Proceedings of the Web-Based Workshop on Independent Wheelchair Transfers (IWT): September 26, 2012

The U.S. Access Board and the National Institute on Disability and Rehabilitation Research (NIDRR) has sponsored a multi-year research project on independent transfers to gain a better understanding of how the built environment impacts transfer performance. One of the purposes of the project was to form an international workgroup of experts with various backgrounds in independent wheelchair transfers in order to facilitate an exchange of ideas and to develop future research directions. The ultimate outcome of the Independent Wheelchair Transfer (IWT) Workgroup is a research agenda that addresses current unmet needs concerning independent transfers in the built environment.

A live web-based IWT Workgroup meeting was held on September 26th, 2012. It was organized and facilitated by project investigators from the University of Pittsburgh’s Human Engineering Research Laboratory (HERL). An online web-based videoconferencing program was used to conduct the meeting. The daylong event was comprised of a combination of two all-participant meetings and three small group breakout meetings. The following small group meeting topics were chosen to focus the discussions on specific areas concerning independent wheelchair transfers.

**Sub-topic Area 1 Standards**: Identifying areas where current accessibility standards for elements designed for independent transfers need updating.

**Sub-topic Area 2 Research**: Identifying what additional research is needed concerning independent transfers, particularly as it relates to the impact of setup on the transfer process.

**Sub-topic Area 3 Other Issues**: Identifying other issues (e.g., multi-step transfers, transfer-aids, surface stability, surface slope/cross-slope, seat-to-surface gap, etc.) related to independent transfer in the built environment that requires further examination.

Potential participants were identified by the University of Pittsburgh study investigators’, the U.S. Access Board, NIDRR project managers personal networks of collaborators and acquaintances in the field, authors of scientific papers related to transfers among wheelchair users, and by internet searches for individuals whose work closely related to this study's purpose. Of the 67 people invited, 31 participated in the live event. The primary occupations of the participants included university professors, clinicians, human factors & ergonomic specialists, architects, assistive device manufacturers, researchers, and engineers. The majority of the participants had at least 15 years or more experience in their current profession (67.7%), 9.7% had 10 to 15 years, 9.7% had 5 to 10 years, and 12.9% had 2 to 5 years of experience. Prior to the meeting, participants were asked to read the research project report from Phase 1 of this research study and the existing standards pertaining to transfers. Participants were assigned to sub-topic groups prior to the live meeting based on preference and so that each group had a relatively even distribution of the occupations and wheelchair users represented. Full verbatim transcriptions were obtained from the audio recordings of the live discussions that transpired during each sub-topic meeting. Three reviewers independently reviewed the transcriptions and identified main 'themes' for each of the sub-topic group discussions. The reviewers met to discuss and reach consensus on the main themes for each group. The transcriptions were independently reviewed again to assign each participant’s remarks to one of the main themes. Afterwards, reviewers met to compare and contrast their findings and reach consensus on the themes and assignments for each remark. The following graph (**Figure 1**) lists all the main themes identified in each sub-topic group and shows where there was overlap in the themes among the groups. All three groups, despite the difference in the sub-topic area of discussion raised points concerning user issues, the transfer process, the built environment, and considerations regarding future research studies. The Research and Other Issues groups both made remarks related to transfer training and evaluation, education and outreach and the complex interaction that exists between the environment, user, and/or transfer process. The Current Standards and Other Issues groups both expressed that the wheelchair design has an impact on transfers. The Research Group remarked about the lack of standardized transfer terminology and definitions in the field. Participant remarks that were made under each group for each main theme were combined across the groups and are outlined below followed by a summary statement for each theme.



Figure 1 - Overlapping Themes of the Three Sub-Topic Areas

Alternate Text Figure 1: This illustration shows three overlapping circles. Each circle contains the name of the sub-topic area and letters that symbolize all the main themes that were identified within that sub-topic area. Contained within the overlap area formed by all three circles are the themes that were present in all three sub-topic groups (Transfer Process/Techniques/Preferences, Built Environment, User Issues, Factors and Concerns, and Considerations regarding Future Studies. An area of overlap between two of the circles (sub-topic Research and sub-topic Other Issues) contains the themes: Transfer Training and Evaluation, Interactions between the Environment, User, and Transfer Processes/Techniques and Preferences, and Education and Outreach. An area of overlap between two other circles (sub-topic Current Standards and sub-topic Research) was Wheelchair Configuration and Design. One circle (sub-topic Research) shows that Terminology and Definition of Transfer Movement/Technique was unique to that sub-topic area.

