ableX is a clinically proven, continuous care solution designed to accelerate the rehabilitation of arms and hands after a stroke or brain injury. The system comprises a suite of computer-based exercises in game format which are designed to promote both movement and cognitive skills, together with two devices with which the client conducts the movement. It is used to augment conventional rehabilitation to improve outcomes and increase clinical productivity.

**About ableX**

The ableX system is a versatile rehabilitation tool shown to be effective in providing repetitive, intense and engaging exercise that improves upper limb function [1,2].

The ableM control device is a table-top arm skate for use uni- and bimanually. It is suitable for clients with minimal ability to move the affected arm against gravity, providing early training for shoulder protraction/retraction and adduction and abduction, and shoulder/elbow flexion and extension. The ableM can be used at a more advanced stage to assist wrist and finger movement.

The ableX control device is a handlebar with an air mouse. This is suitable for clients with some ability to move the arm against gravity (e.g. from the lap onto a table top). It is a mainly bilateral device which progresses a client to autonomous unimanual use and is used to improve range of movement, strength and control.

The ableX software can be set up in minutes on a computer. With either control device it provides engaging and motivating therapy, in any care setting.

**How it works**

The ableX system provides high intensity upper limb training and also influences balance, cognition and engagement. The therapy games are easy to play on any Windows computer.

The system stimulates neural plasticity, the brain's ability to re-establish damaged neural pathways and support recovery and motor relearning. Intensive bilateral training, where both arms move together in activities which engage the patient, is associated with improvements in chronic stroke patients' upper limb function [3,4].

A client using the ableX system performs up to 800 completed movements in a 60 minute session [1]; this is the intensive practice which studies indicate is required for enduring neuroplastic change [5]. These movements are fully patient-directed and unassisted by motors or springs. The body of research indicates that at least 16 hours of additional exercise is required beyond standard background therapy to improve the performance of normal daily tasks [6]. In turn, recent research suggests that exercise may also improve depressive symptoms, some aspects of executive functioning and memory and health-related quality of life after stroke and post-stroke fatigue [7].

**Key Benefits**

- **Proven efficacy** – the system is clinically demonstrated to be effective at accelerating arm and hand rehabilitation by motivating many purposeful movements. The system is in use in multiple rehabilitation facilities for stroke and TBI and is deployed in more than 500 home applications.

- **Patient engagement** – clients find the system empowering and quickly become self-directed. Clients develop positive recovery habits and show high adherence even when unsupervised.

- **Documented progress** – data on individual client adherence, performance and movement parameters are recorded and provided in reports automatically updated after each session.

- **Tailored prescription** – ableX recovery programmes can be tailored to each client, based around the therapist’s assessment and organised to integrate with existing recovery strategies and clinical workflows.

- **Productivity gains** – in most care settings the ableX system immediately increases activity time and intensity for patients, helping clinics to achieve performance targets, for minimal or no additional staffing.
Clinical sites

The ableX system is easy to adopt in a range of practicing rehabilitation settings, with minimal or no additional staff.

- At Royal Melbourne Hospital the ableX system is accessible to acute patients from Day 2 post-stroke. The 10-week Hand Hub intervention forms part of a patient’s rehabilitation journey from inpatient through to outpatient care.
- Specialist rehabilitation centres, such as Laura Fergusonson Rehabilitation in New Zealand, incorporate the ableX system into routine care for residential clients and are exploring its application to conditions other than stroke, such as traumatic brain injury.
- General rehabilitation units employ ableX as a specialist stroke treatment tool when expert therapists are unavailable.
- For individual therapy clients the ableX system enables independent training which augments funded contact time.

Evidence base

The ableX and ableM devices have each been the subject of clinical studies, in conjunction with the ableX suite of therapy games.

Participants with chronic stroke disability completed interventions of 9 hours (ableX) [1] and 12 hours (ableM) [2] respectively, and in both studies showed a clinically significant improvement in arm function. The results compare favourably against more expensive robotic devices, and against commercial computer gaming systems.

Participants were also highly motivated to train independently at home on the ableX system [8,9], and they perceived additional benefits in concentration, coordination and balance [10].

