and avoiding pelvic disruption or spine alignment issues. Seating should be padded over a firm structure and avoid slings or excessive cushioning.

Shear forces occur internally as the skeleton initially slides down, whilst the skin tissues remain static. Shear causes internal damage to the tissues and 'kinks' the capillaries, causing micro-thrombi. Friction occurs when the person slides down in the chair. Both can be reduced by suitable positioning, but never entirely eliminated, as they are caused by gravitational forces. However, consideration of these issues in the seating specification can assist in minimising the consequences. Evaluators should ensure that the materials used in the manufacture of the seating are suitable to support the range of motion that is anticipated. For example, materials with greater friction will resist sliding and slumping but will make positional adjustment more difficult for the user or carer. A more slippery seat back will allow the torso to move as the seat back is inclined or reclined without disturbing the basic seating position. A

low friction or low-shear back recline mechanism is desirable as this reduces shear forces encountered during the recline manoeuvre.

The chair should be able to provide an adjustable lumbar support. This must be removable for those whose condition renders lumbar lordosis uncomfortable and adjustable for other users. The chair should also allow for stabilising of the centre of gravity to provide grounding for the user and so allow them to undertake other tasks comfortably and with confidence.[14].

If contoured seating is provided it should be available in a range of sizes or profiles or ideally feature a cushion that is able to contour to the user, such as visco-elastic foam or similar. Fixed contour panels should be removable or replaceable to accommodate changes in the user's status or subsequent user requirements [14]. It is desirable for there to be an adjustable anti-thrust (or anti 'submarining') support to prevent the body sliding forward. This should be part of the seat contouring.

The chair should be designed such that the user can flex their legs under the leading edge of the seat surface ('boxed' structures are undesirable)[14]. Feet supports should be provided, or the seat should be height adjustable such that any prospective user can ensure that their feet can be maintained at 90° to the lower leg and with the knee joint at 90°.

User wellbeing

Since sitting is a dynamic activity, chairs should be critically appraised for the range of movement they allow whilst still providing the necessary levels of postural support and pressure relief.

Any orientation in space feature provided by the seating should operate whilst allowing the hip extension to be maintained at 90° to aid in postural support.

If an abductor is fitted it should be restricted to performing its sole function of support and should be positioned nearer the knees than the groin. A poor chair design may place the abductor nearer the crotch in an attempt to retain the user [14]. The abductor should also be fully adjustable in both size and position to accommodate different users.

Ideally the seat support surface will be able to reduce the measured pressure under the ischial tuberosities to less than 60mmHg [14]. This should be endorsed by the chair manufacturer. Chair users should be able to undertake pressure relieving exercises without threatening stability or suffering undue strain and a discreet, adjustable and inconspicuous pressure relief timer should be provided which should feature an alarm. It should be easy to connect or disconnect by the user and/or carer [14].

Adjustability

Ideally, adjustability should be provided over all major functions to allow for adaptation for individual user's needs. This should cover seat back height, back angle, seat depth, seat width, recline, tilt in space, head rest, armrest height and footrest position. Headrest adjustment should be available in vertical and fore/aft planes.

All adjustment must be within the capability of the user and/or carer and should be capable of being completed without tools. The means of adjustment should be intuitive and failsafe such that components cannot be left slack, or work themselves loose.

Pelvic positioning belt

If a pelvic positioning belt is provided, it should be detachable and adjustable. Beyond adjustability for fit, the belt should offer 45 degree and 90 degree retention positions. Any chest strap must be separate from the pelvic positioning belt [14]. All straps should be suitably padded and covered, or made from, breathable and padded materials. Pressure points and poor alignment should be avoided.

Fastening, release and adjustment facilities should be clear and intuitive and should be within the capabilities of the user. However, the safety function of the positioning belt and the need for it to be fastened appropriately should be made clear on the product in a permanent fashion.

Ancillary equipment

An audit should be taken of any ancillary equipment, such as respirators or monitoring devices but also including other furniture and architectural features. Cables and tubing etc should be capable of being routed around the chair so as not to cause unnecessary hazards. Communication devices should be freely accessible, provided with adequate support and allow easy access as this may be of great importance to the user.