**IWT Workshop Themes and Remarks**

# WHEELCHAIR CONFIGURATION AND DESIGN

* Wheelchairs have changed in recent years and have a different interface with the environment.
	+ Determine how current wheelchair design interfaces with specifications for things around the environment
	+ Manuals wheelchair wheels that are positioned forward on the chair for enhanced propulsion efficiency make transfers parallel to the transfer surface much more difficult because the wheel is in the way
	+ Flared castors that project forward and laterally and are designed for stability limit how close a wheelchair user can position his or her chair next to the transfer surface
	+ Some frame designs put that caster way out which also puts that footrest way out. It becomes very difficult for the end user to get to the edge of the seat to transfer
	+ Wheeled mobility device (WMD) modifications to facilitate transfers
	+ Wheelchairs designed around adjustability with some minor modifications could have a sliding seat that moves forward to minimize the transfer gap
	+ With a longer frame and a sharper frame angle, a person can scoot to the end and get their chair very close for the transfer, thereby going over with more ease

**Summary Statement: Current wheelchair designs that are optimally designed for efficient propulsion or stability can make it harder to do transfers. Current wheelchair designs do not match up properly with areas designed for parallel wheelchair transfers. Future wheelchair designs should consider incorporating adjustments that make transfers easier.**

# USER ISSUES, FACTORS, AND CONCERNS

* Identify the cohort of people who perform independent transfers (e.g. demographics, physical characteristics, WMD types and sizes, etc.)
* Compare/contrast amongst users with various types of wheeled mobility devices
* Compare/contrast the cohort of people who perform independent transfers with all users of the transfer target (non-wheelchair users)
* Need more information about the needs of users and their capabilities for different types of equipment (scooter, manual wheelchair (WC), power WC)
* Identify which WMD user groups (scooters, powered, etc.) require what kind of configuration for transfer
* Needs may be different between short term and long term wheelchair users
	+ Identify the barriers for people with disabilities to achieving dynamic stability during transfers
* Identify the limiting factors for transfers according to those who do them by initially surveying users to identify personal barriers (e.g. pain, strength, balance, fear of falling), and where they face difficulties with transfers. Follow-up with a more specific survey to address the barriers discovered in the first survey
* Identify what environmental barriers are common to WC users for their given lifestyle
* Identify what environmental barriers influence the desire to perform a transfer
* Identify what environmental factors make transfers safer and more efficient so that we can prioritize issues to address first
* Consider how many people prefer to transfer than stay in their chair if the built environment offered that option if possible (ex. restaurants, benches)
* Consider the impact of wheelchair transfer “skill deficit” in some places
* Consider the impact of stature and anthropometrics:
	+ Those with short stature may need to stand on something to reach the seat
	+ Consider the role that flexibility of the body or spasticity play in transfers.
	+ People are getting larger - body mass and weight is important to keep in mind
	+ Consider wardrobe and bulkiness of clothing and how it interfaces with the transfer surface and texture

**Summary Statement: Little is known about the cohort of people who perform independent wheelchairs and their requirements for transfer with regards to the type of device they use, their disability, physical characteristics, preferences, level of wheelchair transfer skills, and length of time using a wheelchair. The environmental and personal barriers to transfers in relation to lifestyle and the desire to perform a transfer are not well understood. More information is needed to determine where users face the greatest difficulties with transfers. More information is also required to determine environmental factor(s) that most often impacts transfers.**

