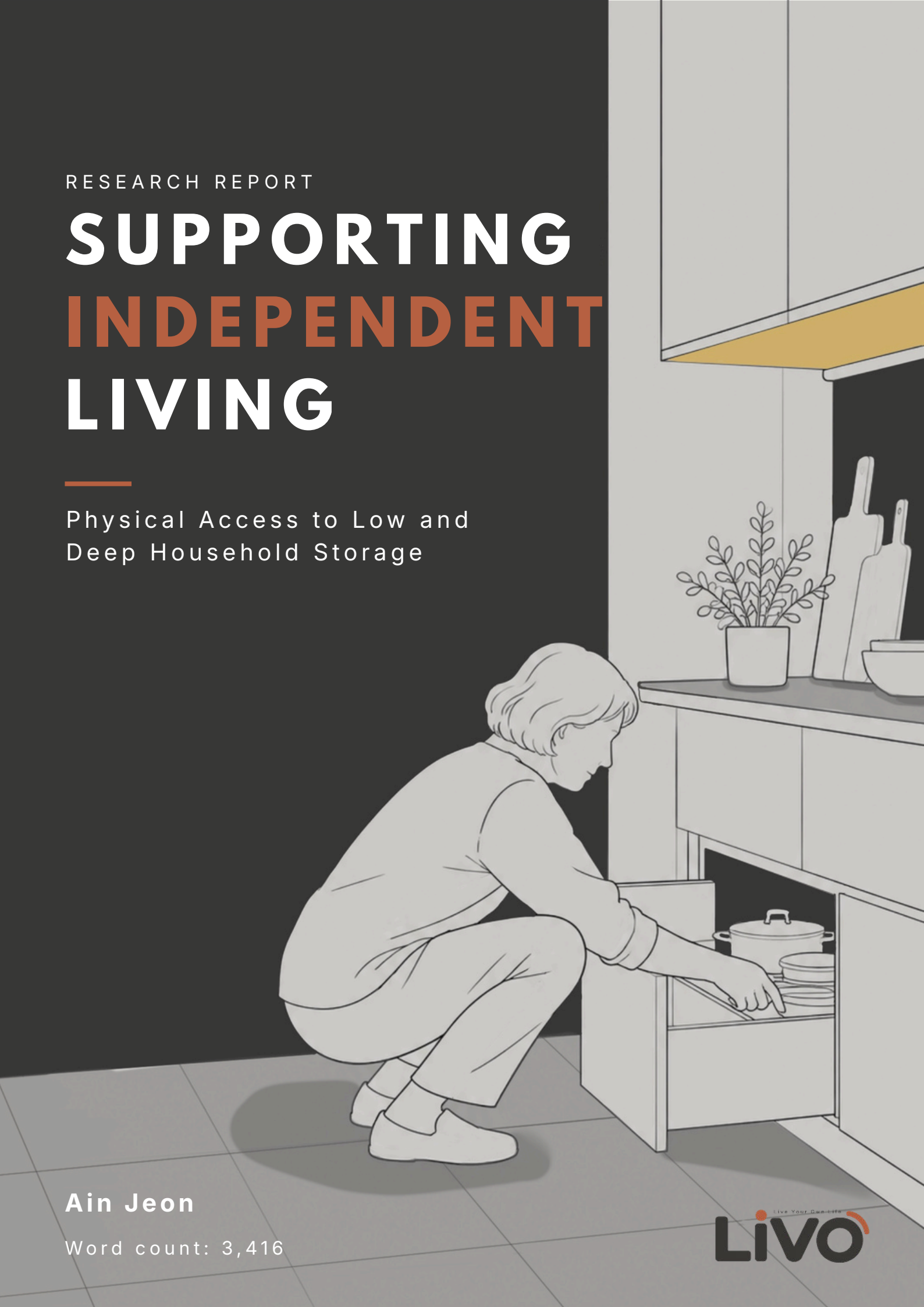
RESEARCH REPORT

SUPPORTING INDEPENDENT LIVING

Physical Access to Low and Deep Household Storage



Ain Jeon

Word count: 3,416

Live Your Own Life
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This is to certify that to the best of my knowledge, the content of this report is my own work. This report has not been submitted for any subject or for other purposes. I certify that the intellectual content of this report is the product of my own work and that all the assistance received in preparing this report and sources have been acknowledged.

Your name: Ain Jeon
Date: 07/09/2026

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This report used generative AI, specifically GPT, in several ways. It was mainly used to reduce word count, check spelling and grammar, improve sentence flow, and refine wording for clarity. The research interpretation, analysis of findings, and final design decisions were completed by me.

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EXECUTIVE SUMMARY

This report investigates the difficulties older adults may experience when using low and deep household storage. The research focuses on the physical movement involved in accessing these spaces, rather than only the ability to reach or retrieve an object.

The project used literature research, product benchmarking, video observation and an online survey. Existing retrieval tools and movement-support products were compared to understand how current products reduce physical effort. Nine publicly available videos were also analyzed to identify how people bend, squat, kneel or use support when accessing low areas. The survey was used to compare these observations with difficulties reported by users.

The research found that accessing low storage involves several stages of body movement. People used different strategies depending on the situation, including bending, squatting, kneeling and supporting themselves on nearby furniture. In the survey, squatting was the most commonly reported movement and lowering the body was the most frequently reported difficult stage. Reducing bending and deep reaching, as well as having support when returning to standing, were also common priorities.

The benchmarking showed that retrieval tools can reduce the need to lower the body, but they also separate the user from the object and depend on gripping and controlling it from a distance. Movement-support products provide another approach, but products with higher levels of assistance are mainly designed for sitting, standing or floor recovery rather than everyday storage use.

Based on this research, the project will focus on supporting the movement involved in low-storage access. The design direction is to assist lowering and rising, provide stability while the user is in a low position, and reduce the physical demand of unsupported squatting while still allowing direct access to stored objects.

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1. INTRODUCTION

Australia's population is aging, with people aged 65 and over accounting for approximately 17% of the population in 2024 (AIHW, 2026). As the older population grows, supporting independence in daily life is becoming increasingly important. The WHO (2025) explains that healthy aging is influenced by both an individual's physical abilities and the environment in which they live. The home and the products within it can therefore support or restrict independent daily activities.

Many household activities involve the use of storage spaces located above comfortable reach or close to the floor. Accessing these areas can require reaching, bending, squatting or kneeling, which may become more difficult as physical abilities change with age. Research on kitchen storage has also shown that cabinet height affects the posture and physical demands experienced by older adults (Zhou et al., 2024). Low and deep storage is particularly important because retrieving an item can involve lowering the body, reaching inside, handling the object and rising again.

This project investigates the physical and environmental difficulties older adults experience when accessing household storage and identifies opportunities for industrial design to support independent living. Existing storage solutions, human movement patterns and low-storage environments are examined, with a particular focus on understanding the physical demands involved in accessing low and deep storage.

