

Rica car boot hoist user testing report

Rica is a national consumer research organisation focusing on the needs of disabled consumers. With grant funding we research and publish free consumer reports. They are all based on rigorous research and provide practical information needed by disabled and older consumers. We also carry out commissioned research work with manufacturers, service providers, regulators and policy makers to improve products and services. Our aim is to increase their awareness of the needs of disabled and older consumers through specialist research.

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1 Executive summary

1.1 Car boot hoists

Many wheelchair and scooter users use car boot hoists as part of a package of solutions for supporting mobility. Car boot hoists form a large, and growing, share of the adaptations bought on the Motability scheme. There are over 30 different models available with many different combinations of features. Because they are a specialist product they cannot simply be viewed in showrooms so users have little opportunity to try out different models or to get advice on their features when choosing a new hoist. Often the choice of model is made by the company carrying out the installation.

No user tests of car boot hoists have been carried out since 2005 when Rica looked at the equipment available then and there is little independent information for wheelchair and scooter users to use when getting a hoist. The research described in this report is intended to address this information gap. The information generated will be used in expanding and updating the consumer guidance provided on Rica's website: www.rica.org.uk/boot-hoists.

1.2 User testing

A discussion was held at the Forum of Mobility Centres AGM in June 2014 with driving assessors who make recommendations for car boot hoists as part of their work. This discussion focused on the skills and capabilities needed to operate a boot hoist and on the features of boot hoists that affect their use and usability.

In November 2014, Rica carried out two workshops at QEF Mobility Services (QEF) with 9 hoist users and 14 other stakeholders. The workshops consisted of a discussion followed by a series of user tests. The discussion covered boot hoists and features of boot hoists, their strengths and weaknesses and considerations when acquiring or using one. During the tests, the wheelchair and scooter users operated a range of hoists while commenting on their features and other factors affecting ease of use and testers recorded their experiences and comments.

The following 6 hoists were tested:

- Autoadapt Carolift 40 (provided by Autoadapt UK)
- Autoadapt Carolift 6900 (provided by Autoadapt UK)
- Four way 80kg hoist (provided by QEF)
- Brig-Ayd Mini 2 way Hoist (provided by Brig-Ayd Controls)
- Brig-Ayd Evotech Hoist (provided by Brig-Ayd Controls)
- Brig-Ayd Telescopic Hoist (provided by QEF)

1.3 Findings

For many disabled people, choosing the right solution for motorised mobility is a question of compromise and prioritisation.

For some wheelchair and scooter users, a car boot hoist is a practical and relatively low cost solution for extended mobility. If you can carry out the tasks needed to operate the hoist and walk from the back of the car to the driver's seat then it provides independence. Users need to be able to position their wheelchair/scooter appropriately, stand while they operate the hoist, attach the wheelchair/scooter to the hoist and perform any actions needed to secure the hoist and load inside the car.

You also have to sacrifice quite a large amount of space in the boot and the wheelchair/scooter or, more likely, the hoist arm may obscure the driver's rear view.

Our tests provided some information about the suitability of various features:

- A 2-way hoist is suitable for an active user, with a fairly light wheelchair/scooter. A 4-way or 6-way hoist is more suitable for a user with reduced strength or flexibility, and is usually used with heavier wheelchairs/scooters.
- Users found it difficult to attach the wheelchair/scooter to some 4-way hoists, as the wheelchair/scooter had to be positioned very carefully. This is not a problem with 2 and 6-way hoists.
- In our user tests, hoists that lift using a strap or cord and a winch were found to be harder to use as the wheelchair/scooter swings while it is being hoisted.

- Hoists with preset stops were much easier to use in the tests. Other features that users may want include the ability to unload to the pavement and the ability to stow the hoist out of the line of sight.
- Controls and clips need to be tried out when choosing a hoist.

It is important to try all features of the hoist, using as far as possible the wheelchair/scooter that will be used, before making a choice.

Finding a hoist capable of lifting your wheelchair/scooter is relatively simple. Usually the lifting capacity of the hoist forms part of the model name. Rica lists available boot hoists arranged in order of lifting capacity on our website: www.rica.org.uk/hoists.

Finding a car suitable for a particular wheelchair/scooter requires users to match their dimensions. Rica provides boot measurements for over 1,000 cars on our website: www.rica.org.uk/carfilter. Suppliers or installers also have specialist knowledge of cars their products can be used with.

1.4 Next steps

Rica is seeking funding for further workshops and user testing exercises to look at other solutions for loading mobility equipment into cars (including some or all of ramps, platform lifts, stowage systems and WAVs).

We also propose a similar exercise to look at adapted driving controls, coupled with a user survey to investigate differences between products and brands.

These exercises will be used to further develop the guidance on our website (www.rica.org.uk/content/motoring) and in our printed guides (www.rica.org.uk/motoring-guides).

