

**IDENTIFYING THE GAP BETWEEN ADAPTIVE CLOTHING CONSUMERS
AND BRANDS**

by

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TABLE OF CONTENTS

LIST OF TABLES.....	vi
LIST OF FIGURES	vii
ABSTRACT.....	viii

Chapter

1	INTRODUCTION	1
	Background.....	4
	Theoretical Framework.....	6
2	METHOD	9
	Data Analysis.....	11
	Results and Data Analysis	13
	Family Interviews	16
	Brand Interviews.....	18
3	DISCUSSION.....	21
	Target Consumer Perspective	22
	Perceived Ease of Adaptive Clothing: Alternative Solutions.....	23
	Fit.....	23
	Fasteners	25
	Fabric	25
	Function	26
	Fashion.....	26
	Perceived Usefulness: Pain Points.....	27
	Fit.....	27
	Fasteners	28
	Fabric	28
	Function	29
	Fashion.....	30

Brand Motivation.....	31
Perceived Ease: Business Advantages.....	32
Social Capital.....	32
Consumer Demand.....	33
Social Media Distinction.....	34
Universal Designs.....	35
Cross-Collaboration.....	36
Perceived Usefulness: Business Challenges.....	37
Adaptive Market Size.....	38
Production Costs.....	39
Supply Chain Issues.....	40
Product Standardization.....	41
Adaptive Market Barriers.....	42
Accessibility.....	42
Size Unavailability.....	43
High Cost.....	44
Limited Knowledge about Adaptive Clothing.....	45
Lack of Awareness.....	46
Lack of Research.....	47
Recommendations and Conclusion.....	48
REFERENCES.....	51
Appendix	
A SURVEY QUESTIONNAIRE (FAMILIES).....	55
B INTERVIEW QUESTIONNAIRE (FAMILIES).....	58
C INTERVIEW QUESTIONNAIRE (BRANDS).....	60
D IRB/HUMAN SUBJECTS APPROVAL (CONSUMERS).....	62
E IRB/HUMAN SUBJECTS APPROVAL (BRANDS).....	68

LIST OF TABLES

Table 1	Demographic Characteristics (F=Female, M=Male).....	13
Table 2	Number of Survey Respondents for Category	14
Table 3	Number of Survey Respondents for Category	15
Table 4	Number of times respondents referred to each of the major themes coded from interviews	17
Table 5	Number of times brand respondents referred to each of the major themes coded from interviews	18

LIST OF FIGURES

Figure 1	TAM (Davis, 1989).....	7
Figure 2	TAM (Extended Model)	8
Figure 3	TAM (Extended Model)	22
Figure 4	Recreated TAM model.....	42

ABSTRACT

The current adaptive clothing brands are limited to numbers and specific to categories. However, a few companies are focusing on consumers having Down syndrome, especially in children's wear. This study explores clothing challenges for children with Down syndrome and factors that influence their perception of adaptive clothing brands. Another aim of this study was to explore brands challenges in the adaptive business and factors that influence their perceptions towards the adaptive market. In order to determine the market barriers affecting adaptive target market needs, researcher applied Technology Acceptance Model. After interviewing and surveying parents/caregivers having children with Down syndrome and current adaptive brands, the results found education as the significant gap in the adaptive clothing market yet to be overcome. Based on the finding, several recommendations were suggested to improve the current barriers in the adaptive clothing market.

Chapter 1

INTRODUCTION

Clothing is considered one of the basic human needs (Chang et al., 2014, 2009; Kabel et al., 2016; Maslow, 1943). For many people, the ability to independently choose dress is of key importance; however, for individuals with disabilities clothing options may be quite limited (Chang et al., 2014; Hall and Lobo, 2018; Margaret G. et al., 2012). Adaptive clothing, or clothing specifically designed for individuals with disabilities, is an alternative option (Deborah, 2018; Strickfaden et al., 2013). Historically, the purpose of adaptive clothing is to “allow individuals to achieve aesthetically normative style of dress while still incorporate functional elements that facilitate independence in activities of daily living” (Strickfaden et al., 2013, p. 1). Although intended to provide enhanced functional features to accommodate an individual with disabilities, this category of dress can be unintentionally stigmatizing as it is often function-driven and therefore lacking in aesthetic and expressive considerations (Kabel et al., 2016). Alternatively, individuals with disabilities could purchase custom tailored clothing, but this option may be cost prohibitive (Stokes and Black, 2012).