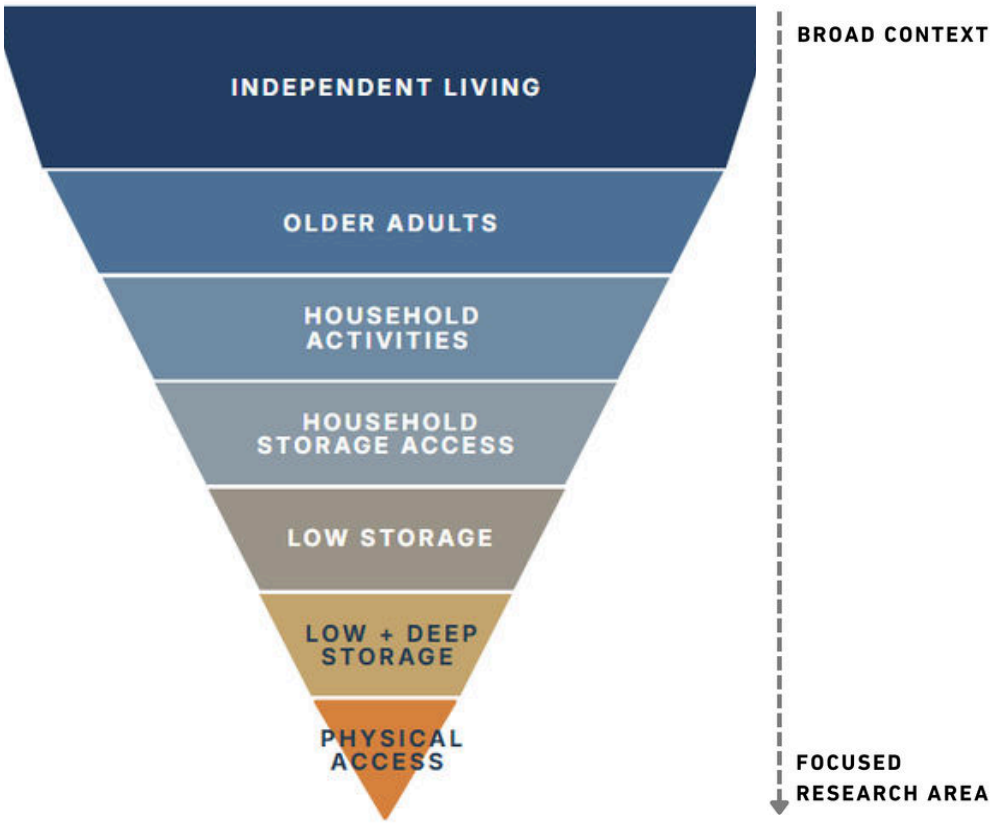


Figure 1. Research scope from independent living to physical access of low and deep storage.

2. BACKGROUND

2.1 Ageing & Physical Capability

Independent living in old age is influenced not only by an individual's abilities but also by the environment in which daily activities take place. The WHO describes healthy aging using the concept of functional ability, which is shaped by an individual's physical and mental capabilities, the environment, and the interaction between the two (WHO, 2020).

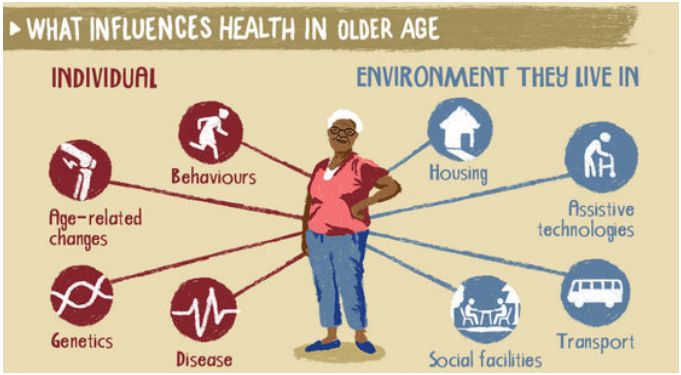


Figure 2. WHO (n.d). Factors influencing health in older age.

This is particularly important in residential environments, as the home and built environment can support or limit what an older person is able to do. WHO also notes that there is no typical older person, with substantial differences in physical and mental capacity between people of the same age (WHO, 2020).

Accessing floor-level storage can involve movements such as bending, stooping, crouching and kneeling. While these movements are used in various daily activities, they can become difficult if there are limitations in lower body strength, joint movement, or balance. Hernandez et al. (2008) reported that approximately one-quarter of older participants experienced significant difficulty or were unable to perform stooping, crouching, or kneeling. However, difficulty with kneeling should not be viewed simply as an inevitable consequence of aging. Zhou et al. (2012) compared kneeling movements in healthy young adults and older adults, finding that the range of motion for the knees and ankles was similar in both groups. However, the older group utilized greater hip flexion and used their hands for support more frequently during the movement.

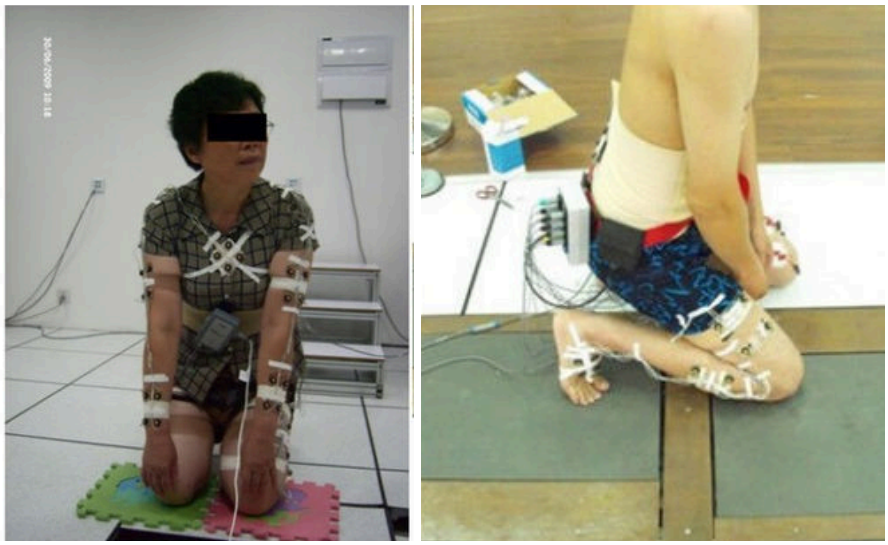


Figure 3. Zhou et al. (2012). Kneeling postures examined in healthy younger and older adults.

2.2 Physical Demands of Low Storage Access

Storage position also affects the physical demands of retrieval. In figure 4, Zhou et al. (2024) investigated the behavior of older adults retrieving items from kitchen cabinets and found a clear difference in movement between upper and lower storage. Upper storage primarily required reaching upwards, whereas lower storage involved more torso and knee movements accompanied by bending. Furthermore, retrieving items from both upper and lower storage was rated as more difficult than various other kitchen activities. This demonstrates that storage accessibility is not merely a matter of whether an item is within reach, but also the posture and movements required to retrieve it.