# TRANSFER PROCESS/TECHNIQUES/PREFERENCES

* Consider how the following factors influence the wheelchair transfer process
	+ User positioning in the wheelchair prior to transfer
	+ Hand placement during transfer: what do people do, how many people do it that way, what makes the transfer safer and more efficient, and where should hands be placed
		- Dependent on anthropometry
	+ Choice of preferred orientation of the device (e.g. angle) to performing a transfer in relation to the characteristics of the transfer surface or type of transfer
		- How the device is positioned will affect the ease of the transfer and ability to do it
	+ Left and right side transferring preferences
	+ Foot contact during and after transfer
	+ Impact of footrest placement and caster designs
		- Interferes with barriers next to the transfer surface and how close you can get to the surface
	+ The position users prefer for transferring from the surface back to the wheelchair
	+ After the transfer to the new surface, users should be positioned optimally for the function they are engaged in
* Choice of transfer type (e.g. forward, lateral, etc.) in relation to the characteristics of the transfer surface
* Variation in requirements depending upon independent transfers versus assisted transfers
* Consider the impact that “technique” has on whether or not someone was successful at transferring
	+ Injuries caused by improper techniques
	+ Short-term WC users at higher risk for injury
	+ Wheelchair users may lack knowledge of proper transfer technique.
	+ Evidence shows what a lack of proper technique causes (e.g. repetitive strain injury )
* Time is a barrier
	+ Users feel under pressure to make a transfer (eg. amusement park rides)
	+ Where possible an alternate space, custom vehicles etc. should be provided

**Summary Statement: Users tend to choose a type of transfer (e.g. forward, lateral, etc.) based on the characteristics of the transfer surface. Factors to consider in the initial stages of transfer include the position of the user in the WMD, WMD orientation with respect to the transfer surface which is dependent on footrest placement and wheelchair design, and preferred direction of transfer. During the transfer, hand placement and foot contact are important. The transfer surface must not only be designed to enable for a successful transfer but also supports the user in a position that meets their functional needs. The transfer back from the surface may involve repositioning of the device and require different space needs. Transfer technique has an impact on how efficiently and safely someone transfers. Users are pressured when they have limited time to perform transfers.**

# Built Environment

## Transfer Surfaces

* Consider the influence of these environmental factors on transfers
* Transfer seat height
* Obstacles that impede the transfer surface
* Transfer surface size
* Transfer surface physical characteristics (e.g. firmness and stability, wet/dry)
* Locations on the transfer surface for facilitating hand placement or grip
* Stability of places on the surfaces where hands are placed
* ADA recommended height for toilet does not always work well for those using an accessory device on the toilet
	+ Prevents proper foot support and prohibits correct postural alignment for bowel care
* Unpadded surfaces
	+ Using the wheelchair cushion on the transfer surface relieves pressure but can interfere with function

## Space

* Clear floor space needed to do the actual transfer
	+ Consider size, shape and placement of wheelchair
	+ Consider space needs for bariatric wheelchairs and power wheelchairs
* Maneuvering space needed (same or more than the clear floor space used to position the device next to the transfer surface)
* Physical obstruction may impede the space next to the transfer surface that is accessible to the wheelchair user
* Wheelchair stowage space is a consideration in public places
	+ Retrieving the wheelchair back out of wheelchair stowage after using lifts, pool, park ride decreases independence with transfers
* Space considerations under the transfer surface to accommodate flared caster housing on manual wheelchairs and power chairs

## Floor

* Floor surface characteristics (e.g. firmness, stability, wet/dry)
* Canting [sloping] of the bathroom floor - need for stabilizing while doing the transfer

## **Accommodations and Equipment**

* Multiple fixed [environmental] setups
	+ For example, consider more than one accessible stall. Some toilets could be at a height other than 17” to 19”
* User adjustable accessibility features
* Transfer equipment availability in public places and weight capacity/durability
* Idea of a “universal transfer handle” carried by person
* Anchoring straps used to help pull/assist
* Device needed to stabilize the user when doing transfers to unstable surfaces
* Use of an intermediate device (e.g., bench) to help with unstable transfers
* Minimizing or bridging the gap to accommodate the height differential
* Stabilizing ‘side supports’ used alongside a boat dock, for example, that help in doing transfers
* Use of an incremental step to handle large vertical heights (e.g. hot tub or pool)
* Foot rest attachments
	+ Use of a flip down foot support for transfers onto higher surfaces
* Handholds or grab bars
	+ Could be complimentary to better technique which leads to minimal demand when performing the task
	+ Need to consider functional reach and strength in environmental design
	+ Grab bar physical characteristics (height, surface texture, shape, size, contour, position, angle and length)
	+ Impact of grab-bars
		- What are the benefits of getting better leverage (e.g. on a grab bar) for a transfer? Does getting “better leverage” affect transfers in other ways?
	+ Indications for grab bar use
		- What types of grab bars support what types of transfers?
		- What is the function you are trying to perform and the relationship between the grab bar and getting into that position, or what type of transfer you are doing or for what purpose?
	+ Is there a constituency for the vertical grab bar that is different from that of the horizontal one –also angled bars?
	+ Vertical floor mounted pole versus a wall-mounted bar for persons who have a stroke or one-sided disability. Needs to be out of everyone's way yet stable.
	+ Handhold availability on a portable device