A secondary clothing limitation for individuals with disabilities is the lack of adaptive clothing awareness and education (Thorén, 1996; Yunyi Wang, Daiwei Wu, Mengmeng Zhao, 2014). The adaptive clothing target population may not be aware of the usefulness of said clothing and the adaptive clothing brands may not be adequately informed of market needs, frustrating both ends of the market (Chang et al., 2014; Shim and Bickle, 1994; Stokes and Black, 2012).

There is a growing demand (Groer, 2019) for adaptive clothing to be addressed appropriately by the companies. The global market for adaptive clothing is expected to reach \$400 billion by 2026 (Gaffney, 2019). A few apparel companies have been working on filling this gap by the creating clothing from an universal design perspective, meaning clothing that would suit individuals of all ability levels (Deborah, 2018). However, few brands have created adaptive clothing lines for specific populations (Groer, 2019). This lack of focus may be attributed to the fact that manufacturing adaptive clothing for people with disabilities requires changing the conventional production system, increasing costs and production time (Hall, 2021).

Previous studies on clothing related challenges for individuals with disabilities have identified the specific physical limitations of users, apparel related needs and barriers, and/or proposed related design solutions (Antonela et al., 2014; Chang et al., 2009; Kabel et al., 2016; Thorén, 1996). There is a limited evidence-based knowledge

that addresses clothing and dressing related challenges specifically for children with disabilities (Hall and Lobo, 2018).

In this study, I investigated the clothing preferences and challenges for children with disabilities (specifically Down syndrome) and their family caregivers. I also explored adaptive clothing brand awareness from the perspective of both this target population and the adaptive apparel brands. The purpose of this study is to (1) identify specific clothing challenges for children with Down syndrome and their caregivers, (2) contextualize these findings with the current children's apparel market assortment, (3) determine market barriers in reconciling adaptive target market needs, and (4) recommend modifications for both adaptive product assortment and the adaptive apparel market.

Background

Down syndrome, or Trisomy 21, is one of the most common congenital disabilities (Parker et al., 2010). Since 1979, the number of children born with Down syndrome has risen by 30% until 2003, and by 2008, became about 1 out of 1000 children in the USA alone (Shin, M. et al., 2009). To date, about six thousand children are born with Down syndrome in the USA each year (Presson et al., 2013). Down syndrome is a genetic disorder that is caused by irregular cell division from Chromosome 21 (Parker et al., 2010). Individuals born with Down syndrome experience developmental delays and intellectual disabilities which may affect activities of daily living, such as the dressing task (Cronk et al., 1988; Pangalos et al., 1994). The motor function of children with Down syndrome may be delayed compared to typical children (Broggi, 1998). As a result, they may have to depend on a parent or caregiver to assist with performing the dressing task (Hayton et al., 2020). Individuals with Down syndrome often have common physical features which may also pose challenges for both dressing and clothing options, such low muscle tone, low levels of manual dexterity, sensory sensitivity, rounded abdomen, petite limbs, and small hands and feet (Capone, 2002; Latash et al., 2002; Patterson, 2002; Spanò et al., 1999).

Due to the lived experience and potential atypical body shape of children with Down syndrome (compared to their typical peers), mass market children's clothing

may not adequately address comfort, fit, aesthetic preferences, ease of use, and/or accessibility. Lack of appropriate clothing options may frustrate caregivers as well as arbitrarily constrain the child's personal expression (Dolva et al., 2004). Moreover, adaptive clothing for children is often difficult to find, limited in selection, and more expensive, when compared to typical children's clothing (Hall and Lobo, 2018). Historically, adaptive clothing has been marginalized within the global fashion industry and therefore designed from a medical/healthcare perspective (Carroll, 2014; Helen Cookman, 1961). For this reason, adaptive clothing tends to focus on end-user physical limitations, rather than fit and style, leading to "an institutional look" (Alexa et al., 2018, n.d.; Carroll, 2014)

Recently, the global fashion industry has started to address body diversity within the population. Mass market brands, such as Target™ and Tommy Hilfiger™, have begun to offer adaptive clothing collections, with options available in children sizes (Alexa et al., 2018). Other small brands, such as Abilitee™, Special Kids Company™, and Independence Day Adaptive™ exclusively offer adaptive clothing for children, but on a small production scale due to the companies' size (Matchar, 2018). To date, there is only one apparel company focused on end-users with Down syndrome and it has since closed (NBZ Apparel International, 2019).