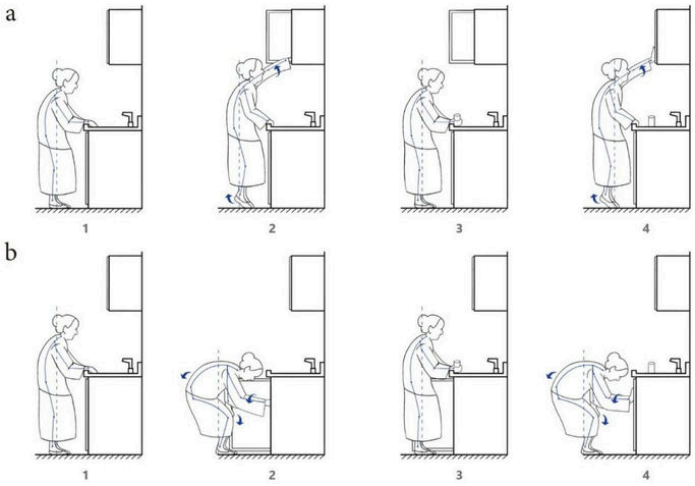


Figure 4. Zhou et al. (2024). Behavioural sequence of older adults retrieving objects from upper and lower kitchen cabinets

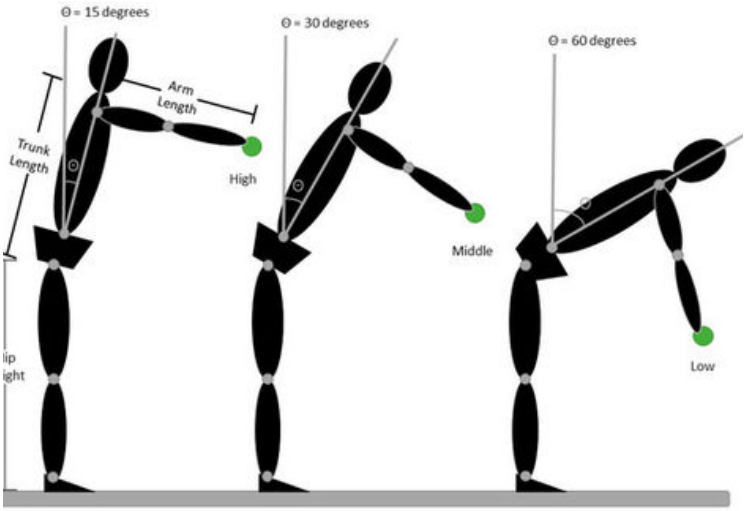


Figure 5. van der Veen et al. (2024). Functional reach task used to examine coordination between body regions

Retrieving an object from low storage is therefore not simply a reaching task, but a movement that can involve the whole body. Figure 5 showed that bending and reaching involve coordinated movement between the trunk, pelvis and lower body. While individuals with chronic low back pain or knee conditions may experience greater limitations in these movements, this study focuses on older adults living independently rather than a specific clinical population.

Overall, existing studies demonstrate that storage accessibility is influenced by both physical capability and storage location. While previous research provides useful information regarding storage height and body posture, In the studies reviewed, the combined demands of lowering, reaching and recovering during low and deep storage access were less clearly addressed. This provides an opportunity to further investigate how older adults physically interact with these spaces during everyday activities.

3. BENCHMARKING

3.1 Market Approaches

Initial market research identified several approaches to improving access to low household areas, including installed storage systems, retrieval tools, and products that support users during lowering or rising. As the project became more focused on the physical movement involved in low-level access, two relevant markets were selected for direct benchmarking: retrieval tools and movement-support products. These were analysed separately because they address different parts of the same activity.

3.2 Retrieval Tool Benchmarking

Note. Scores are author-assessed from published product specifications (1 = low, 5 = high), not measured performance ratings.

	Product	Key Specification	Mechanism	Physical Effort Reduction /5	Object Handling Capability /5
	Aidacare Dressing Stick	520 mm	Hook / push-pull	3	1
	Classic PRO	660 / 810 mm	Trigger jaw	3	3
	Featherweight	660 / 810 mm	Low-effort trigger jaw	4	3
	Etac Aktiv	450–900 mm	Angled handle + gripping jaw	4	3.5
	Arthri-Grip PRO	660 / 810 mm	Whole-hand trigger + rotating jaw	4.5	3.5
	Aspire Pick Up Reacher	Multiple lengths	Trigger + rotating head	4	4
	Redgum Heavy Duty	870 mm	Heavy-duty gripping jaw	3	4.5
	JACO Assistive Robot	Powered system	Multi-axis robotic arm	5	5

Table 1 Retrieval Tool Benchmarking

As shown in Table 1, most retrieval products use lightweight manual mechanisms to extend reach and reduce the need for bending or kneeling. Simple hook-based products provide basic access with limited object control, while trigger-operated reachers improve gripping and positioning through specialised jaws and rotating heads. Products with greater object-handling capability generally use more specialised gripping mechanisms or complex systems. This shows that retrieval tools vary not only in reach, but also in the physical effort and control required from the user.