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2 Car boot hoists

2.1 Model range

There are many different models of car boot hoist ([Rica's consumer guide](#) lists 32 products distributed by 9 suppliers). They range in size from the smallest, designed to lift manual wheelchairs up to 40kg, to the largest which can lift powered wheelchairs or scooters up to 200kg.

Hoists are 2-way (lifting and lowering under power), 4-way (both lifting and lowering and transferring into and out of the vehicle under power) or 6-way (having also a powered telescopic lifting arm). Exceptionally, the Brig-Ayd telescopic hoist lifts the wheelchair/scooter and transfers it into the vehicle in one action, running on rails.

All 2-way hoists and some 4-way hoists lift the wheelchair/scooter using a winch and a cord or strap. Some 4-way hoists have a moving arm controlled by electric or hydraulic actuators. On these hoists, the wheelchair/scooter is attached directly to the end of the arm. Where the hoist is controlled by actuators they may have pre-set stops (adjustable on installation) to allow them to be 'programmed' to suit the user and the vehicle. This means that the user doesn't need to concern themselves with how far the arm needs to move in any direction – it will automatically stop in the right place.

The wheelchair/scooter is attached in one of two ways: where there is a cord or strap, this sometimes has a single clip on one end, which is passed through a suitable part of the wheelchair/scooter and clipped onto the cord (often with a karabiner) to secure the load; alternatively, there is a spreader bar with two clips suspended from it attached to the end of the cord/strap or to the moving arm and the two clips are clipped onto fittings on the wheelchair/scooter. In the second case, the fittings need to have been fixed in the right place to ensure the load will balance when hoisted (this is generally done as part of the installation). The clips and fittings are usually of a common design, with a safety guard to prevent them slipping off. However, most manufacturers offer alternative clips if these are unsuitable.

Two other features that are available on some hoists are the ability to hoist the wheelchair/scooter on and off the pavement to the side of the car and the ability to stow the hoist to one side out of the driver's line of sight when the wheelchair/scooter is loaded.

Controls for hoists consist of small keypads with usually two or four buttons. These are fixed to the moving arm of the hoist, attached to a control cable or in some cases wireless.

2.2 Using a hoist

A car boot hoist is a practical solution for many wheelchair and scooter users. It allows them to load indoor and outdoor wheelchairs and compact and pavement scooters into a car to extend their range. Many wheelchair and scooter users are able to stand while loading the mobility equipment and then walk the few steps to the driver's door, some have someone help them by loading the mobility equipment after they have transferred to the seat and some use both these strategies, receiving help when it is available.

Following the discussion at the Forum of Mobility Centres AGM, Rica prepared a hierarchical task analysis (HTA) to map the processes involved in completing the task of getting a wheelchair or scooter into a boot using a boot hoist. This can be seen in Appendix 1. The hierarchy shows the breakdown of the main task into less complex sub tasks each with layers of operations reduced to the finest detail of how to complete these.

The process of getting a wheelchair or scooter into a boot using a boot hoist involves eight sub tasks; 6 essential and 2 dependent on user preference but due to variations in boot hoist design, some of these can be completed in different ways. All potential methods are listed as operations on the HTA and to guide the process, plans accompany each layer explaining how, when and whether to complete each operation. This highlights the range of tasks users may be required to perform and the product features used when operating a boot hoist.

From this Rica has performed a skills and capabilities assessment. This can be seen in Appendix 2. Operating a boot hoist can be a demanding process as every model involves users exercising strength, dexterity, range of reach/flexibility, vision and most importantly balance and coordination.

- Users must have dexterity in their hands for attaching the wheelchair or scooter to the boot hoist as opening the clips involves users manipulating and applying pressure. Open hooks are available, which reduce the demand on users' dexterity. However these are less secure.
- In addition, users are required to bend down to attach and detach clips which demands user balance and range of reach/flexibility.
- Similarly moving the hoist requires dexterity to activate buttons and switches on a control unit. There are many different designs of control units and controls suiting different user capabilities.
- On 2-way hoists, users must have the balance and strength to move the hoist with the wheelchair attached manually in and out of the boot. On 4-way hoists users must be able to move and balance to guide the wheelchair/scooter.

- Finally, users need to be able to walk between the rear of the car and the driver/passenger seat.

3 User testing

3.1 Rica/QEF workshops

Rica held two half day workshops at QEF Mobility Services attended by experienced car boot hoist users and other stakeholders, some of the hoist users were accompanied by a personal assistant or relative. A full list of delegates can be seen in Appendix 3. Each workshop consisted of a 45 minute discussion on car boot hoists that considered the skills and capabilities needed to operate them and factors affecting choosing and purchasing followed by 1 hour and 45 minutes of product tests where the hoist users operated each hoist under test in turn and researchers recorded how easy it was to perform each part of the task.

During the discussion, delegates were first asked to identify positive and negative aspects of boot hoists. Responses to these questions were general ('It gives you your freedom') or specific ('I liked the switch on my old one better'). Next delegates were asked to give general advice about equipment or other solutions for carrying a wheelchair/scooter in a car and specific advice about getting a hoist. Findings from the two discussions are presented in the following section (3.2).