Key features

- ableX is easy to install and use, with oversized icons, cursor and text.
- Simple game design avoids confusion and frustration.
- Games provide a progressive intensity of repeated movements, increasing accuracy, concentration and speed.
- The ableX and ableM devices work in various modes, progressively improving range of movement and control in multiple joints, strength, fine motor skills, and finger function.
- Feedback is automatically provided to patients during training. Data showing adherence, exercise intensity and progress are easily accessible to the therapist.
- Training, programme design and prescription support are available to assist optimal use.
- The ableX system is available for purchase, rental or on a programme of service basis. Ask us about our clinical packages to help you tailor ableX training routines for your patients’ rehabilitation goals.

Implications for your practice

Incorporating the ableX system into routine care provides an immediate and recorded increase in patients’ total rehabilitation time and especially time engaged in active upper limb rehabilitation, for minimal or no extra staffing or supervision. This can accelerate recovery and improve patient outcomes. The standard ableX intervention of 45-60 minutes per daily session aligns with current clinical recommendations for inpatient stroke and brain injury, and it provides highly intensive training to complement conventional therapy resources.

Incorporating the ableX system into routine care provides an immediate and recorded increase in patients’ total rehabilitation time and especially time engaged in active upper limb rehabilitation, for minimal or no extra staffing or supervision. This can accelerate recovery and improve patient outcomes. The standard ableX intervention of 45-60 minutes per session aligns with clinical best practice, as an adjunct to conventional therapies.

Therapists apply the ableX system for patients with stroke, traumatic brain injury, dementia, cerebral palsy and similar neurophysical conditions where intensive task-based repetitive training improves patient outcomes.

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  - info@im-able.com
  - NZ: 0800 000 639
  - Int’l: +644 909 7304
  - Accelerate stroke recovery
**International Classification of Function (ICF)**

**Application of ICF framework to the ableX system**

**Indicated conditions:** Stroke, TBI, CP, MS, Parkinsons, SCI, Dementia

**Impairment**

- **Target:**
  - Upper limb neuromuscular tone C + D
  - Balance, postural control
  - Sensation
  - Cognition/inattention
  - Communication
  - Behaviour

- **Structure and function:**
  - Control/range of movement
  - Reduce stiffness
  - Cognitive behavioural alertness
  - Concentration
  - Communication

**Activity**

- **Train:**
  - UL performance of ADLs
  - Bimanual tasks
  - Motor planning
  - Decision making

- **Address limitations:**
  - Structured training at individual's level
  - Optimise intensity and repetition
  - Motivate and engage in task
  - Group or individual

**Participation**

- **Enable:**
  - Community interaction
  - Communication
  - Computer skills
  - Engagement

- **Reduce restrictions:**
  - Access (transport/time/cost)
  - Within daily/weekly routine
  - Training and adherence online
  - Robot-enabled practice
  - Shared social interaction

**Contextual**

- **Environmental**
  - Adaptive equipment
  - Carer or self-administered

- **Personal**
  - Empower self-management
## Model of care: indicated provider settings for ableX system

<table>
<thead>
<tr>
<th>Setting</th>
<th>Acute</th>
<th>Inpatient/ outpatient rehab</th>
<th>Specialist/ Residential/ Day centre</th>
<th>Home</th>
</tr>
</thead>
<tbody>
<tr>
<td>Role</td>
<td>Initial patient engagement</td>
<td>Increasing intensity, activity</td>
<td>Continuity/ transition</td>
<td>Self-management</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Teaching self-management</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Implementation</td>
<td>Hospital MDT incl. nursing, aids</td>
<td>PT/OT specialist Carer</td>
<td>Allied health team Carer</td>
<td>Carer Self-managed</td>
</tr>
<tr>
<td>Optimise</td>
<td>Within existing training</td>
<td>Monitored individual program Self-accessed Hub</td>
<td>Individual or group program Remotely monitor</td>
<td>Online &amp; onsite analysis and training</td>
</tr>
<tr>
<td>Measures</td>
<td></td>
<td>Choice of measures indicated, depending on setting and service targets</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Service model</td>
<td>Set up, introduction</td>
<td>Program recommendations</td>
<td>Train the trainer, advanced training</td>
<td>Carer education Program management</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Patient management tools</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The ableX model bridges the gaps in transition between provider settings