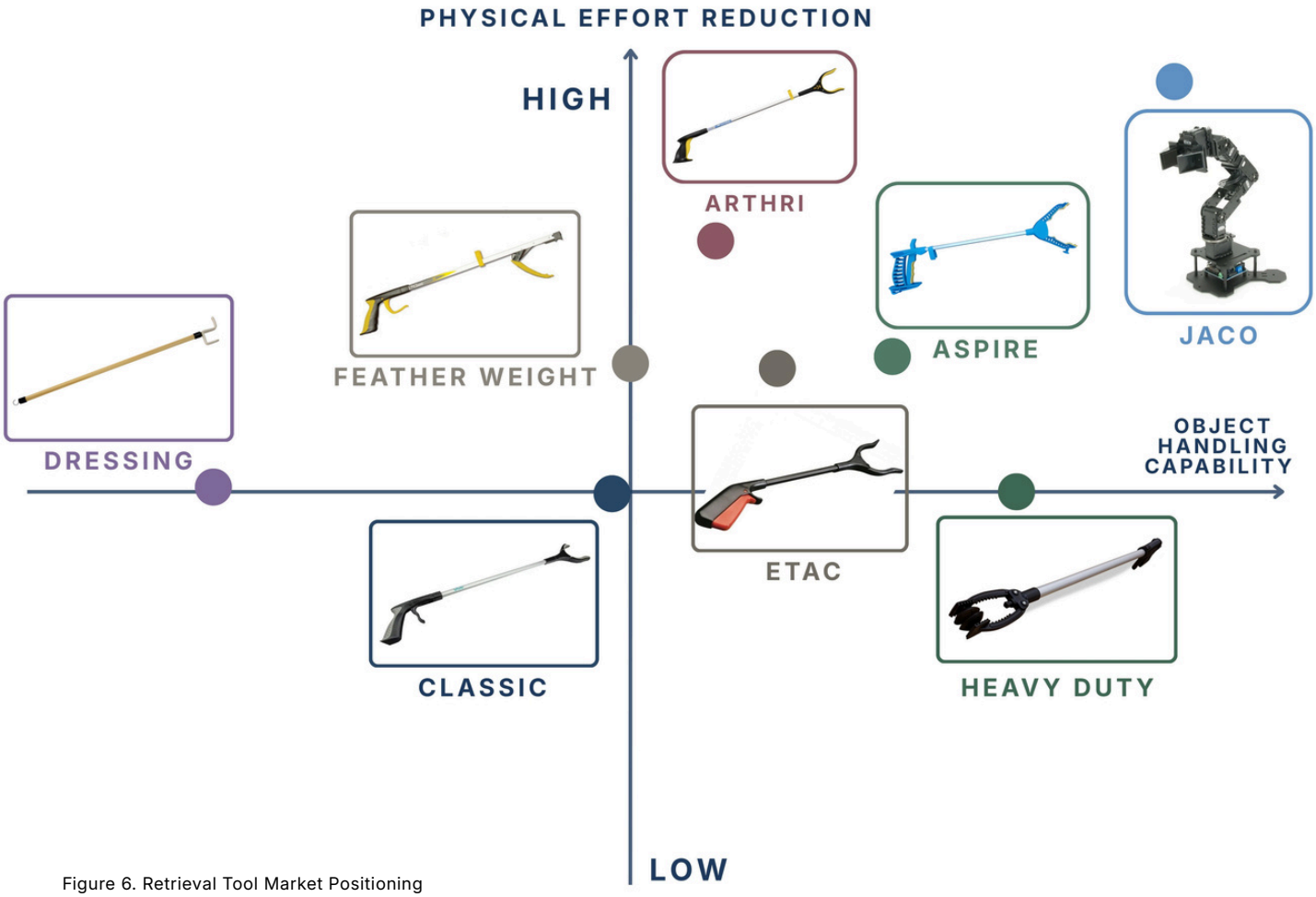


Figure 6. Retrieval Tool Market Positioning

The perceptual matrix in Figure 6 makes this trade-off clearer. Most manual reachers are positioned around the middle of the market, providing moderate-to-high physical effort reduction with moderate object handling capability. Products with stronger object handling move further to the right, while the powered JACO system is positioned separately in the upper-right, combining high qualitative scores in both areas. The product forms shown in the matrix also illustrate the progression from simple passive tools to specialised gripping mechanisms and powered assistance. Overall, extending reach alone does not necessarily provide both high physical effort reduction and flexible object handling.

3.3 Movement Assistance Benchmarking

Movement-support products address low-level access differently by supporting the user's body rather than retrieving objects remotely. The products reviewed ranged from passive kneeling supports and support rails to mechanically assisted seats and powered floor-recovery systems.

Note. Scores are author-assessed from published product specifications (1 = low, 5 = high), not measured performance ratings.

	Product	Supported Movement	Mechanism	User Input	Movement Assistance /5	Everyday Usability /5
	Aidapt Kneeler	Lowering / Kneeling / Rising	Padded platform + rigid handles	User performs movement; pushes handles to rise	**2**	**4.5**
	SitnStand	Sitting / Rising	Battery-powered inflatable cushion	Powered lift raises seated height	**4**	**4**
	Chair Cane	Sitting / Rising / Balance	Fixed support handle	User transfers load through arm	**2**	**3.5**
	Raizer II	Floor → Seated	Powered articulated lifting chair	Very low physical input	**5**	**2**
	Mangar Camel	Floor → Seated	Sequential inflatable chambers	Powered elevation while supported	**5**	**2.5**
	Carex Uplift	Controlled Sitting / Rising	Weight-responsive mechanical lift	User provides partial movement	**4**	**4.5**
	VOCIC AX05	Floor → Raised Position	Battery-powered rigid lifting chair	Minimal physical input	**5**	**1.5**

Table 2 Movement Support Benchmarking

As shown in Table 2, movement assistance varies considerably across the products reviewed. Passive products such as the Aidapt Kneeler and Chair Cane rely on handles or fixed supports, meaning users still perform most of the movement themselves. Sit-to-stand products provide greater mechanical or powered assistance while maintaining relatively high everyday usability. In contrast, floor-recovery systems such as Raizer II, Mangar Camel and VOCIC AX05 provide the highest movement assistance but score lower in everyday usability due to their more specialized purpose.

