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Considerations for modifying homes for children

Modifying a home enables a child to live with their family and is an alternative to institutionalisation. Staying put and deinstitutionalisation programs have resulted in greater numbers of children with disabilities living in normal residential housing. For instance, 99% of children with disabilities between the ages of 0-14 resided in the community (Australian Institute of Health and Welfare, 2004). This has resulted in increasing demand for effective children's home modification interventions. To be effective modifications must improve safety, wellbeing and enable in-home care and support. Regardless of whether a child has a disability or not, younger children usually require a greater degree of assistance with self-care and other activities, and when coupled with mobility difficulties and an inaccessible home, in-home care provision can become difficult and if not dealt with well the carer may be unable to sustain themselves and/or provide the degree of care necessary.

When modifying a home, the interventions must address the immediate needs of the individual with a disability, and should aim to promote independence for the individual and support for their carers into the future. However, children's needs continually change, and as growth and development occur and or health status fluctuates, different supports and access needs will be required. For instance, a modification for a child, with a typical growth pattern, may not be suitable five years down the track. Handrails will need to be raised as the child's reach range increases. Further, children with disabilities seldom follow typical growth patterns and their needs as they grow may be more variable.

Australian Standards

AS 1428.3-1992 Design for access and mobility, Part 3: Requirements for children and adolescents with physical disabilities, states the minimum requirements for public access in relation to children of different ages with physical disabilities. For example, a minimum height of a handrail from a landing for a child between age 3-6 ½ who may or may not use mobility aids is 825 mm whereas, the minimum height for a child between age 6 ½ -10 of the same mobility is 860 mm (Standards Australia, 1992). The Australian Standards are clearly relevant for public buildings; however, while they are not regulatory in the home, they can act as an effective guide for creating greater accessibility. Anecdotal feedback from paediatric occupational therapists has generally concerned three concerns regarding the applicability or otherwise of AS1428.3 to children's homes. First, the reliability and validity of the dimensions given the relatively small sampling size (288 children, including 109 able-bodied children); second, the minimum access provision or A80 concept (i.e. that only 80% of existing children's wheelchairs would be accommodated); and third, concerns with the recommended heights of handrails and grabrails.

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The research underpinning the children's access and mobility standard (AS1428.3) found that the 'preferred' handrail, grabrail, seat and toe heights for children were sometimes higher than the minima given in adult standards, implying that a young wheelchair user might require slightly higher handrails and higher toilet seats for transfers than some adults (Seeger & Bails, 1991). Nevertheless, most dimensions given remain within the adult limits. For instance, the dimensional window in adult standards permits grabrail and handrail heights positioned between 865mm and 1000mm from the floor (Standards Australia, 2001). Further, AS1428.3 like all the access and mobility standards is subject to review and it is likely that the next review will aim to have a minimum provision of 90% not 80% as with the current AS1428.1 revisions (Standards Australia, 2001). That is, it will be broadened to facilitate access for at least 90% of children with disabilities.

Additionally, optimal grab rail position requires children to have their muscles at an extreme range, in order to maximise biomechanics during transfers. For example, when standing up from sitting on a toilet, a vertical or diagonal rail requires maximum extension (150° -180°) and shoulder flexion (90°) in order to gain maximal pull for the transfer. As Woodson (1981) describes it, "maximum arm force occurs when the force can be applied at shoulder level…for the seated individual, pull force is greatest when the object is positioned at nearly maximum arm length." Therefore, the recommended grab rail heights may be a little higher than expected.

> For more information regarding functional grab rail prescription refer to article 'Basic biomechanical and anatomical principles underpinning grab rail prescription for sit-to-stand transfers' by (Bridge, 2004), found in the 'occasional papers' section in the 'resource library' of the HMMInfo website: www.homemods.info/publications-by-hminfo

When modifying homes for children, some of the other relevant Australian Standards to consider are as follows:

AS 1428.1-1993
Design for access and mobility. Part 1: General requirements for access-New Building Work. For circulation space, continuous accessible path of travel, surfaces, grab rails, doors and doorways, and lifts.

AS 1428.2-1992
Design for access and mobility -Enhanced and additional requirements -Buildings and facilities. For circulation space, continuous accessible path of travel, surfaces, grab rails, doors and doorways, and lifts.

AS 4299-1995
Adaptable Housing. Planning and design standards for residential accommodation enabling potential adaptations.