## Unique Transfer Environments

### *Car transfers*

* Past vs. present automobiles: some newer more conducive to transfers (allow for smaller ‘gaps’)
* Seating surface firmness issues
* More contoured seat = more difficulty
* Leather better than fabric = less friction
* Ideal seat
	+ Seat rotates out
	+ Positions the seat however person would like
	+ Adjusts to user
	+ Slight bucket good for stability
* Vehicle doorways: 4-door harder to transfer into
	+ Loading wheelchair into car: Passenger seat causes major problems; extreme ranges of motion and shoulder forces

### *Boat Transfers*

* Edging near the dock/piers is a safety issue
* Variability in boats and water height
* Transfers to an unstable surface of boat and height are issues

### *Amusement Park Rides*

* Shouldn’t adapt only one car - like ‘the disabled car’
* Modifying an existing vehicle works for transfer and rides should operate with more than one modified vehicle
* Placement of the chair is critical for the transfer out of the ride
* Retrieval and relocating the chair to the unload station can be complicated
* Unload environment provides a clear floor space but space can vary based on the ride and user’s preference
* Most rides have unique vehicles that are designed to temporarily remove barriers such as hinged sidewalls or foot bolsters that swing out of the way. Unique grab points and gripping surfaces have been added to assist with transfers. Most ride seats are made to have padding to protect the skin.

### *Movie Theater Seats*

* Wobbly backrest makes for an unstable system
* Recommended locking mechanism on the [movie theater seat] for transfer
* In assembly areas with traditional seating theaters, it seems challenging unless you have portable companion seats to achieve the shoulder alignment with respect to the wheelchair space and the companion seat – it’s a wheelchair space issue
* Knee clearance can be a problem when there is a seat in front
* People transfer to seats that are not intended to be transferred onto

## Other

* Equipment that is installed for the purpose of making an area accessible is sometimes not compliant with the standards
* Errors in construction where transfers take place
* Broken transfer surfaces and maintenance of surfaces
* Adapting designs to accommodate larger WCs, scooters, etc.
* Changing the environment to accommodate one group of WMD users (e.g. scooters) may limit another
* Need a transfer analogy to the ski slope level of difficulty indication (e.g. green slope – easy, black diamond – challenging). For transfers a similar system could be used (i.e., “This is the type of transfer this environment was set up for”)

**Summary Statement: Environmental factors impacting transfers include the transfer surface (size, height, firmness, stability, texture, and presence of obstacles), the space next to the transfer surface that is available for maneuvering and positioning the device, space under the transfer surface, and space for stowing the device where applicable. Characteristics of the floor surface where the transfer takes place should be considered. A number of environmental accommodations to consider include multiple fixed setups (e.g. more than one accessible bathroom stall), adjustable accessibility features, and availability and public access to transfer assist devices. Transfer assist devices are needed to help stabilize someone who needs to transfer to an unstable surface, minimize or bridge the gap and/or height differential between the mobility device and transfer surface, provide foot support, and act as an anchor to help pull or assist with transfer. More information is needed on grab bar/handhold physical characteristics, positioning and placement which needs to consider functional reach, strength of the user and indications for their use. Certain environments such as motor vehicle transfers, boat transfers, amusement park ride transfers and transfers into movie theater seats have unique challenges. Non-compliant installations of equipment, errors in construction, and broken down surfaces cause problems with transfers. Consider that changing an environment for a specific group of wheeled mobility device users may limit another. Consider a ‘level of difficulty’ rating system that would indicate the type of transfer and degree of transfer difficulty for a given environment.**