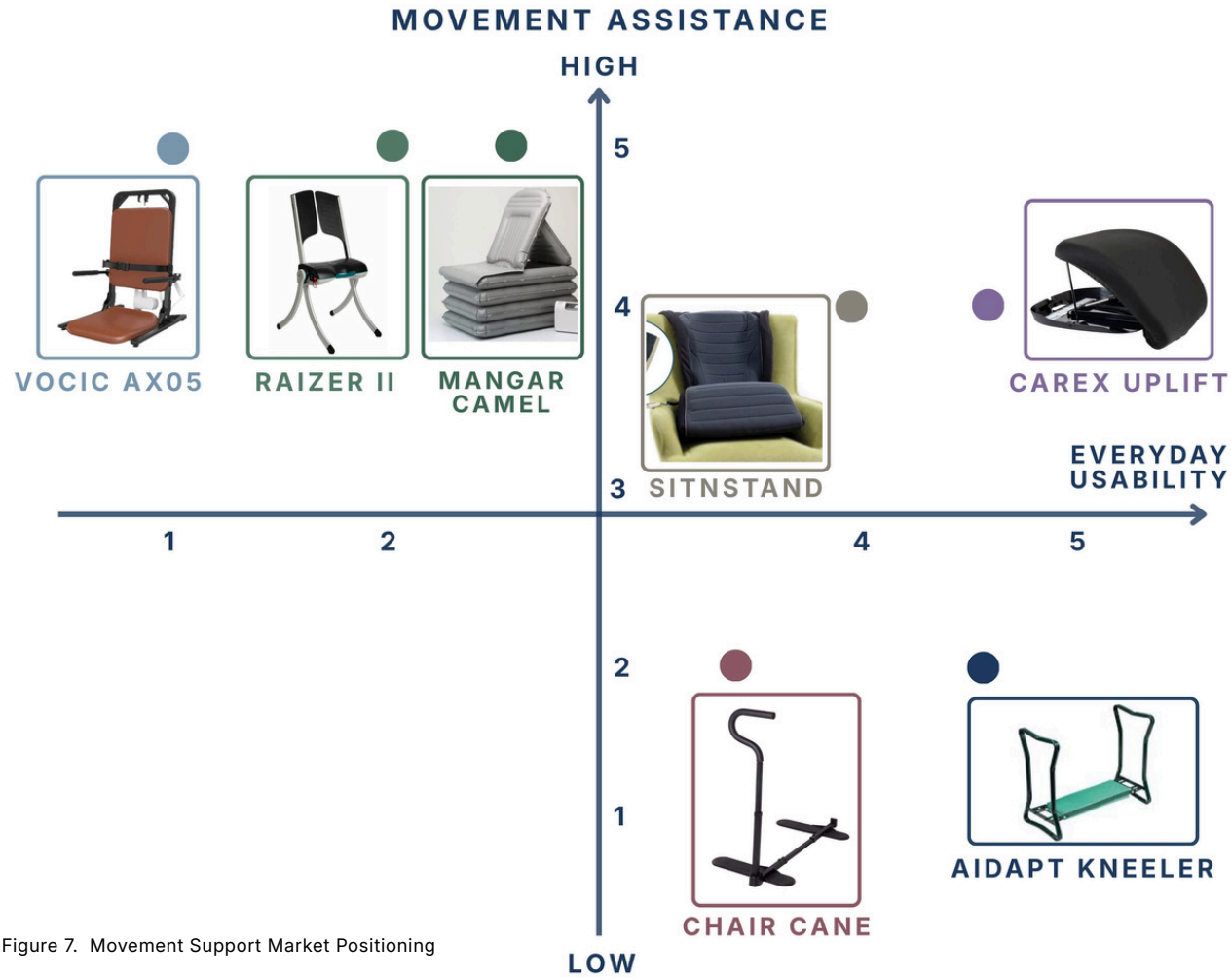


Figure 7. Movement Support Market Positioning

The perceptual matrix in Figure 7 shows the relationship between movement assistance and everyday usability. Powered floor-recovery products provide the highest assistance but are positioned lower in everyday usability. Passive supports such as the Aidapt Kneeler and Chair Cane show the opposite pattern, providing limited assistance but greater suitability for regular use. SitnStand and Carex Uplift sit between these approaches, combining relatively high assistance and usability. Overall, the strongest assistance was mainly found in products designed for seated transfers or floor recovery, while products suited to everyday low-level tasks generally provided less active assistance.

3.4 Existing Market Gap and Opportunity

Together, the two markets show different ways of reducing the physical demands of low-level access. Retrieval tools reduce the need to lower the body but require objects to be handled indirectly. Movement-support products allow more direct access, but passive products provide limited assistance while stronger assistance is mainly found in products designed for seated transfers or floor recovery. This identifies an opportunity to support the physical movement required to access low household spaces while allowing users to interact directly with stored objects.

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4. RESEARCH

4.1 Research Approach

Two complementary research methods were used to examine low-storage access: structured observation of publicly available videos and an online user survey. Video observation was selected to examine visible body movements and different strategies used during low-level tasks, while the survey was used to understand people's own experiences, including how they access low storage and which movements or areas of the body they find difficult. Using both methods allowed observed movement patterns to be considered alongside self-reported experiences.

4.2 Structured Video Observation

Method

Structured video observation was conducted using nine publicly available online videos. The nine videos were selected across three categories: older or physically limited user movement (V01–V03), low-storage interaction (V04–V06), and portable retrieval-aid use (V07–V09). This range was selected to capture different movement strategies rather than focusing on a single user or task. Videos were included when relevant body movements were clearly visible and sufficient visual information was available for coding. Footage was excluded when movement was obscured, no relevant low-level action occurred, or user interaction was not clearly shown.

Coding and Analysis

Each selected sequence was coded using a consistent framework covering trunk and body posture, knee position, reach, external support, recovery movement and movement sequence. Retrieval-aid videos were additionally coded for body lowering and object control. Rather than attempting to measure physical performance from video alone, the analysis identified repeated movement patterns and differences in how users lowered their bodies, maintained a low position, reached towards the task, used support and returned to standing. The same coding framework was applied across all nine videos so that the frequency of observed movement patterns could later be compared.

Category	ID	Video
Older / Physically Limited Movement	V01	4 See and Hear in the Kitchen (iLA. 2021)
	V02	Berg Balance Scale — Picking Object From Floor (StopFalls.org, 2013)
	V03	PBS — Active Elders: At Home, But Not Forgotten (WQLN PBS, 2021)
Low Storage Interaction	V04	Entire House Speed Cleaning 2020 — Alexandra Beuter (Beuter, 2019)
	V05	Whole House Deep Clean With Me — The Mom Resource (The Mom Resource, 2025)
	V06	Elderly Woman Searching in Low Kitchen Cabinet (ShotHappens, n.d.)
Portable Retrieval Aid	V07	Reacher/Grabber for Quad Hands — Active Hands (The Active Hands Company, 2017)
	V08	Easireach Reacher — Available in 4 Different Lengths (Complete Care Shop, 2020)
	V09	Approved Reacher Tool That Makes Daily Life Easier (AskSAMIE, 2025)

Table 3 Videos Used for Structured Observation

4.3 Online Survey

Method

An online survey was conducted to investigate how people experience low-storage access in everyday life. The survey received 18 valid responses. Participation was anonymous and voluntary, with submission of the completed survey taken as consent to participate. Responses were analysed using frequencies and percentages, with multiple-response questions reported as the proportion of respondents selecting each option.

Survey Measures

Questions were organised around seven areas covering participant context, physical capability, object interaction, movement strategies, retrieval difficulty, current responses and preferred improvements (Table 4). Multiple-choice and multiple-response formats were used where participants could reasonably report more than one behaviour or difficulty. Responses were analysed using frequencies and percentages to identify common patterns.

Question category	Information collected
Participant context	Age, living situation
Physical capability	Difficulty bending, kneeling, reaching or standing
Object interaction	Types of objects that are difficult to retrieve
Movement strategy	Bending, squatting, kneeling, sitting, use of support
Retrieval difficulty	Lowering, reaching, gripping, lifting, returning to standing
Current response	Reorganising, avoiding low storage, asking for help, using tools
Preferred improvement	Less bending, kneeling, deep reaching, easier lifting, visibility

Table 4 Survey Questions

5. ANALYSIS & FINDINGS

5.1 Video Observation Findings

Analysis across the nine videos identified differences in how users approached low-level tasks. The coded observations showed that low-level access involved combinations of trunk movement, knee movement, reaching, external support and recovery rather than a single consistent movement strategy.

Across the six direct-access videos (V01–V06), trunk flexion was the most consistently observed movement pattern. Deep or extended reaching was also common, while knee-based lowering varied between clear and limited movement. External support was observed in several videos, particularly during lowering or recovery.