Care-giver role

The cushions and chair padding should be capable of being removed and replaced by a single caregiver whilst the user remains in place. Any handles for pushing the seat should be adjustable in height from at least 889mm to 1016mm from the ground [62]. The force required to turn the seat on its axis (if it is mobile) should be minimal and the space required to turn through 360° should be less than 1900mm x 1900mm [62]. The brakes should be intuitive, ideally down for on and up for off (if foot activated) with a clear status indicator. Any operating lever or pedal should fall within the envelope of the chair such that it does not present an obstacle or tripping hazard to the care-giver or other.

Longevity

The chair should provide a level of durability compatible with the expected demand for its use. This durability should be clearly stated by the supplier and should cover all appropriate components integral to the functioning of the seat. Consumables should be clearly stated as outside of this reasonable durability period if appropriate.

The chair should still function structurally if any of the interfaces were to fail – for instance if an inflation system were punctured – such that the user would still be able to use the chair whilst waiting for a replacement. Body support structures should be fully optional, such that the seat is future-proofed.

A clear statement should be provided on the life expectancy and duration of spares availability of the cushioning material. The replacement costs of these items should be made clear such that these costs can be factored into the overall cost of the seating.

Mobility

If the seat can be detached from a wheeled interface then the attachment and detachment should be able to be undertaken by a single care-giver in safety. Ideally this should be possible without tools and with the user in place in the seat. If instructions are necessary for this procedure then they should be capable of being stored on or with the seat such that they are not easily lost.

If it is determined by a therapist that a patient needs to be mobile in the chair over a wide area, such as between buildings, a specialist wheelchair-based seating solution may be more appropriate. However, this is outside the scope of this report.

Cost-effectiveness

No evidence regarding the cost-effectiveness of specialist seating interventions for stroke was identified. However, stroke unit care has been found to be more cost efficient, when cost per patient day alive and effectiveness are taken into account, than a specialist stroke team on a general medical ward or specialist domiciliary care at home [63].

Whole-life costs

Total ownership costs should be considered for the chairs prior to purchase. A specialist seating system may cost between £300 and £4000, and will generally have a lifespan of at least ten years. Additional costs include:

- replacement of the supporting cushions and / or loose covers at intervals of 6 months to 5 years, depending on usage
- storage of the chair when not in use
- cleaning of the chair during use and between patients
- maintenance and servicing. Modular chairs allow easy replacement of components, facilitating maintenance.

Funding

There is no consistency of funding provision for specialist seating throughout the UK. The main funding streams identified cover specialist seating in general, not just seating for stroke in the acute hospital trust. These include:

- foundation and acute hospital trusts (various budget streams, including wheelchair services)
- primary care trusts
- charitable funding sources
- social services
- nursing or care homes
- self-funding by patients/carers/relatives.

Some suppliers may offer rental or leasing options for their chairs and these contracts may include an element of planned cleaning, servicing and maintenance.

Purchasing procedures

The Trust Operational Purchasing Procedures Manual provides details of the procurement process [64].

European Union procurement rules apply to public bodies, including the NHS, for all contracts worth more than £90,319 (from January 1st 2008) [65] (appendix 1). The purpose of these rules is to open up the public procurement market and ensure the free movement of goods and services within the EU. In the majority of cases, a competition is required and decisions should be based on best value.

NHS Supply Chain (www.supplychain.nhs.uk), a ten year contract operated by DHL on behalf of the NHS Business Services Authority, offers OJEU compliant national contracts or framework agreements for a range of products, goods and services. Use of these agreements is not compulsory and NHS organisations may opt to follow local procedures.

Sustainable procurement

The UK Government launched its current strategy for sustainable development, *Securing the Future* [66] in March 2005. The strategy describes four priorities in progressing sustainable development:

- sustainable production and consumption – working towards achieving more with less
- natural resource protection and environmental enhancement – protecting the natural resources and habitats upon which we depend
- sustainable communities – creating places where people want to live and work, now and in the future
- climate change and energy – confronting a significant global threat.