# TRANSFER TRAINING AND EVALUATION

* Teaching energy-efficient transfers is a critical part of rehab
* Transfers are difficult to learn for newly injured users because they require strength to support body weight
	+ Develop a weight assisted transfer system to help support the user’s body weight while teaching technique in rehab and while they get stronger
* Someone who is temporarily in a WC may have received limited information or lack experience with proper technique to prevent injury
* Shorter rehab stays have led to less time spent on transfer training
* Need to quantify what’s not good about transfer technique to justify what the lengths of stay in rehab should be (they are generally not long enough)
* Essential wheelchair skills are not being taught in rehab—users could be taught how to lift their front end and put it over a rail to get closer to surfaces
* Lack of time to adequately teach and train transfer skills in a clinical environment is a concern
* Transfer Assessment Instrument (TAI) is a good tool designed to assess transfer technique that with practice can be quick to administer
* Experienced clinicians can easily identify who has good technique and who doesn’t
* Need a way to capture elements of ‘correct’ technique and describe it clinically
* Identify the amount of time spent on transfer training in different health care systems and settings and compare standards of practice (e.g. VA, Model Systems SCI, Canada, etc.)
* Difficult to ‘re-train’ persons who have already adapted to using certain “poor” techniques
* Identify issues related to the 90-degree pivot swing (e.g. current standard of training)
* Develop materials and guidelines for clinicians for transfer training that goes beyond the ‘basics’ (e.g. identifies environmental constraints and ‘other things’ that minimize effort)
* Consider “telerehab” and video-based training

**Summary Statement: Transfers are difficult to learn for newly injured users with limited strength. Equipment should be developed to support transfer training for these users. Short-term wheelchair users may not have been provided with adequate information or practice on how to properly transfer. It’s difficult for long-term users who use “poor” techniques to learn and adopt “correct” techniques. The field needs a way to describe clinically what “correct” technique is. Essential wheelchair skills may not be taught in rehabilitation due to limited time. Rehab stays are too short and have resulted in less time spent on transfer training. More data is needed on transfer training outcomes to help justify longer rehab stays. Clinicians have limited time to learn, teach and evaluate transfer skills. Educational materials are needed that teach clinicians how to teach transfers that go beyond the “basics”. Tele-rehabilitation and video training would enable remote training opportunities for clinicians.**

# Interactions Between the Environment; USER; and/or transfer Techniques/Process/preferences)

* Should we adapt techniques to the environment or environment to techniques?
* Environment may be better addressed as we don’t really know what good technique is
* How much risk is appropriate?
	+ Does designing an easier environment put the user at an increased risk?
* What is the ultimate goal of making the environment accessible?
* Designing an environment that everybody can independently transfer OR
* Designing an environment that people within a certain capacity can transfer within
* What type of transfer is best for person with X condition in Y environment, etc.
* Build algorithms and regression/prediction models
* Determine what works better for people with certain physical characteristics (e.g. weak upper body strength) and within certain environments (e.g. nursing homes) and then tailor the environment to them
* What is the economic cost to configuring the environment when someone is missing a skill set and where would we be better off spending our money?
* Which wheelchair users (e.g. subgroups, types, etc.) really have problems with performing transfers and is it because of their ability, device or environment or combinations thereof?
* Users transfer a dozens of different ways. What is the correlation between kind of transfer, the prevalence of each transfer, and the space that you are trying to make accessible?

**Summary Statement: Interactions exist between the transfer environment, user characteristics, and transfer skill sets. These interactions make it difficult to understand the problems that wheelchair users have with transferring in different kinds of environments. Should the environment be tailored around the skill set or vice versa and what is the economic cost to configuring an environment when someone is missing a skill set? In what ways does designing an easier environment impact users? What is the relationship between the kind of transfer and the environment that is to be made accessible? The goals for making the environment more accessible need to be better defined –do we design for everybody that can independently transfer or for those with certain capabilities. A greater understanding is needed of the types of transfers that work best for users with certain conditions and in each environment.**

# Terminology and Definitions of Transfer Movement/Technique

* Clear and consistent terminology and definitions needed for sharing and distributing evidence
	+ Need a taxonomy of different types of transfers
	+ Need a standardized approach to describe the movement
	+ Consider breaking down transfer movement into distinct movements similar to gait description (e.g. swing phase, stance)
	+ Develop names for events so technique during an event can be characterized
* Limitations in current methodology make it difficult to determine phases uniformly across research sites