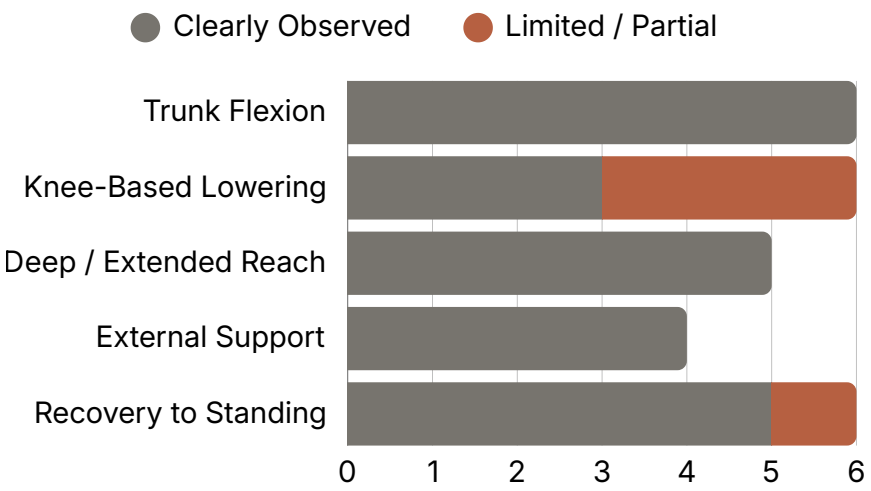


Figure 8. Frequency of Coded Movement Patterns Across Direct-Access Videos (V01–V06)

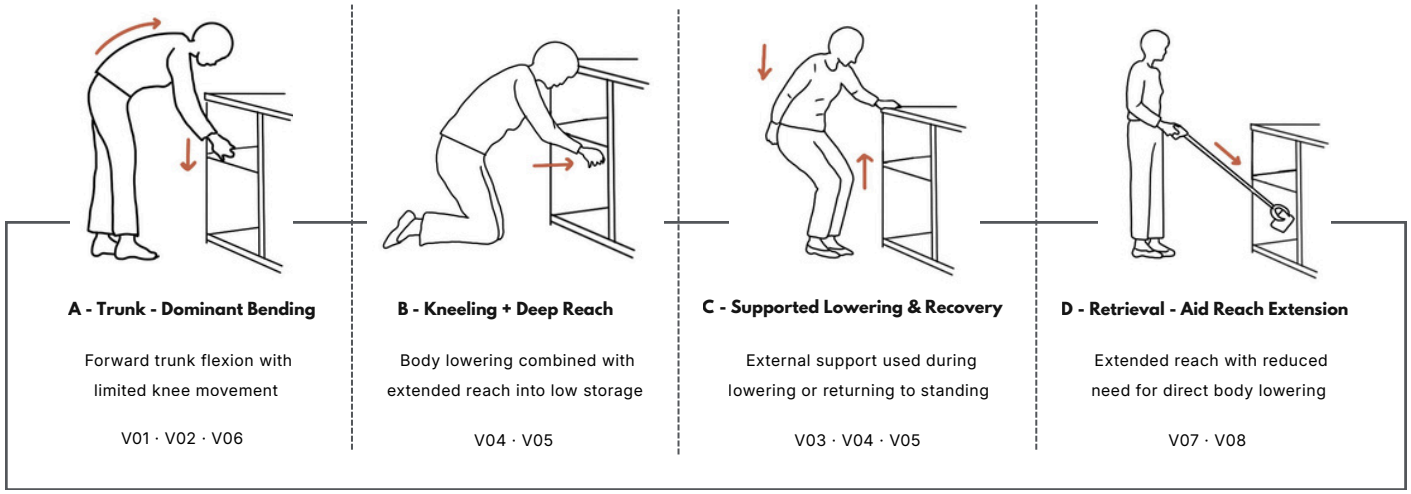


Figure 9. Observed Movement Strategies During Low-Level Access

Together, these patterns show that low-level access can place demand on different parts of the body depending on the strategy used. Trunk-dominant bending provided access without substantial knee movement, while kneeling allowed deeper access to low storage. External support was used during some lowering and recovery movements, whereas retrieval aids reduced the need for direct body lowering by extending reach.

5.2 SURVEY FINDINGS

Survey responses were analysed to identify how participants access low storage, which stages of the activity are most difficult, and what improvements they would find most useful. The findings show that difficulty was associated not only with reaching objects, but also with the body movements required to access and recover from low positions.

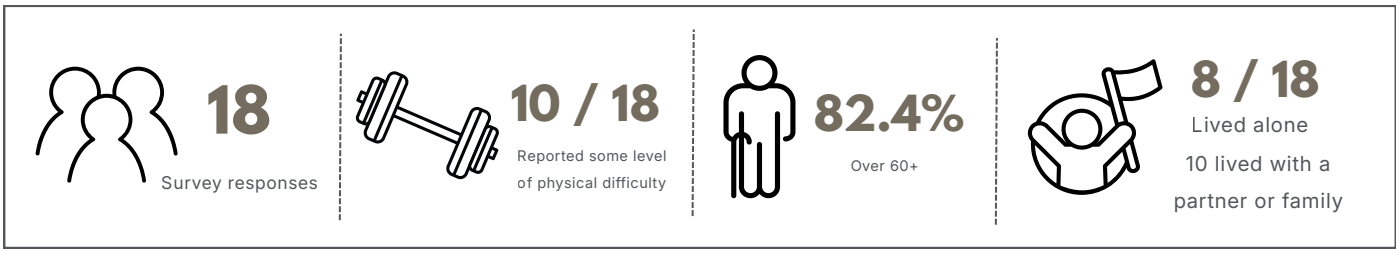


Figure 10. Overview of Survey Participant Characteristics

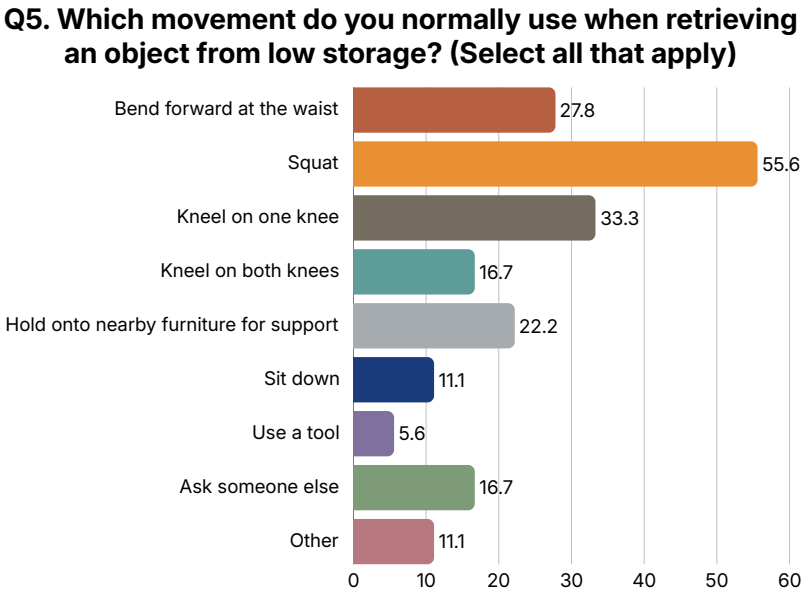


Figure 11. Movement Strategies Used to Access Low Storage

Participants reported using a range of body movements when accessing low storage. Squatting was the most commonly reported strategy (55.6%), followed by bending at the waist (27.8%). Kneeling was also reported, either on one knee or both knees. These results show that low-storage access involves different combinations of lower-body and trunk movement rather than one consistent posture.