Theoretical Framework

The Technology Acceptance Model (TAM) is a theoretical model used to assess consumer acceptance of new forms of technology (Chae, 2009; Liang et al., 2020). In the field of fashion and apparel, this model has been used in previous studies to contextualize consumer attitude towards online co-design processes (Lee and Chang, 2011), wearable technology applications (Lunney et al., 2016), and enhanced retailing technology (Kim et al., 2017) etc. Davis (1989) developed the Technology Acceptance Model and suggested that an individual's attitude towards a new system (technology) is dependent on two variables, (1) *perceived ease* and (2) *perceived usefulness*. Perceived ease is defined as the degree of believed effort to use the technology, whereas perceived usefulness is defined as the degree of believed benefit of using the technology (Davis, 1989). There are several external factors that may influence consumer perceptions and attitudes towards new technology (Figure 1). These factors may have a direct or indirect influence on consumer's decision to use said technology (Liang et al., 2020).

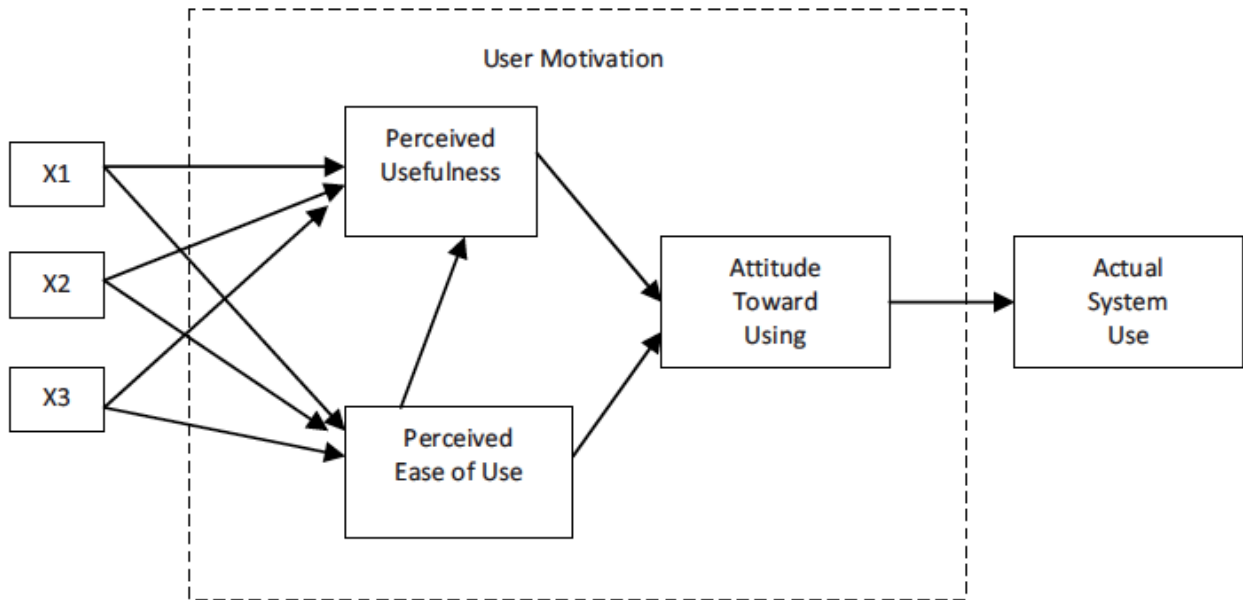


Figure 1 TAM (Davis, 1989)

In this study, I applied TAM to the adaptive clothing market. To explore and understand this market, I need to assess the perceptions and attitudes of both the target adaptive clothing consumer and the adaptive clothing brand (Figure 2). For this reason, my research aims to identify the perceptions and attitudes towards adaptive clothing from the target consumer and brand.