### About the ICF
- The ICF is a biopsychosocial framework applied by the World Health Organisation, which explores the multiple determinants of health and quality of life.
- A common language/coding system for describing health and health related states, outcomes and determinants.
- Takes account of social/disability-related policy and patient's contextual information, as well as statistical data through research and clinical use.
## ableX system: sample program framework

<table>
<thead>
<tr>
<th>Recovery journey phase</th>
<th>Module Number</th>
<th>Module purpose</th>
<th>Expected Duration</th>
<th>Routine number</th>
<th>Observed UL condition of patient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hospital in patient immediately after stroke, medically stable, in stroke or acute ward.</td>
<td>1</td>
<td>Positively influence early neural recovery by self assisted arm movement and useful sensory and proprioceptive feedback and establishing movement baseline</td>
<td>7 days</td>
<td>1.1</td>
<td>Has limited to no arm movement against gravity. No grip in affected hand.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.2</td>
<td>Can move arm at least 20 degrees against gravity, has some grip.</td>
</tr>
<tr>
<td>In patient in a stroke ward or rehab facility - patient fatigues limits therapy session duration</td>
<td>2</td>
<td>Begin using the modality and pathway to initiate neuro UL rehab, build movement awareness with a focus on arm movement separate from the trunk</td>
<td>2 weeks</td>
<td>2.1</td>
<td>Has limited to no arm movement against gravity. No grip in affected hand.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2.2</td>
<td>Can move arm at least 20 degrees against gravity, has some grip.</td>
</tr>
<tr>
<td>In patient in a stroke rehab facility - patient can tolerate longer therapy sessions, may have safe sitting balance +/- support</td>
<td>3</td>
<td>Plan recovery pathway to drive cortical reorganisation for recovery, increase range of active arm movement, build core strength, increase intensity of practice, motivate and engage the client to succeed.</td>
<td>4 weeks</td>
<td>3.1</td>
<td>Has limited to no arm movement against gravity. No grip in affected hand.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3.2</td>
<td>Can weakly lift elbow and hand off lap, has some grip action.</td>
</tr>
<tr>
<td>In patient in a stroke rehab facility - can stand independently or with supervision.</td>
<td>4</td>
<td>Build and increase motor control, arm strength, coordination and trunk control, standing balance</td>
<td>2 weeks</td>
<td>4.1</td>
<td>Has limited to no arm movement against gravity. No grip in affected hand.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>4.2</td>
<td>Can lift elbow and hand off lap, has some grip action.</td>
</tr>
<tr>
<td>In patient in stroke rehab facility - gaining increased confidence and movement ability, this module is for the advanced patient close to discharge.</td>
<td>5</td>
<td>Improve motor control, range of movement, coordination and arm strength by mixing unilateral and bilateral treatments for translation of therapy into functional activities.</td>
<td>2 weeks</td>
<td>5.1</td>
<td>Patient can move affected arm against gravity and has some grip. The patient can use both the Able-Reach and the Able-X and can operate at intermediate level in most exercises.</td>
</tr>
</tbody>
</table>
### ableX System: Sample Program Framework (continued)