For the testing, users were divided into groups, each of which toured the hoists under test with a researcher to record their experiences and other delegates as observers. Each user operated each of the hoists to load and unload a wheelchair or scooter. The task was divided into parts and each part was scored out of 5 for how easy the user found it. Users were also asked to evaluate the usability of the controls specifically. The record sheet can be seen in Appendix 4. Test findings are presented in section 3.3 below.

3.2 Discussion groups

3.2.1 Advantages of hoist ownership and use

The main advantage of boot hoist ownership raised by users was that the hoist provides both freedom and independence. If you can load your wheelchair/scooter into a car and unload it again at your destination without help, then you have the freedom to go wherever your car can go independently. This is particularly important for people who have specialised wheelchairs, because they cannot rent or borrow one at their destination.

Users also pointed out that if you are buying your own car, a boot hoist counts as an adaptation, so you do not have to pay VAT on the price of the car.

Advantages of hoists identified by other stakeholders were that you can often stow your wheelchair without dismantling it and that a car with a boot hoist is considerably cheaper than a wheelchair accessible vehicle (WAV).

The hoist users also identified some specific features that made particular car boot hoists easy to use. These were pre-set stops as discussed above (2.1), magnetic control units that can be conveniently attached to any point on the hoist and controls with switches instead of buttons so you don't have to hold the button in (this feature was found on the Hodge hoist, which is no longer available).

General advantages:

- freedom and independence
- VAT exemption on car
- stow wheelchair without dismantling
- cheaper than a WAV.

Specific positive features:

- preset stops
- magnetic control unit
- switches better than buttons.

3.2.2 Disadvantages of hoist ownership and use

Users identified considerably more disadvantages of boot hoist ownership, though many were arguably less significant. The main disadvantage raised was that they take up space in the boot. This is unavoidable, though some hoists are designed to take up less space than others.

Additionally, some hoists obscure the driver's view out of the back of the car, which has implications for safety and comfort.

Many users complained that their hoists move very slowly. This means that you have to be able to remain standing for a long time when loading/unloading, sometimes in the rain. Some users also complained that hoists move in a jerky way.

Users identified two problems with on-street parking: it's not always possible to leave enough space at the back of the car to unload the wheelchair/scooter and, except with the two Autoadapt hoists, you have to unload it onto the roadway, which means you sometimes have to go quite a long way in the road to find a dropped kerb.

Many users complained about the noise that hoists make while you are driving. This may vary between products, but all users in the discussion groups recognised it as a problem.

Other stakeholders raised the issues of noise when driving (the parts can rattle) and of restricted rear view. They also noted that it limits the choice of vehicle – you have to buy a car that can take a hoist.

Pain points associated with specific products were that the clips are often difficult to use, that the controls can be difficult to use and that hoists with dangling straps mean you have to support and guide the wheelchair/scooter while hoisting it.

One user had experienced difficulty getting a second set of attachments for a spare scooter.

General disadvantages:

- space in boot
- obscure view at rear
- move slowly: stand for a long time even in rain
- on-street parking: space, unload to roadway
- restricted choice of vehicle.

Specific negative features:

- noise (rattling)
- clips difficult to use
- dangling straps.

3.2.3 Advice

Asked for advice for people considering getting a boot hoist, many users replied simply 'Get one!', though one would recommend at least thinking about a WAV. More specific issues to be taken into account were:

- the cost (especially if your condition is progressive, or of you are getting your car on the Motability scheme – you only get 3 years' use out of the hoist)
- making sure the four components work together (the hoist, the wheelchair/scooter, the car and the user)
- securing the wheelchair/scooter and the hoist in the boot
- the importance of trying it out (especially the clips) before buying
- the importance of specialist advice (from a supplier or an independent advisor such as QEF or another mobility centre).

Some users also advised getting a powered boot opener fitted, and thinking about a 4-way hoist which is easier to use on hills.

Other stakeholders also advised potential users to think about boot openers and stressed the importance of a demonstration. They felt it was important to understand the nature of the mobility equipment being transported before settling on a solution for stowing it in the car.

3.3 User tests

3.3.1 The hoists

The following car boot hoists were tested:

- Autoadapt Carolift 40 (provided by Autoadapt UK)
- Autoadapt Carolift 6900 (provided by Autoadapt UK)
- Four way 80kg hoist (provided by QEF)
- Brig-Ayd Mini 2 way Hoist (provided by Brig-Ayd Controls)
- Brig-Ayd Evotech Hoist (provided by Brig-Ayd Controls)
- Brig-Ayd Telescopic Hoist (provided by QEF)

However, only the two hoists provided by Autoadapt UK and the two hoists provided by Brig-Ayd Controls are designs that are currently available. The two hoists provided by QEF are earlier designs of current models. Furthermore, these hoists represent only 20% of the total number of available products. Because of these two constraints, it is not possible to use the test results to draw conclusions about the suitability of particular products. Instead the focus of the testing is on the suitability of particular features.