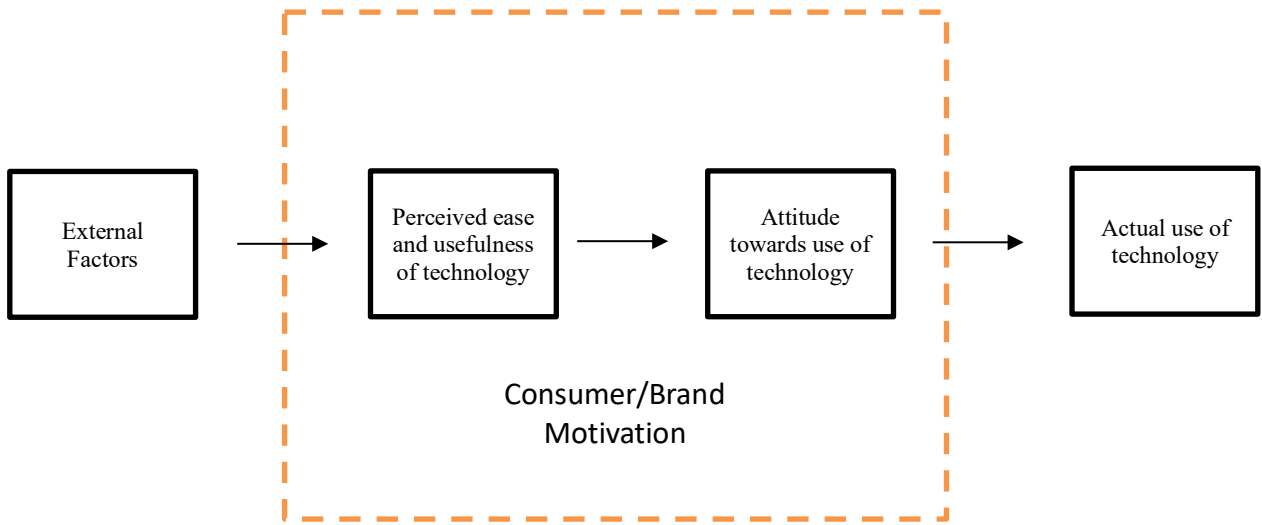


Figure 2 TAM (Extended Model)

Chapter 2

METHOD

This study used a qualitative research approach using data analysis to explore issues related to dressing and clothing for the target population. There are two target population for this study: (1) families of children with Down syndrome and (2) current adaptive brands. In order to identify the perceptions and attitudes towards adaptive clothing from target population (consumers and brands), I used a two-phase data collection process. First, general information about dressing and clothing issues for the target population (consumers only) was collected using an online survey (see Appendix A). Survey questions were related to “functional challenges in clothing”, participant’s “everyday go to brands”, difficulties “finding the right size/fit” and “preferred style”. Survey questions (total ten in quantity) were both open and closed-ended. Close-ended questions asked about their demographic information, and open-ended questions asked about the clothing-related challenges. One dressing-related question was also added where participants would rate the challenges on a 5-point Likert scale (1 being not challenging, 5 being very challenging).

The survey was distributed with the aim of targeting families of children with Down syndrome with the goal of gathering information from at least 50 people and identify daily challenges of the said category (Britten, 2006). The survey was distributed via Qualtrics™ to the National Down Syndrome Society (National Down Syndrome Society, 2021) which has more than 300 local organizations across the United States. Survey data were coded using qualitative analysis coding software NVivo to identify themes.

The purpose of this survey was to collect preliminary data to assess general dressing and clothing related issues for the target population. Based on the results, I framed a questionnaire for the second phase of the data collection: in-depth interviews with the target population (Appendix A). The interview was aimed at identifying the child's dressing and clothing related challenges, and the caregiver's perceptions/preferences regarding commercial clothing options. Interview questions were related to "complaint reasons from child regarding size, fit and function of the clothing", "child's favorite designs", "comfortable fabric choice" "importance of clothing in social participation". This sample population was recruited from National Down Syndrome Society. Inclusion criteria included families of children with Down syndrome, age 0-14 years old of any gender. Exclusion criteria included families of children with Down syndrome over the age of 14 years, children with comorbidities, or families with children with Down syndrome having no self-identified

dressing/clothing challenges. Parental consent and child assent were obtained prior to participation.

Another questionnaire was framed to understand the adaptive brand's perception of adaptive clothing. The goal of the brand's one-on-one interviews was to identify their most important issues/challenges in the adaptive clothing industry with achieving customer satisfaction in adaptive clothing purchase (Appendix B). All of the interview questions were semi-structured, open-ended. Interview questions were related to brand's "motivation", "perception about target consumers", their "challenges to meet consumers expectations", and their current approaches to "solve business challenges and meeting market demand". LinkedIn was used for initial adaptive brands search and as the participant recruitment medium. Inclusion criteria included any adaptive clothing brands across the USA. Exclusion criteria included brands only selling non-adaptive clothing. Interviews were conducted online, via zoom. Participant consent was obtained prior to participation.