**Summary Statement: The field needs clear and consistent terminology for describing the movements involved for various types of transfers so technique during an event can be characterized. This would enable for uniformity in communicating, sharing and distributing evidence.**

# Education and Outreach

## Problems

* Users improvise and use common household items in their environment to assist them with the transfer because they don’t know what’s available to them in terms of durable medical equipment and assistive devices
* A few things are known about technique that are not being disseminated well to clinicians
* If you want to change environment you need to educate those who are creating it to make it easier to use
* The emphasis on long term safe technique of wheelchair skills (propulsion/transfers) is not the same as that for ambulation training
* Wheelchair design changes to enhance transfers is not a priority right now

## Solutions

* Showing healthcare that you can create an environment that prevents injuries gets their attention and brings changes
* Users need to advocate for making the environment more accessible
* There has been a big push in industrial design towards universal design and inclusion
* Educate mainstream engineers/designers/architects on the needs of those who independently transfer early on in their curriculum or professional society
* Educate manufacturers on why they need to shift back to a longer wheelchair frame for stability during transfers
* Educate those prescribing chairs (Assistive Technology Practitioner (ATP) or clinician) on how to select and configure wheelchairs to make transferring easier
* Partnering between researchers, academic setting and manufacturers is needed to learn how wheelchairs can be designed to make transferring easier
* Consider data sharing across multiple constituents
* The Access Board website is a great place for disseminating information

**Summary Statement: There is a knowledge translation gap with transfers that exists among stakeholders. For example, users are not aware of the durable medical equipment and assistive devices that are available to help them transfer, clinicians are not aware of the evidence that exists on transfer technique and mainstream designers are not aware of the needs of those who transfer. Healthcare and wheelchair manufacturers do not regard transfer issues as a high priority. A number of potential solutions to these issues were identified including showing outcomes on what a 'good' or 'bad' environment causes, users advocating for more accessible environments, educating mainstream students and professionals who would be involved with environmental design on the needs of those who transfer early on in their careers, educating wheelchair manufacturers on why they need to keep stability during transfer in mind when designing wheelchairs, and educating clinicians on how to select and configure chairs to make transferring easier. Collaboration among stakeholders is needed to share data and bring about design changes that make transfers easier.**

# Considerations regarding Future ReseaRCH Studies

* Consider that different users groups have different transfer abilities and needs
* Consider that there is a lot of variability between users in terms of performance
* Restricting studies to a specific disability groups means designing an environment for that group only
* Biomechanics laboratory-based research is not totally realistic
* There are many variables which makes it difficult to study the influence of the environment on transfers
* Talking to users can provide a lot of information about transfers
* Survey based research should start with a conceptual framework
* National registries (e.g. Model Systems on SCI) could be used to survey users about transfer issues
* Consider conducting research outside of the lab using portable instrumentation
* Video Ethnography would provide a good real-world look at the day-to-day work of the transfer
	+ Videotaping users would help to determine if the user has a skill deficit versus environmental barrier, or both
* Need research that shows transfer training is an essential skill and not optional learning to support the need for specialty training
* Research is needed that says particular handholds should be avoided because they may be damaging
* Research is needed on ways to transfer that are least destructive to any tissue in the body
* Analysis of clear space is needed for those who transfer between 17” to 19”
* Guidelines need to address assisted transfers

**Summary Statement: Research on transfers should consider the variability that exists among user groups regarding the range in transfer abilities and needs, that there are many variables that impact transfers, studies involving certain user groups means the environment will be designed around that group's needs, and that laboratory based research isn't directly applicable to real-world. Much can be learned by surveying and watching users perform transfers in natural environments. Biomechanics research outside of the lab would be more ecological and may be possible with portable instrumentation. Research is needed to support the importance of transfer training and to determine what types of movements should be avoided and those that are least injurious on tissues. Data is needed on clear space for those who transfer within the ADA transfer height allowances. Guidelines should be expanded to address assisted transfers.**

**CONCLUSIONS**

The purpose of the IWT workshop was to bring together experts in the field to discuss the issues that wheelchair users currently face within the built environment with regard to independent transfers. The IWT web-based meeting presented a unique opportunity to gather and share information among experts in the field. Rich information and new ideas in each sub-topic area were attained through the use of focus groups that were designed to encourage an open flow of ideas amongst participants. The diversity of professional experience and interests in each group added breadth of knowledge to the content of the information obtained from each group. Although a systematic process was followed to translate the transcripts into a summary and decide upon themes, the results are the opinions of experts based on their experience and may or may not represent the opinions of other experts in the field who were not part of the focus groups.