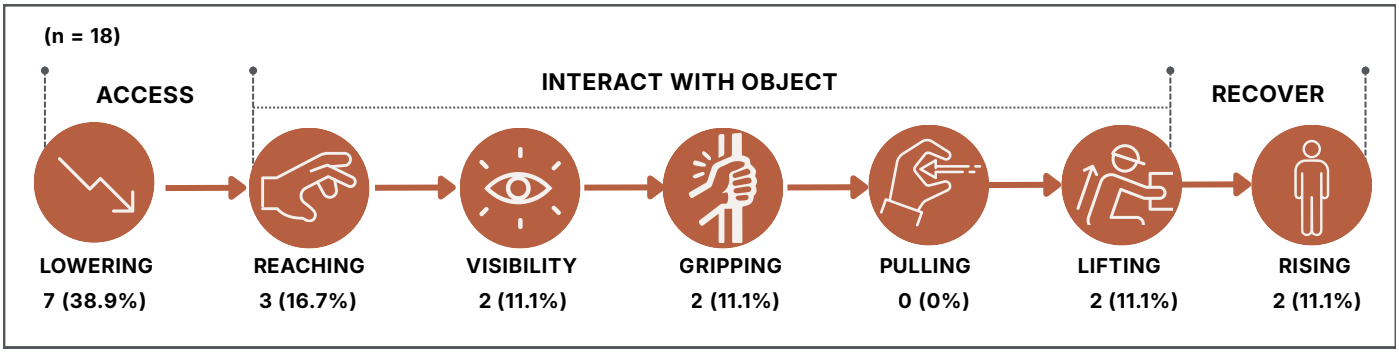


Figure 12. Most Difficult Stage of Low-Storage Retrieval

Lowering the body was the most frequently reported difficulty, selected by seven participants (38.9%). When lowering and returning to standing were considered together, body-transition stages accounted for 50% of responses. Reaching was the next most common difficulty, while gripping, pulling and lifting were reported less frequently.

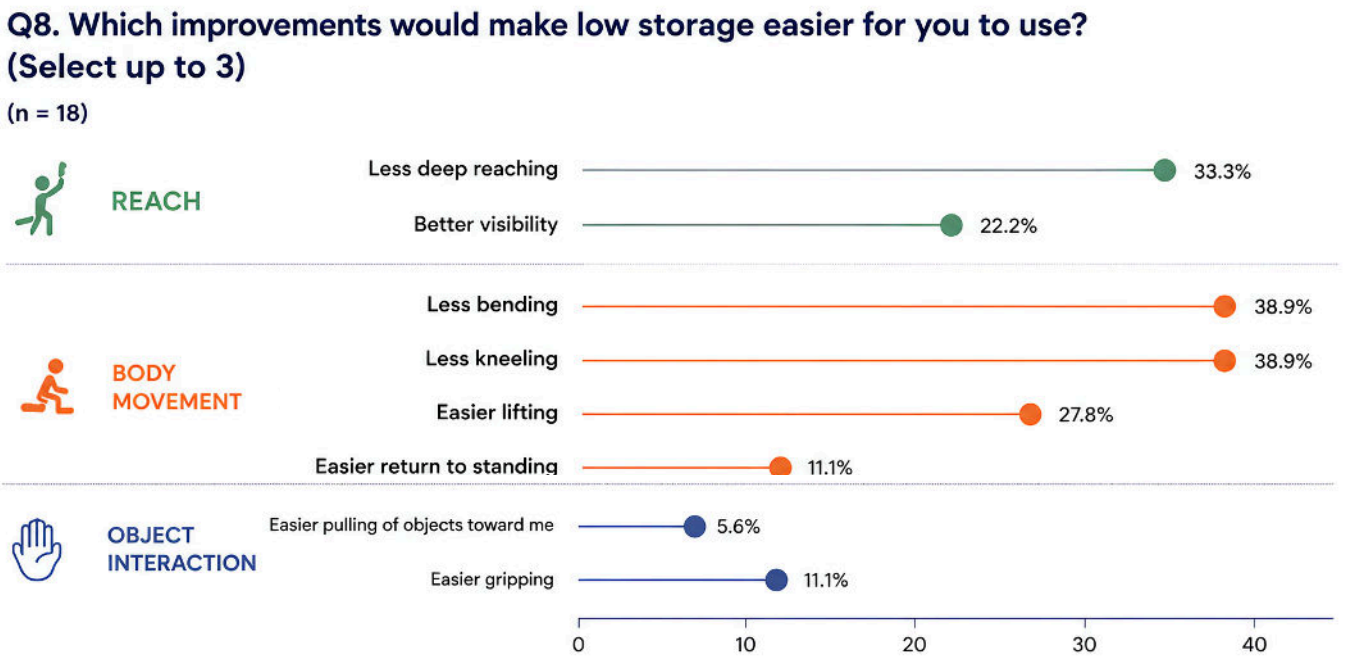


Figure 13. Preferred Improvements for Low-Storage Access

Preferred improvements reflected both movement and reach-related needs. Less bending and less kneeling were the most frequently selected improvements (38.9% each), followed by less deep reaching (33.3%) and easier lifting (27.8%). Better visibility was selected by 22.2% of respondents, while easier gripping and returning to standing were selected less frequently.

5.3 Combined Findings

Finding	Video Observation	Survey
Body posture	Trunk flexion consistently observed	Squatting most commonly reported
Body lowering	Kneeling/body lowering observed in low-storage tasks	Lowering was the most difficult stage (38.9%)
Reaching	Deep/extended reach common	Less deep reaching was a commonly preferred improvement (33.3%)
Support	External surfaces used during some movements	Easier return to standing was selected by 11.1%
Object handling	Remote gripping possible with retrieval aids	Easier gripping relatively low priority (11.1%)

Table 5 Comparison of Video Observation and Survey Findings

The two research methods showed both similarities and differences in how low-storage access was experienced. Video observations frequently showed trunk flexion during direct access, while survey participants most commonly reported squatting. Despite this difference, both methods indicated that low-storage access involves substantial body movement as well as reaching. The survey identified lowering as the most difficult stage, while video observations showed the use of external support during some lowering and recovery movements. Together, these findings suggest an opportunity to support body movement during low-storage access while maintaining direct interaction with stored objects.

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6. DISCUSSION

6.1 Low-Storage Access as a Movement Task

The findings suggest that accessing low storage is not simply a reaching task, but a sequence of whole-body movements. Across the video observations, trunk flexion was consistently observed, while knee-based lowering and deep reaching were also common. Survey participants identified lowering as the most difficult stage of retrieval (38.9%), while less bending and less kneeling were the most frequently selected improvements (38.9% each). These findings are consistent with previous research showing that stooping, crouching and kneeling can become difficult with limitations in lower-body strength, joint movement and balance (Hernandez et al., 2008, 2010). Together, the findings indicate that low-storage difficulty is influenced not only by whether an object can be reached, but by the physical demands required to lower the body, access the space and recover from a low position.