The relevant features of the hoists under test are shown in the table:

Hoist	2/4/6-way telescopic	strap	unload to pavement	stow out of sight	automatic stop	control
Autoadapt Carolift 40	2	y	y	y	n	on hoist
Autoadapt Carolift 6900	6	y	y	n	y	wired
Four way 80kg hoist	4	n	n	n	n	wireless
Brig-Ayd Mini 2 way Hoist	2	y	n	n	n	wired
Brig-Ayd Evotech Hoist	4	n	n	y	y	wired
Brig-Ayd Telescopic Hoist	telescopic	n	n	n	y	wired

Table 1 Features of hoists under test

3.3.2 The users

All users had been using a car boot hoist for at least three years. All but one had been using one for far longer than that – up to 20 years. Most had had experience of more than one design. All were wheelchair or scooter users, who could stand for a short time. Many had experience of a range of different mobility aids.

Users filled in questionnaires to give details of their abilities. As well as giving the weight of their mobility equipment, and how long they had been using a car boot hoist, users were asked to rate their ability to stand, balance, strength, dexterity, reach and vision on a scale from 1 (weakest) to 5 (strongest). Responses are summarised in the table:

	standing	balance	strength	dexterity	reach	vision	wheelchair	scooter	years owned hoist
User 1	3	2	2	1	2	5	60kg	60kg	6+
User 2	3	3	2	2	3	4		150kg	12+
User 3	3	2	2	1	3	4	70kg		15+
User 4	2	1	4	2	3	2	manual		5+
User 5	2	3	2	4	2	4	140kg		12
User 6	2	2	3	3	2	4	66kg		5+
User 7	2	2	2	2	2	4		150kg	3
User 8	1	1	2	3	2	5	70kg		15
User 9	2	2	3	3	2	4	70kg		6+

Table 2 Properties of boot hoist users

Distribution of capability ratings are shown in this figure:

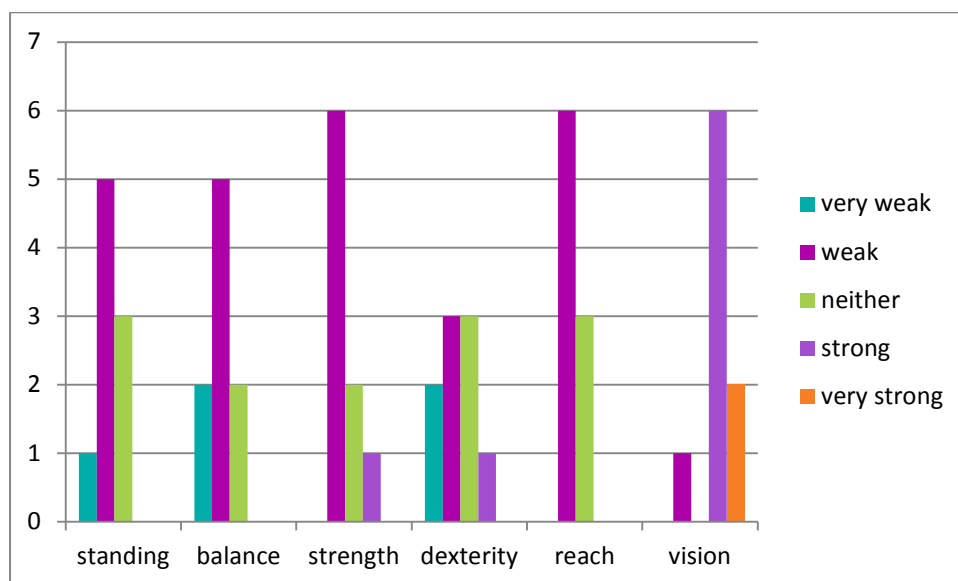


Figure 1 Capabilities of boot hoist users

3.3.3 Test results

3.3.3.1 Autoadapt Carolift 40



This is a 2-way hoist in which the wheelchair/scooter is attached to the end of a cord and lifted by a winch. The hoist consists of a vertical component and a horizontal swinging arm with a bendable joint in the middle of it. This allows the wheelchair/scooter to be unloaded onto the pavement beside the car. Also, since the vertical component can be folded down, the hoist can be stowed in the bottom of the boot parallel to the tailgate.

Only two users (Users 1 and 2) were able to fully test this hoist, since there was no suitable wheelchair to be lifted, and the vehicle it was installed in was unable to be brought inside the test centre.

User 1 can stand moderately well but has difficulty balancing and reaching out and particular difficulty with strength and dexterity in the hands. They found it difficult to get the hoist out of the boot to begin hoisting, though it is likely that this would become easier on future attempts (it is a slightly complicated procedure, but once learnt it should not present a very great challenge). They also found it difficult to raise the load on the hoist, since they had to support the load to prevent it swinging and had to lean on the hoist to operate the control.

User 2 also has limited strength and dexterity, but not to the same extent as user 1. They did not experience great difficulty with any part of the process, except unfolding it from the boot floor to begin operating it.