Data Analysis

Recorded interviews and survey data were analyzed following the principles of Grounded Theory (Glaser and Strauss, 1967) in four iterative phases. First, as

recommended by Glaser and Strauss (1967) and Corbin and Strauss (2008), raw data were transferred and transcribed using NVivo software (Corbin and Strauss, 2008; Glaser and Strauss, 1967; Urquhart, 2013; Welsh, 2002). Then responses were organized into descriptive themes. Next, the descriptive themes were generated, analyzing every sentence of the transcriptions and subsequently compared across two or more coders. Second, in the axial coding phase, the descriptive themes were contextualized into a theme-based setting. In this stage, higher-order theoretical concepts were established (Spiggle, 1994) and relationships and linkage between first-order concepts were determined and grouped into second-order themes. Thus, axial coding developed a template of emerging factors (Corbin and Strauss, 1990). Third, as proposed by Glaser & Strauss (1967), in the selective coding phase, a core category was created contextualizing themes to broader concepts of a theory. For example, “complaints from the child” could be the first order of theoretical concepts, while “oversize” could be a subcategory / higher-order theoretical concept of that descriptive theme.” “Oversize” could fall under the “pain points” category, which may fit in one of the core theoretical categories of 5F framework™ (Hall, 2018), i.e., “Fit.” At last, Cohen’s Kappa coefficient was used to report the inter-rater reliability of coding (Wiederhold and Martinez, 2018)

Results and Data Analysis

The online survey was sent to 178 Down syndrome organizations. Forty-nine respondents completed the full survey. Participants answered 10 questions related to their child’s clothing preferences and challenges in activities of daily living (ADL). Questions include two related to demographics (age and gender) and included eight clothing preferences questions. Table 1 shows the demographic results of the survey participants.

Table 1 Demographic Characteristics (F=Female, M=Male)

Age Groups (Years)	Diagnosis	Participants	F	M	Not Answered (Gender and Age)
8-14	Down syndrome	28	25	20	4
5-7	Down syndrome	9			
2-5	Down syndrome	5			

0-2	Down syndrome	3			
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Survey questions included describing clothing-related challenges and clothing preferences for children with Down syndrome and/or their caregivers. Data indicated clothing as a key issue with the majority of the participants. For example, a typical shirt sleeve is longer than needed and does not fit the arm length of children with Down syndrome. As a result, children in this population need assistance in rolling up or altering the sleeves, which can be a burden for the families. Within the topic of clothing challenges, clothing fit was the most frequently reported clothing challenge by the respondents, with the Cohen’s Kappa coefficient = 98.04% agreement between raters (Table 2).

Table 2 Number of Survey Respondents for Category

Clothing Challenge	Number of Times Respondents Reporting
Fit Issues	52
Caregiver assisted dressing	27
Physical Limitations	26
Sensory Sensitivity Issues	19
Stylistic Challenges	4
Clothing Cost Issues	3

Clothing Issues Related to Devices	2
------------------------------------	---

Participants described their clothing preferences among current commercial mass-market children’s wear. Data indicated that participants look for comfortable and cost-effective clothing options that provide various styles and ease in donning on and off. For example, participants frequently purchase leggings for comfort, due to soft fabric construction, elastic waists, and relatively low cost. Within the topic of product category, leggings were the most frequently reported clothing preference by the respondents, with the Cohen’s Kappa coefficient = 92.48% agreement between raters (Table 3).

Table 3 Number of Survey Respondents for Category

Clothing Preferences	Number of Times Respondents Reporting
Different Fashion Style	36
Sensory Friendly Material	39
Breathability	14
Easy to put on and off	13

Low cost	13
Easy to use fasteners	9
Size and Fit	7
Age Appropriate Style	3

Participants described their current alternative solutions for finding clothing that fits their child. Data suggests that caregivers try to find easy to use fasteners and loose fit in clothes thereby facilitating the dressing task. Within the topic of alternative solutions, an alternative to mass-marketed fasteners and purchasing loose clothing were significantly reported by the respondents with the Cohen's Kappa coefficient = 99.76% agreement between raters (Table 3).

Family Interviews

Interviews were conducted via Zoom™, an online video conference platform, using a semi-structured interview format. Questions were used as conversation prompts in order to explore the concepts of clothing related issues and preferences for families of children with Down syndrome. Descriptive and axial coding determined conversation topics (Table 4).