6.2 Movement Strategies, Support and Recovery

Movement strategies also varied between users and tasks. Trunk-dominant bending appeared consistently in the direct-access videos, whereas squatting was the most commonly reported strategy in the survey. This suggests that there is no single posture that represents how people access low storage. Zhou et al. (2024) similarly found that lower-cabinet retrieval involves coordinated changes in trunk and knee movement. External support was also observed during some lowering and recovery movements. This is consistent with Zhou et al. (2012), who found that older adults used their hands for support more frequently during kneeling. Research on floor rising also found that furniture support can assist some older adults during recovery from low positions (Alexander et al., 1997). Although floor rising is more demanding than typical storage access, these findings suggest that stability and support may be important throughout low-level movement.

6.3 Research Gap and Contribution

When these findings are considered alongside the benchmarking, a gap between existing approaches becomes clearer. Retrieval tools reduce the need for body lowering by extending reach, but require indirect object interaction. Movement-support products allow greater direct involvement, but products providing high levels of assistance are mainly designed for seated transfers or floor recovery rather than repeated household storage access. The research therefore reframes low-storage access as a movement problem rather than only a reach problem. It identifies an opportunity between retrieval assistance and specialized mobility equipment: supporting lowering, low-level access and recovery while maintaining direct interaction with stored objects. This suggests a household-focused design opportunity that supports the user's movement without unnecessarily replacing their existing physical capability.

7. DESIGN IMPLICATIONS

7.1 Overall Design Direction

The design should support the user's movement rather than replace the activity of retrieving an object. It should allow users to continue reaching and handling stored objects directly while reducing the physical demands associated with moving into and out of a low position. As gripping was a relatively low priority for improvement, the design should not center on object-handling assistance alone. Instead, the primary focus should be on supporting the physical movement required to access low and deep storage while maintaining user control and independence.

7.2 Physical Support

(a) Lowering (b) Recovery

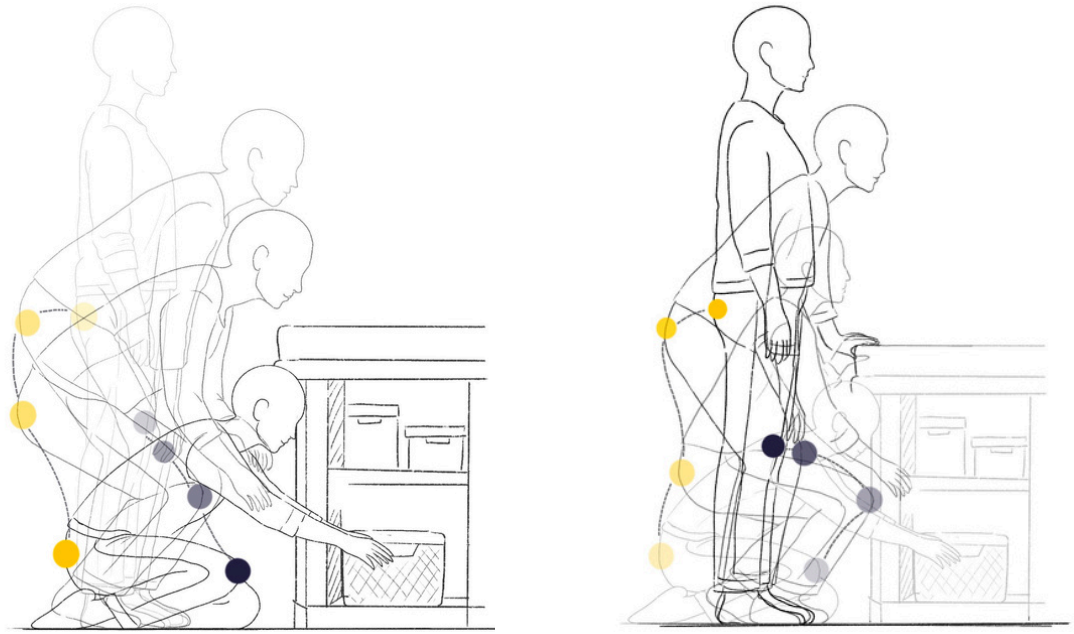


Figure 14. Conceptual motion studies of (a) lowering and (b) recovery during low-storage access. Coloured points indicate conceptual hip and knee movement paths

Support should also extend across the movement rather than focusing on only one posture or stage. Participants used different strategies including squatting, kneeling and bending, while the video observations showed variation in trunk and knee movement between tasks. Squatting was the most commonly reported movement in the survey, while bending and kneeling were also used. This suggests that the design should not force users into one fixed posture. Instead, it should provide stable assistance during lowering, allow the user to maintain a stable low position while accessing storage, and provide support when returning to standing. Because external surfaces were used for support in several observed movements, providing a stable point of support may also reduce reliance on surrounding furniture or cabinetry.

7.3 Everyday Use

The product needs to provide enough support to reduce physical effort without becoming difficult to use in everyday life. While a higher level of assistance may reduce physical effort, the benchmarking showed that highly supportive products are often larger, more specialized and intended for specific mobility or recovery situations. For low-storage access, the solution should avoid becoming unnecessarily complex or clinical. It should be practical for repeated household use, suitable across different storage contexts such as kitchens, bathrooms and other low cabinets, and simple to understand without specialized training. The design should also minimize the effort required to prepare or position it before use, as additional setup could create another barrier to accessing storage. As the intended users are independently living older adults rather than a specific clinical population, the solution should support existing physical capability and integrate naturally into everyday household activities.

7.4 Design Opportunity

Together, these findings identify an opportunity for an everyday movement-support product that reduces the physical demand of accessing low and deep household storage. The opportunity is focused on supporting the full movement sequence: lowering the body, maintaining a stable low position while accessing stored items, and assisting the user to rise again. Survey findings showed that squatting was the most commonly reported movement used to access low storage, highlighting the importance of reducing the effort required during repeated lowering and rising. Rather than retrieving objects remotely, the product should allow users to remain directly involved in the task while providing physical support where the movement is most demanding. This creates a more focused design opportunity for a simple household product that assists body-weight transition, improves stability, and reduces reliance on unsupported squatting during low-storage access.

8. CONCLUSION

This research investigated the physical challenges associated with accessing low and deep household storage, with a focus on how body movement affects everyday access. Literature review, market benchmarking, structured video observation and survey research were used to examine existing solutions, movement patterns and user-reported difficulties. The findings showed that low-storage access involves more than reaching for an object, requiring users to lower their body, maintain a low position and recover to standing. Squatting was the most commonly reported movement in the survey, while difficulties related to lowering and returning to standing further highlighted the importance of body transition during the task.

Existing retrieval tools can reduce the need to approach stored objects, while movement-support products provide varying levels of stability or physical assistance. However, products relevant to kneeling and low-level activity mainly provide passive support, while stronger assistance is generally designed for seated transfers or floor recovery. Together, these findings establish an opportunity for an everyday product that supports lowering and rising, improves stability while the user is in a low position, and reduces the physical demand of unsupported squatting while maintaining direct access to stored objects. These findings provide the basis for subsequent concept development and evaluation.

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