Both users felt the controls were clear, but both found them difficult to access as they are mounted on the hoist. This would not be a suitable solution for either of these users. They both favour a 4-way hoist.

3.3.3.2 Autoadapt Carolift 6900



This is a 6-way hoist in which the wheelchair/scooter is attached to the end of a strap and lifted by a winch. The hoist consists of a vertical component and a telescopic horizontal swinging arm turned by power. It is able to reach right round to the side of the car and the (powered) telescopic action of the swinging arm allows the wheelchair/scooter to be loaded/unloaded from the pavement.

Four users (1, 2, 8, 9) were able to test this hoist. All users found it easy to operate the hoist to load and unload a mobility scooter. User 1 and user 9 found it difficult to attach and detach the scooter, particularly when it was in the boot, as they had to reach quite far and high to do so. Users 1 and 2 found the process of assembling and dismantling the hoist complex and demanding.

Users 1 and 8 found it awkward that the hoist doesn't stop automatically. All users found the fact that the wheelchair/scooter can be unloaded to the pavement extremely positive.

User 1 found the control bulky and difficult to hold. The other users found it easy to use.

3.3.3.3 Four way 80kg hoist

This is a 4-way hoist where the wheelchair/scooter is attached directly to the end of the moving arm. It has a wireless control.

Users 1 and 2 did not test this hoist, though all others did.

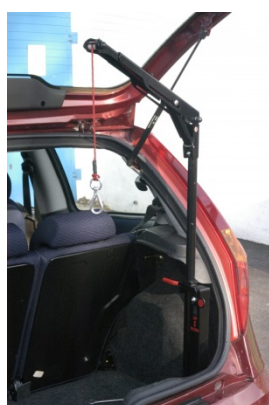
Generally, users found it easy to raise and lower the wheelchair with this hoist. However, all but three (6, 5, 8) had problems attaching the wheelchair to the hoist. The wheelchair needs to be positioned in the right place so the hoist will be in position when it comes out of the boot; user 4, who is used to a 2-way hoist, kept trying to swing the moving arm into the right position manually. Users also found it difficult to know when the moving arm was far enough out. Many did not trust it to stop in the right place as the design under test did not seem to have an automatic stop. Both of these problems may improve with familiarity.

Users 3, 4, 7 and 9 had great difficulty attaching the clips to the wheelchair. The clips are closed and need good manual strength and dexterity to attach them. Also users had to lean over quite far to reach them, and were working under the wheelchair seat so it was difficult for them to see what they were doing. One user began to raise the hoist with one of the clips unattached.

Users 7 and 9 had difficulty moving the hoisted wheelchair into the boot. It was quite a tight fit and the wheelchair needed to be steadied as it went in. User 7 was standing with crutches so they could not move and operate the hoist at the same time. They had to keep stopping the hoist while they repositioned themselves closer to the wheelchair before continuing.

Users found the control accessible except user 4 who found the buttons too close together.

3.3.3.4 Brig-Ayd Mini 2 way Hoist



This is a 2-way hoist in which the wheelchair/scooter is attached to the end of a cord using a karabiner and lifted by a winch. The hoist consists of a vertical component and a horizontal swinging arm.

Only one user (user 3) performed a complete test with this hoist. Additionally, two other users (8, 9) evaluated the controls.

User 3 found it difficult to attach the scooter using the clip but all other parts of the procedure were very easy. All users found the controls very easy to operate.

3.3.3.5 Brig-Ayd Evotech Hoist



This is a 4-way hoist where the wheelchair/scooter is attached directly to the end of the moving arm. It has a wired control. The moving arm can be rotated through 180° so when the wheelchair/scooter is stowed it can be detached and moved to the side out of the driver's line of sight. Three positions on the horizontal dimension (stowed to side, wheelchair/scooter in boot, wheelchair/scooter out of boot) and two on the vertical (wheelchair/scooter in boot, wheelchair/scooter out of boot) can be preset with automatic stops.

All users tested this hoist. Generally users found it very easy to operate. The presets made it easy to locate it in the right place for attaching the scooter and the powered movement was smooth. User 7 had difficulty moving the scooter into the boot as with the Four way 80kg hoist above:- they had to keep stopping operating the hoist to move closer so they could guide the scooter into the boot.

Many users found the clips difficult to operate as they are closed clips that require considerable manual strength and dexterity. This was particularly difficult when attaching/detaching the scooter inside the boot as users also had to lean into the boot and reach quite high.

The ability to stow the moving arm to the side was appreciated by most users, though as noted some found it difficult to detach and reattach the hoist to do this.

3.3.3.6 *Brig-Ayd Telescopic Hoist*



This hoist is of a unique design. The wheelchair/scooter is attached to a horizontal bar, which rotates in a vertical plane to lift the wheelchair/scooter. Then the whole assembly moves backwards on rails into the boot. This means that the wheelchair/scooter can be hoisted and stowed in the boot or brought out of the boot and unloaded in one movement. This requires only two buttons on the control ('in' and 'out') and also means that the user only has to perform one action to load and one action to unload the wheelchair/scooter.