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Anthropometrics

The concept of “fit” relies on knowledge of children’s physical dimensions or anthropometry. According to Norris & Wilson (Norris & Wilson, 1995) static anthropometry is the measurement of body dimensions and body landmarks in sitting and standing such as stature, weight, limb segment length etc. Functional anthropometry on the other hand, measures the range of human movement such as how far an individual can reach overhead from a wheelchair or from standing. Therefore, applying static and functional anthropometric data to better understand implications of equipment and modification interventions increases safety, usability and wellbeing for children and their carers. For example, the installation of a handrail or toilet at a height, that best ‘fits’ the child’s stature and functional reach range. Anthropometric data can also be applied to design to ensure areas and products are inaccessible for safety, for example, ensuring the gap between railings on cots does not risk head or limb entrapment.

A typical child’s growth can be evaluated and monitored by comparing their individual measurements to standard recorded anthropometric data, such as growth charts. Data is also variable for gender, ages, pubertal ‘growth spurts’, genetics, cultural differences and trends in living conditions. It is important to note how current the standard data is, as changes in living conditions and nutritional influences can cause a difference in average measurements. In this sense, a child’s changing needs may be predicted and home modifications may be set in place for a longer period. Re-evaluation intervals can also be planned, assuming the child has a typical growth pattern. For example, installing a diagonal grab rail or installing an adjustable toilet grab rail (table 1), ensures that the height of the grab rail corresponds to the child’s functional reach as they grow. Much of the anthropometric data is carried out on typical children and therefore, may be inapplicable for children with disabilities. For instance, children with Down syndrome tend to have a smaller head circumference and shorter stature when compared to typical children (Maternal & Child Health Bureau, 2000). Children with special care needs are at a higher risk of factors that can influence growth, such as impaired motor skills and long-term use of medications (Maternal & Child Health Bureau, 2000). These special conditions can also make children with disabilities difficult to measure for example, measuring a child with Cerebral Palsy who has contractures. Special conditions and disabilities require specific data and can be retrieved from various organisations and websites, such as Kidsgrowth.com (KG Investments LLC, 19992005): www.kidsgrowth.com/resources.

Anthropometrics measurements need to be highly accurate if they are to be a valid indicator of a child’s growth. Considering factors such as data collection styles and data collection contexts i.e. time, season, clothing and environment can enhance accuracy. For example, alternate styles of measuring can be used for children who are unable to stand, for example, sitting height and crown-rump height can be used in place of stature, or stature can be measured whilst lying. While, consideration of the time of day the data is recorded should be noted, as human stature varies in a twenty-four hour period, for example, a child may be shorter in the night when compared to morning

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measurements, as gravitational forces and pounding forces upon the cartilage, can cause vertebral disc compression (Body Trends Health & Fitness, 2004).

Since standard anthropometric data is unlikely to describe a particular client, personal measurements need to be taken, but what are the important measurements? According to (Snell, 1983) the following measurements are important for home design:

Table 1. Important Measurements

Measurement	Comments	Design aspect
Eye height	Taken standing and sitting depending on child's abilities	Line of sight for controls, windows, sharp edges
Elbow height	Taken standing and sitting depending on child's abilities	Determines working-surface and grab rail heights
Shoulder height	Taken standing and sitting depending on child's abilities	Determines heights of controls and fixtures
Side-to-side width	Widest point of body (hip) or mobility aid	Determines widths for doors and seating space
Maximum hand grip diameter	Diameter of thumb touching middle finger	Determines choice of grab rail and door hardware
Upper-leg length	Hip to knee	Seating depth
Chest-toe length	Horizontal distance	Space allocation beneath a work surface
Horizontal arm reach	Front and side reach for sit and stand	Placement of light switches, storage, controls
Vertical arm reach	Sit and stand	Heights of cupboards
Upper leg height	For wheelchair users	Seated leg clearance under tables
Turning radius	For wheelchair users	Circulation space
Seat height	For wheelchair users include cushions that affect the height	Transfer heights i.e. toilet height, bed
Foot-pedal height	For wheelchair users	Determine cupboard and wall protector height

Methods of measuring maximum hand diameter need to be valid if this data is to be used to chart growth; however, when using this data functionally, it is useful for prescribing a grab grail. A reliable method for calculating optimal grab rail diameter for a person is to measure their maximum grip diameter by measuring the distance between the tip of the 3rd digit (middle finger) to the palmar crease. This measurement

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can then be used to decide which standard grab rail internal diameter (25mm, 32mm or 38mm) will enable the person the most powerful and functional grip. Assuming typical growth patterns, the most common diameter for a child is obviously the narrowest standard diameter available on the market. However, therapists should question the length of time this diameter will be appropriate for the child and plan to re-evaluate the modifications in the future to accommodate growth. Further measuring methods can be accessed by visiting http://depts.washington.edu/growth/index.htm (Maternal & Child Health Bureau, 2000) or charts on https://depts.washington.edu/growth/

Adaptable Housing

The concept of adaptable housing can answer the need for changing modifications. An adaptable house is one that can cater for future modifications, for example, installing a reinforced wall for subsequent installation of grab rails for a child with a progressive condition. As a child with a disability grows, there will be certain aspects of the home that were required to be inaccessible that are now required to be accessible. For example, installing an adjustable stovetop would ensure that the child has future access to cooking facilities that will need to be inaccessible whilst the child is young.