While some clear main themes arose from the discussions in each group, there were some conflicting areas between and within sub-topic groups. For example there were comments about addressing wheelchair design to adapt to the environment while other remarks were made about adapting the environment to accommodate for current wheelchair designs. Similarly, questions were raised as to whether the environment needs to accommodate what may be deficits in transfer skill or is it a matter of training better transfer technique to overcome environmental challenges to performing transfers. Other questionable areas pertained to the degree that the environment needs to be adapted in order to accommodate specific types of transfers or degrees of physical capacity. The comments received indicate that the area of independent transfers is multi-faceted and several factors need to be taken into consideration when considering how to make environments more accessible to wheelchair users who independently transfer.

It was surprising that despite choosing different small group topics to discuss, many overlapping themes were discovered. Only one unique theme was uncovered: Terminology and Definition of Transfer Movement/Technique in sub-topic meeting 2 (Research). This is because the discussion went to developing materials and guidelines to be used by clinicians for transfer training. Before that can happen, the field needs to standardize terms that everyone agrees on.

All things considered, advancements in technology have led to new wheelchair designs and an opportunity for a more diverse group of individuals with disabilities to participate in their communities. The interface of newer wheelchairs with the built environment is different now than it was when the standards were originally developed. Moreover changes in healthcare policy and insurance coverage have decreased the time that individuals spend in inpatient rehabilitation. Subsequently, therapists have less time to spend with the patient addressing the wheelchair and transfer skills necessary to perform transfers in different environments. Individuals may be released from a rehabilitation program before they have had an opportunity to develop adequate strength and physical conditioning needed to do biomechanically correct transfers. Transfer performance cannot be attributed to just one factor, but some combination of the users' preferences, physical ability, technique, WMD, and the environment.

Although a significant amount of research has already been done, the focus groups identified additional areas where future research is warranted. Tremendous opportunity exists for collaborative research amongst the stakeholders (e.g. United States Access Board, engineers, physical and occupational therapists, university researchers, architects, and manufacturers of assistive technology) which could lead to better transfer technology, environments and techniques for wheelchair users.

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Name: Bob Minnick, PE, CSP

Title: Technical Director (Disney Safety and Accessibility Expert)

Affiliation: Walt Disney Parks & Resorts

Name: Steven Mitchell, OTR/L, ATP

Title: Clinical Specialist Seating/Wheeled Mobility & Assistive Technology

Affiliation: VA Cleveland Medical Center

Name: Rex Pace

Title: Technical Assistance Coordinator

Affiliation: US Access Board

Name: Michael Pavol, PhD

Title: Associate Professor

Affiliation: Oregon State University

Name: Phillip Requejo, PhD

Title: Director of Rehabilitation Engineering Program / Adjunct Assistant Professor

Affiliation: Rancho Los Amigos National Rehabilitation / University of Southern California

Name: Laura Rice, PhD, MPT, ATP

Title: Visiting Assistant Professor

Affiliation: University of Illinois at Urbana-Champaign

Name: Linda M. Riek, DPT, PhD

Title: Academic Professor

Affiliation: Department of Physical Therapy Nazareth College

Name: Mary Esther Van Shura, Ed.D

Title: Director of Community Affairs

Affiliation: Office of the County Executive (Allegheny County Pennsylvania)

Name: Karen St. Germain, OT

Title: Occupational Therapist

Affiliation: Ottawa Hospital Rehabilitation Centre

Name: Maria Toro

Title: Graduate Student Researcher

Affiliation: University of Pittsburgh/Human Engineering Research Laboratory (HERL)

Name: Tom Tuckowski

Title: Director of Engineering

Affiliation: Invacare Corp.