Eight users tested this hoist (1, 2, 3, 5, 6, 7, 8, 9). Most found it easy to operate. The hoist is such that the wheelchair didn't need to be steadied or aligned when being loaded in or out of the boot. The horizontal bar is large and sturdy and provided support to help the user to stand while attaching/detaching the wheelchair and while operating the hoist.

Three users had difficulty attaching the clips (this hoist was again fitted with closed clips). Additionally, two users found it difficult to move round the hoist to attach/detach the wheelchair after operating the control. It was pointed out that this problem might be resolved if the control was mounted on the other side of the vehicle.

All but one user found the control easy to use (this hoist is now provided with a different control).

3.4 Features

3.4.1 2-way/4-way

During the discussion users and other stakeholders expressed the view that a 4-way hoist (where the wheelchair scooter is both lifted/lowered and moved in/out of the boot under power) was more convenient and more useful. However, 4-way hoists were not universally preferred in the tests. Some users found it difficult to position the wheelchair/scooter in the right place to attach it to the hoist (this is not a problem with a 2-way hoist as the boom can be moved into place by hand). Additionally one user, who stands with the aid of crutches,

found it difficult to load the wheelchair/scooter using a 4-way hoist as they could not operate the control while moving to help guide it into the boot.

It was recognised a 4-way hoist is easier to use with a heavy wheelchair/scooter.

Users responded positively to the Brig-Ayd Telescopic hoist, which none had seen before.

3.4.2 Straps and cords

Hoists where the wheelchair/scooter is attached to the end of a strap or cord caused users difficulties during the tests. The load is more likely to swing and sway and it requires at least one hand to steady it as it is being hoisted. Some users also expressed the concern that they might get their fingers caught in the winch on some of these hoists.

Users preferred hoists where the wheelchair/scooter is attached directly to the end of the lifting arm.

3.4.3 Unload to pavement

The Autoadapt UK hoists are able to move the wheelchair/scooter through 180°, which allows it to be loaded/unloaded to the pavement when the car is parked alongside the kerb. This was considered a very useful feature, which users would like to see available on more products.

3.4.4 Stow out of sight

The Autoadapt Carolift 40 and the Brig-Ayd Evotech hoist can be stowed out of the driver's line of vision when the wheelchair/scooter is loaded in the boot. Again, this was considered a very useful feature, which users would like to see available on more products.

3.4.5 Preset stops

The Autoadapt Carolift 6900 and Brig-Ayd Evotech and Telescopic hoists can be programmed on installation so the movement in each direction stops at just the right point for the car and wheelchair/scooter. Again, this was considered a very useful feature, which users would like to see available on more products.

3.4.6 Controls

Users preferred a control that could be held in the hand separately from the hoist. In some cases the wires caused problems: users struggled to hold the control against the resistance of the springy wire or they found it wouldn't stay where they had put it when they put it down.

Users need to be able to put the control down for short or long periods somewhere convenient, and where they know it won't fall off.

Some controls had buttons that were too close together, making them difficult to access. Some were also difficult to press, which meant that users with weak grips found them difficult to use.

3.4.7 Clips

All hoists that were tested had the same kind of clips. These caused significant problems for many users. Hoist suppliers state that all hoists can be supplied with alternative clips.

4 Conclusions

4.1 Choosing a mobility solution

As is the case for many other decisions facing disabled people, choosing the right solution for motorised mobility is a question of compromise. It is difficult to find a single solution that meets all a user's requirements and it is often necessary to prioritise these.

For some wheelchair and scooter users, a car boot hoist is a practical solution for extended mobility. If you can stand to operate the hoist and walk from the back of the car to the driver's seat then it provides independence. It can be fitted to a standard car (as long as the boot is large enough) and allows even heavy wheelchairs and scooters to be loaded without dismantling them.

It is also relatively low cost compared to other solutions (eg a WAV) and it means you do not have to pay VAT on the car. Some Motability users, however, find that a boot hoist is not a low cost solution, as they have to get a new one every three years.¹

You have to sacrifice quite a large amount of space in the boot, but this is true of other solutions where the wheelchair/scooter is carried inside the car. The hoist itself takes up some space – some more than others. The wheelchair/scooter or, more likely, the hoist arm often obscures the driver's rear view.

You also have to be able to attach the wheelchair and stand while you hoist it into the boot. This can take some time, which can be particularly inconvenient if it is raining.

4.2 Choosing a car boot hoist

Usually people have a firm idea of what kind of wheelchair/scooter they want to use (if they have complex mobility needs they may have no choice), and design the rest around that.²

¹ Some suppliers now fit boot hoists that have been designed to be transferrable between cars, so that you can use the same product over more than one three year lease.