Does this mean you safety gate the kitchen? Doesn't this then become an access issue for the child in the wheelchair? All of these questions need to be discussed and the family needs to be informed of any risks that could result from a modified area.

Refer to the following references for more details on adaptable and accessible housing:

- For room specifics refer to the Independent Living Centre 'Guide to planning bathrooms and kitchens' (Independent Living Centre NSW, 2003).
- For site principles refer to 'The accessible housing design file' (Mace, 1991).

Note: dimensions are based on US standards so not applicable in Australia.

- For Australian specifics and attractive graphics refer to 'Welcome: Design ideas for accessible homes' (Building Commission Victoria, 2002).

Home Safety & Accidents

Whether a child has a disability or not, they will still get curious about their environment. Curiosity generally leads to environmental exploration and increases the likelihood of an accident occurring. Fiscally, home injuries result in annual health related expenditure estimated at $660 million for children (Atech Group & Minter Ellison Consulting, 2001).

Home accidents are common and can result from poor housing repair, inaccessibility and inappropriate accessibility. On the one hand, an environment where dangerous things are in closer reach can lead to injuries for the child and other household members (e.g. falls, poisons, scalds etc.), while on the other hand, inaccessible elements such as an open riser or a steep stair might cause a slip, trip or a fall.

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Unfortunately both situations can result in hospitalisation and at worst create secondary disabilities. The lack of standardised assessment tools for children's home assessments raises concern about the tools in current usage. If practitioners apply only a generic home visit checklists designed for adults, child-related issues may be overlooked. For example, is the child's play area assessed for access and safety? Is it visible from the kitchen and other supervisory areas? Is the area that has been made accessible, inaccessible for younger siblings at risk, for example, are there safety gates in place where there is a lowered stove height for a wheelchair user? Children with behavioural/intellectual difficulties may require safety measures to prevent them from exiting the home or accessing unsafe areas.

Further, modifying a home to suit a child with a disability can impact the safety and convenience of other family members and/or formal carers. For example, lowering a toilet for a child with a disability can make the toilet impractical for adults and may also present a drowning risk for younger siblings. Another example may be; rearranging furniture to increase the circulation space available for a child who uses a wheelchair, which may introduce the risk of a younger sibling climbing or falling out the window. The household must be considered and informed when modifying any aspect of the home. Any interventions may become a safety issue for family members, for example, introducing a shower chair for a child may promote independence in showering for that child, but at the same time may be a trip hazard for family members when it is not in use and does not have a particular storage place. Incorporating a child safety checklist into the process of home assessment would help ensure that all issues are fully addressed. Generic home safety checklists for children, such as the 'Home Safety Checklist' available from (The Children's Hospital at Westmead, 2003) www.chw.edu.au/parents/factsheets/safhomej.htm?print or 'Childproofing Your Home' checklist (Baby Place, 1995) www.babyplace. com/safety_checklist.html can be easily incorporated into the assessment phase.

Caring for the Carer

When modifying a home for a child, the household and carer's needs must also be considered, as children are not the primary users of all home facilities. Home environments need to meet the needs of all occupants i.e. other children and adult family members and/or carers. Thus measuring family members of the client to highlight possible conflicting requirements in home design is important (Snell, 1983). In addition, exclusive areas or inaccessible areas have been reported to be an advantage to parents in some situations. For instance, (Mayes, 1997) reported that parents sometimes valued inaccessible aspects of their home (e.g. a mother of a disabled child indicated that a second storey that was inaccessible provided her with a personal space for 'time out').

When the child is young, much of the modifications typically proposed are to assist the parent in their role, for example, installing a wall mounted change table. In this case, the occupational, health and safety issues for the parent or primary carers need to be

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assessed. For example, a parent has the right to make a decision not to go through with certain modifications and cope with home environment as is, but an external care agency, that might be needed in the future, may refuse to work under these conditions. As a child with mobility impairment grows older and as they gain weight, they may require more assistive equipment or care for independence and therefore require more space and better consideration of equipment and its storage. For example, an English study found that the most frequently reported problem area for family members was a lack of family space, as well as common difficulties with toileting and bathing, and a lack of additional or downstairs facilities and equipment (Beresford & Oldman, 2002). Just over a third of the families they surveyed (more than 2,500 parents) reported that they had a lack of space for storing equipment and one in five families also said there was a lack of space for therapies to be carried out in the home and specialised equipment to be used. Thus the sort of questions most pertinent to consider includes the following:

- Will the child's bedroom have the capacity for an electrically operated bed?;
- Will the bathroom be large enough to accommodate a hoist and have enough circulation space for a powered wheelchair? and is there space for home therapy?