<table>
<thead>
<tr>
<th>Recovery Journey Phase</th>
<th>Module Number</th>
<th>Module Purpose</th>
<th>Expected Duration</th>
<th>Routine Number</th>
<th>Observed UL Condition of Patient</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Outpatient, in home, periodic supervision and caregiver assistance</strong></td>
<td></td>
<td>Improve range of active movement, strength, coordination and functional activities of affected arm, sitting and standing.</td>
<td>3 weeks</td>
<td>6.1</td>
<td>Has no or limited movement against gravity. No grip in affected hand. Some movement of arm against gravity but no grip action. Some arm movement and some grip action.</td>
</tr>
<tr>
<td>7</td>
<td></td>
<td>Improve arm control</td>
<td>3 weeks</td>
<td>7.1</td>
<td>Can raise affected arm to waist</td>
</tr>
<tr>
<td>8</td>
<td></td>
<td>Increase concentration and cognition</td>
<td>3 weeks</td>
<td>8.1</td>
<td>Can use Able-X or M and can click mouse button with unaffected or affected hand or index finger.</td>
</tr>
<tr>
<td>9</td>
<td></td>
<td>Improve wrist function and control in affected hand</td>
<td>3 weeks</td>
<td>9.1</td>
<td>No or limited wrist movement, high tone in wrist or hand</td>
</tr>
<tr>
<td>10</td>
<td></td>
<td>Improve finger function in affected hand</td>
<td>4 weeks</td>
<td>10.1</td>
<td>Lifting arm against gravity freely but no or limited finger movement</td>
</tr>
<tr>
<td><strong>Long term recovery, in home, largely unsupervised</strong></td>
<td></td>
<td>Progress UL recovery focusing on improving speed, co-ordination, strength and function.</td>
<td>3 weeks</td>
<td>11.1</td>
<td>Can raise arm above waist, has some grip action</td>
</tr>
<tr>
<td>12</td>
<td></td>
<td>Improve fine control and smoothness of movement of UL and cognition</td>
<td>6 weeks</td>
<td>12.1</td>
<td>Can raise arm above waist, has some grip action</td>
</tr>
<tr>
<td>13</td>
<td></td>
<td>Regime for maintenance and long term improvement of arm function</td>
<td>7 weeks</td>
<td>13.1</td>
<td>Has some arm, hand and finger movement</td>
</tr>
</tbody>
</table>
A list of publications related to the ableX system for neurological rehabilitation

Journal papers

- Hijmans J M, King M. 2012. The use of an off-the-shelf gaming technology for tracking movement and upper limb stroke rehabilitation. Gait & Posture; Volume 36, Supplement 1, Pg S75,

Book Chapter

Conferences


- Hijmans J, King M & Hale, L. 2010 Computerised table top exerciser for stroke survivors. Australian Rehabilitation and Assistive Technology Association annual conference. 11 – 13 August Hobart


- Sampson M and King M. 2010 Computer gaming and assistive devices in stroke rehabilitation. NZd Stroke Foundation Research 26th April, Christchurch. (invited)


After a stroke, most people don’t recover the ability to use their affected arm or hand for everyday activities. The ableX system is a clinically proven combination of therapy games and two versatile control devices, which accelerates rehabilitation of your arms and hands after a stroke.

The ableX system is fun and easy to use. You can set it up in minutes on any Windows computer, and it quickly forms part of your independent daily routine, helping you to a better quality of life.

The best recoveries happen when your rehabilitation is high intensity and task-based, and the ableX system helps you complete up to 1000 movements per daily session without you even realising you’re doing it. Stroke people have enjoyed ableX recoveries even years after their stroke.

**How it Works**

The ableX software and control devices work together, providing high intensity rehabilitation through a series of progressive challenges. You perform all movements – there are no motors, no wires or springs, just you.

Research tells us that movement practice and repetition stimulates neural plasticity, which is the brain’s ability to form new neural pathways after a stroke or brain injury. Achieving neuroplastic change through daily exercise is the focus of the ableX system.

**Key Benefits**

Improvement in everyday life – with the ableX system you will be able to do more with your affected arm and hand.

- It’s fun – the exercises are in a game format so that your rehabilitation is enjoyable and challenging, for up to 60 minutes every day.
- You see your progress – each ableX exercise shows how you have improved.
- Independence – you can do your rehabilitation in your home, no travel needed, at a time that suits you.
What you need to get started

ableX Pro requires a desktop or laptop computer with the Windows 7 operating system or better. No internet connection is required.

A control device to suit you

We have two control devices: the ableX which is a handlebar and the ableM which slides on any tabletop. Both work with the ableX therapy games.

If you can lift your affected arm even a little, for example from resting in your lap up to a table, the ableX handlebar will help you increase your range of movement, strength and control. For many of our customers this has meant being able to do ordinary everyday tasks by themselves.

If you can’t lift your arm at all by itself, the ableM arm skate is likely to be the best device to help you start to get some arm movement back. Most people who start with ableM progress to the ableX handlebar. ableM is also useful later in recovery to improve independent finger movement.

ableX works

Stroke participants in clinical trials of both the ableX and ableM devices recorded clinically significant improvements in their range of arm movement after just a few hours of prescribed use. They also noticed improved concentration, co-ordination, balance, and well-being.

The findings of these trials have been published in respected medical journals. You can also read ableX recovery stories from real stroke people on our website.

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