² Rica's scooter research indicates that some scooter users are selecting smaller scooters so that they can be more easily carried in a car boot, but also that many subsequently find these smaller

Finding a hoist capable of lifting your wheelchair/scooter is relatively simple. Usually the lifting capacity of the hoist forms part of the model name. Rica lists available boot hoists arranged in order of lifting capacity on our website: www.rica.org.uk/boot-hoists.

Finding a car suitable for a particular wheelchair/scooter and a particular hoist is less straightforward. Rica provides boot measurements for over 1,000 cars on our website: www.rica.org.uk/carfilter. Generally speaking the boot needs to be wide enough to accommodate the wheelchair/scooter and high enough to accommodate it with 100mm (4") clearance above. However, there are other considerations that may make particular models unsuitable for particular hoists so it is necessary to check with suppliers or installers. There are many other factors involved in choosing a car of course, including accessibility at the driver's door, driving ease and comfort, fuel type and consumption, transmission and aesthetics and personal preference. It's also important to consider where and how it will be used.

The features of individual hoists affect the choice of product. Users need to choose the features that best suit their needs and preferences. Our tests provided some information about the suitability of various features:

- A 2-way hoist is suitable for an active user, with a fairly light wheelchair/scooter. A 4-way hoist is more suitable for a user with reduced strength or flexibility, and is usually used with heavier wheelchairs/scooters. The user tests identified some problems with using 4-way hoists, but practised users will be able to overcome these. The Brig-Ayd Telescopic hoist solves some of the problems of 4-way hoists. It is rather expensive.
- In our user tests, hoists that lift using a strap or cord and a winch were found to be harder to use as the wheelchair/scooter swings while it is being hoisted.
- Hoists with preset stops were much easier to use in the tests. Other features that users may want include the ability to unload to the pavement and the ability to stow the hoist out of the line of sight.
- Some controls were easier to use than others. Additionally most users had difficulty with the clips provided (all the hoists on the test were provided with the same clips). Both of these features need to be tried out when choosing a hoist.

It is important to try all features of the hoist, using as far as possible the wheelchair/scooter that will be used, before making a choice. Suppliers and installers of hoists will bring demonstration models to the user's home for a no obligation demonstration; they are also available at exhibitions and events ([Mobility Roadshow](#), Motability [One Big Day](#) and [The Big](#)

scooters don't meet their mobility needs and exchange them for larger ones. [Mobility scooters: a market study](#), p13.

[Event](#)). Alternatively, users can get a driver of passenger assessment at an accredited [Mobility or Driving Assessment Centre](#).

4.3 Future research

It is clear from the discussion groups and user tests that boot hoists are suitable for some wheelchair/scooter users but not for others. Alternative solutions include:

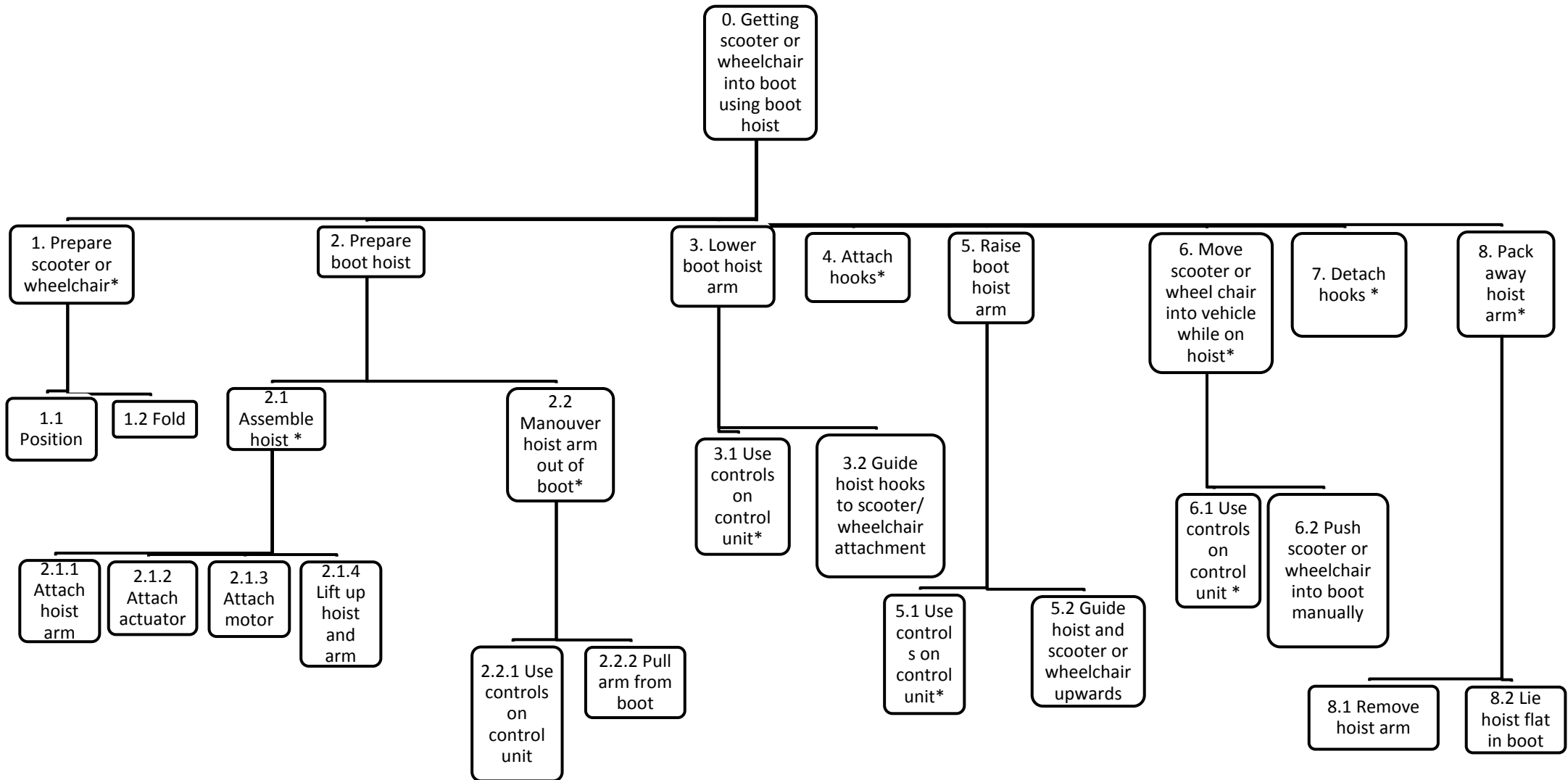
- fixed and portable ramps
- platform lifts
- roof top and boot stowage systems (eg Autoadapt Roof Topper, Abi-Loader)
- WAVs