If the environment does not facilitate independence or accommodate the use of specialised equipment required for prevention of injury to carers, the demands upon the family only increase.

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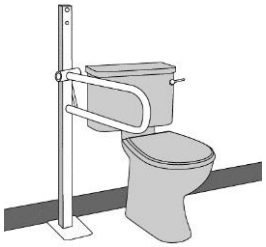
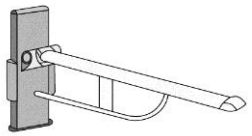
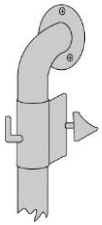
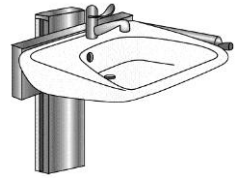
Products

There are a number of products that could be used for the accessibility and safety of a home for a child with a disability and their family. Note: this is not an exhaustive list.

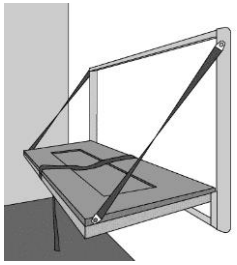
Table 2. Products for children's home access and safety

Product	Comments/Advantages/disadvantages	Image
Adjustable Folding Rail	- Clamp with plastic knob for adjustments ✓ Can be adjusted to suit the height of a child ✓ Can be adjusted as the child grows ✓ Can be folded away for other users × needs to be installed to a reinforced wall × load capacities, but unlikely to limit a child	
Support Arm	✓ Adjustable in height to accommodate growth by 250mm.	
Adjustable Hand Shower Bracket	- Made of plastic. Used in conjunction with a vertical grab rail. ✓ Can be adjusted to the required height of the user. ✓ Can be set to the various heights of all users. × Cannot be fitted to existing grab rails.	

Note: Table key for advantages and disadvantages column ✓ Advantages × Disadvantages

Product	Comments/Advantages/disadvantages	Image
Manual wash basin bracket	✓ Can occasionally adjust height for growth. Up to 250mm height adjustment, once mounted at recommended height. ✓ Bracket fits most mounted wash basins. × User cannot adjust height as weight of basin needs to be lifted.	
Wash basin bracket electric motor	✓ Lever control or remote control. ✓ Lever can be placed on right or left side. ✓ Electrically height adjustable for multiple users. ✓ Up to 300mm height ✓ adjustment, once mounted at recommended height. × Expensive	
Safety door gate	✓ Ensures unsafe areas are inaccessible for infants. ✓ Can act as a deterrent for children with behavioural/intellectual difficulties. × Risk of entrapment between vertical rails. × May cause an area to be inaccessible for a family member with a disability.	

Note: Table key for advantages and disadvantages column ✓ Advantages × Disadvantages

Product	Comments/Advantages/disadvantages	Image
Para-mobility wall mounted change table	✓ Can be adjusted to suit the height of the carer. ✓ Can be folded away to wall when not in use ✓ Can be useful for infants and adults. × Requires a large wall space and floor area when in use. × May have weight limitations.	
Thermostatic mixing valves	- Regulates the flow of hot and cold water ✓ Keeps temperature constant-reduces risks of scalding. ✓ If cold water supply fails, the valve immediately shuts off. ✓ A good safety feature for the entire household. ✓ Can be installed to control any hot water outlet.	

Note: Table key for advantages and disadvantages column ✓ Advantages × Disadvantages

Checklist

- ☐ Has the family considered moving or relocating? This is best done prior to school commencing so as to minimise disruption to educational and social relations as little as practicable.
- ☐ Does the family frequently move or is the home a private rental? If so temporary solutions may be best.
- ☐ Are there workable equipment solutions as alternative to home modifications? This may save time and money in the short term.
- ☐ Has the family been in touch with their local Independent Living Centre for advice about the full range of equipment solutions?
- ☐ Is the housing located in a safe area (i.e. near a busy road etc.)? Home modifications may not be worthwhile, if as soon as the child leaves the front door they are unsafe?
- ☐ Does the home have sufficient security (i.e. child safe gates, doors and locks)?
- ☐ Does home location increase or decrease service accessibility (i.e. transport, therapy etc.)? If not, how will services be accessed.
- ☐ Will the child require in-home therapy? If so, will the home accommodate room for in-home therapy?
- ☐ Will an external care agency have OH&S issues with the home environment? Agencies may refuse to work in the state of the home.

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