The strategy highlights the key role of public procurement in delivering sustainability.

End-of-life disposal

Consideration should be given to the likely financial and environmental costs of disposal at the end of the product's life. Where appropriate, suppliers of equipment placed on the market after the 13th August 2005 should be able to demonstrate compliance with the UK Waste Electrical and Electronic Equipment (WEEE) regulations (2006) [67]. The WEEE regulations place responsibility for financing the cost of collection and disposal on the producer. Electrical and electronic equipment is exempt from the WEEE regulations where it is deemed to be contaminated at the point at which the equipment is scheduled for disposal by the final user. However, if it is subsequently decontaminated such that it no longer poses an infection risk, it is

again covered by the WEEE regulations, and there may be potential to dispose of the unit through the normal WEEE recovery channels.

Purchasing routes

A number of procurement routes have been identified through stakeholder engagement:

- direct purchase by wards
- local trust procurement services
- regional collaborative procurement hubs (CPHs)
- NHS Supply Chain for some suppliers or bulk purchase.

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Lease options

National frameworks are in place for operating leases to help the NHS procure leases more cost efficiently and effectively. Further details are available from the PASA website [68].

EU procedures

The Public Sector Directive (2004/18/EC) has been transposed into UK law via the following statutory instruments:

- the Public Contracts Regulations SI 2006 No.5 (the regulations)
- the Utilities Contracts Regulations SI 2006 No. 6 (not relevant to this guide).

The regulations apply to contracts worth more than £90,319 (from January 1st 2008) [65] over their whole life, and specify the procedures to be followed for public sector contracting, including adherence to strict timetables, requirements for advertising, invitation to tender and the award of contract. Organisations undertaking a procurement exercise covered by the regulations must give all suppliers an equal opportunity to express an interest in tendering for the contract by placing a contract notice in the Official Journal of the European Union (OJEU).

At all stages of the procurement process, the purchaser must be demonstrably fair, as any decision made can be challenged by the unsuccessful suppliers.

Establishing a procurement strategy

To achieve a successful outcome, decisions need to be made on:

- whether an existing contract/agreement can be used
- the need to consider sustainable development issues
- whether EU directives apply
- the type and form of contract
- sourcing potential suppliers
- duration of contract and opportunity to review/extend
- payment schedules
- how to minimise any risks with the chosen strategy, including supplier appraisal and evaluation/clarification of suppliers' bids.

Preparing a business case

A business case should be drafted and approved before conducting any procurement exercise. Further guidance on preparing business cases is available from the Office of Government Commerce [F] and an illustrative example is provided in the *NHS PASA Operational Purchasing Procedures Manual*, Procedure 1-01 [69].

The EU tendering exercise

EU procurements usually take between 4 and 6 months to complete. This needs to be taken into account in the planning stages. The length of the exercise depends on the chosen procedure (open or restricted). Further information is available from the Department of Health [70].

The procurement panel

A multidisciplinary team should be selected to guide the purchase. Representatives from clinical, user, technical, estates and financial areas should be considered.

Identifying potential suppliers

Criteria for supplier selection must be established. A pre-qualification questionnaire, seeking background information (eg on the skills and experience of the service engineers) may be employed as an initial screen to exclude unsuitable suppliers.

Evaluation criteria

Performance specifications should be derived from local operational requirements, and agreed by the procurement panel. They will form the basis for assessing the adequacy of suppliers' technical specifications, provided in response to the technical specification questionnaire.

It is important to have agreed on the performance specifications of the product as they will be used in the adjudication against company specifications.

Requests for features which are supplier-specific are not permitted under the regulations. Very specific features which are not supported by operational requirements are also not allowed.

Award of contract

Following award of the contract to the successful supplier; unsuccessful suppliers may need to be debriefed. This is at the supplier's request.

Buyers must be aware of the 'Alcatel' procedure (see the *Trust Operational Purchasing Procedures Manual* [64], Procedure No.T-08, section 6 - *Mandatory Standstill Period*).

For more information on procurement please refer to the Department of Health Website [71].

Buyers' guide: Specialist seating for stroke patients in the acute hospital setting

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