Rica proposes carrying out further research with users and other stakeholders looking at a selection of these alternative solutions. The focus will be on identifying the factors affecting the usability and suitability of the solutions and the kinds of users/uses they are appropriate for. This proposed research will inform the development and updating of existing consumer guidance on our website at www.rica.org.uk/motoring-guides.

Rica also proposes using the model developed here to investigate the use and usability of adapted driving controls. Many disabled motorists use adapted controls, and there is little comparative information to help them identify which kinds and brands are suitable for their needs. We would combine a series of discussion groups and user tests with a survey of adapted control users to provide this information.



Appendix 1 Hierarchical task analysis



Appendix 2 Skills and capabilities assessment

1. Coordination/Divided attention

- While operating the boot hoist users are required to perform varying tasks simultaneously:
 - i. Use control panel (dexterity) while guiding hoist hooks and standing with minimal support (balance).
 - ii. Standing with minimal support (balance) while pushing scooter or wheelchair on hoist into the boot (strength).

2. Balance

- Users are required to leave their scooter or wheelchair and stand with minimal support while using the hoist as, depending on design, one or both hands are required to be free during the process.
- Once the scooter or wheelchair is in the boot, users must be able to get to the vehicle door with minimal support.

3. Strength

- When assembling the hoist varied strength required to either attach hoist arm, actuator or motor or raise the hoist from the boot.
- If using a two-way hoist the user must be able to pull the hoist arm from the boot towards them and push the scooter or wheelchair into the boot on the hoist.
- When dismantling the hoist users need the strength to remove the hoist arm or to guide the hoist down flat to the boot base.

4. Dexterity

- The scooter or wheelchair may have to be folded or dismantled before using the hoist so users must be able to operate appropriate controls.
- Fine motor skills required when using the control unit yet the level depends on the unit design chosen by the user.
- The hoist hook/s are attached to the scooter or wheelchair manually requiring fine motor skills when using both open and closed hooks.
- If using closed hooks, an increased dexterity is required.

5. Range of reach/Flexibility

- To attach the hooks to the scooter or wheelchair, users may be required to bend down.

6. Vision

- To accurately use the control unit and attach the hooks (open or closed) users should be free of visual impairment affecting close-up vision.
- Some safety features are small eg. shouldn't be able to see 3mm drilled hole, if it can be seen report immediately.
- General safety inspection of wear and tear.

Appendix 3 Workshop delegates

Morning		Afternoon	
User 1	Hoist user	User 6 + relative	Hoist user
User 2 + PA	Hoist user	User 7 + relative	Hoist user
User 3	Hoist user	User 8 + relative	Hoist user
User 4	Hoist user	User 9	Hoist user
User 5 + PA	Hoist user		
Jasper Holmes	Rica	Jasper Holmes	Rica
Jo Holliday	Rica	Jo Holliday	Rica
Chris Lofthouse	Rica	Chris Lofthouse	Rica
Chris Kingsley	QEF	Paul Graham	QEF
Ron Spence	Cornwall Mobility Centre		
Tom Jamison	Editor Able Magazine		
Lauren Curtis	Motability		
Wendy O'Brien	Motability		
James Aiken	Motability		
John Bhogal	Autoadapt UK	John Bhogal	Autoadapt UK
Terry	Brig-Ayd Controls	Terry	Brig-Ayd Controls