Table 4 Number of times respondents referred to each of the major themes coded from interviews

Major Topic Themes	Number of Respondent References
Clothing Preferences	135
Clothing Challenges	137
Alternative Approaches	28
Recommendation for Brands	45

Selective coding themes from the interviews categorized the respondents' general discussion of the child's clothing related challenges, which are categorized by clothing pain points and alternative solutions for the adaptive market.

For the specific theme of "Clothing Preferences and Clothing Challenges," participants reported limited availability of a range of styles, size related difficulties and functional attribute related issue are mostly reported. For example, participants said:

"A lot of pants are too tight and too long because they're more made for people with longer legs and a skinnier waist"

"There's so much variety in height, weight, do you know, body shape, all of that, so it's hard to find something that works for everybody"

"It's hard to get a wet bathing suit down. It's even harder to get it up. It's harder when maybe you're less coordinated and you have low muscle tone and now you're in a stall by yourself or you're trying to get

it down. And then are you going to have an accident trying to use the bathroom”

For the specific theme of “Alternative Approaches,” purchasing available clothing from the store and adapting them are respondent’s major alternative approaches to meet child’s clothing requirements. For example, participants reported:

“Yeah, I just know that there's certain things she's not that are going to bother her. And so I that I just keep it simple, like a simple T-shirt”

“I typically I just work with what I have at the store”

“I have purchased a sewing machine and attempted to learn how to sew”

Brand Interviews

Interviews were conducted via Zoom™ an online video conference platform using a semi-structured interview format. Questions were used as conversation prompts in order to explore the concepts of adaptive clothing related challenges and advantages in the business. Descriptive and axial coding determined conversation topics (Table 5).

Table 5 Number of times brand respondents referred to each of the major themes coded from interviews

Major Topic Themes	Number of Respondent References
--------------------	---------------------------------

Business Motivation	9
Business Challenges	96
Advantages	19
Future Prospects	21

Selective coding themes from the interviews categorized the respondents' general discussion of adaptive clothing related challenges, categorized by clothing pain points and alternative solutions.

For the specific theme of "Business Challenges," expensive production, marketing challenge, designers struggle in solving fit issues are reported by majority of the respondents. For example, participants reported:

"We have a lot of entrepreneurs that are starting little businesses, along with the help of their parents, generally with clothing. Financially, to have a specific line of clothing just for Down syndrome just doesn't work because of the money that it takes"

"Under her (child with Down syndrome) knee from the crotch, her inseam was nine inches. Nine inches. That was a pair of Capris! Nine inches and it fit under her knee. Think about that. Think about how short that femur is. Where are there? That's their major problem in the pants"

"To raise awareness. So it's just like your standard marketing. So we did try, like ads, for example, on Facebook and Instagram, and those are often rejected"

For the specific theme of “Advantages,” and “Future Prospects”, emphasizing design solution related to functional and size issues and ideating different marketing strategies was reported by the majority of the participants. For example, participants reported:

“We previously had a lot of accessories, insulin about colostomy bag covers, sleeves for PICC lines. We did have clothing items, which were the women's recovery class. That's like a rap glass that doesn't require you to raise your arms if you have muscle rigidity and can be used for surgical recovery. And we also had a baseball team that had snapped like along the chest to provide access to team sports or to make it easier for someone to go for their head. So our in our relaunch, we're going to add potentially pants, but most likely more shirts, possibly a bra that's better suited for people with limited dexterity and for people with and walks in their chest and then potentially jackets as well. So, a lot of making sure things are sensory friendly, MRI friendly”

“I think the better that we do, the easier that we make it to get dressed or think about the fabric that's used and sensitivity to it and whatnot”

“We use social media a lot. Involvement, community involvement, we have fashion shows, luncheons, things like that, where the community can come in, we can bring in Down syndrome young ladies to model not only the clothes that we made, but we can show that clothes can be found, that will fit them”

Chapter 3

DISCUSSION

In order to contextualize the study findings within the Technology Acceptance Model (TAM) theoretical framework, we re-present the original extended model (Figure 3). The “technology” for this study is adaptive clothing. This study examined factors influencing target consumers and brands perceptions and attitudes towards adaptive clothing, in this case specifically for children with Down syndrome. As previously stated, researchers have used this model in other apparel consumer applications, however we further extend this model to explore and understand the current adaptive clothing market from the perspective of both the target consumer and the adaptive brand.

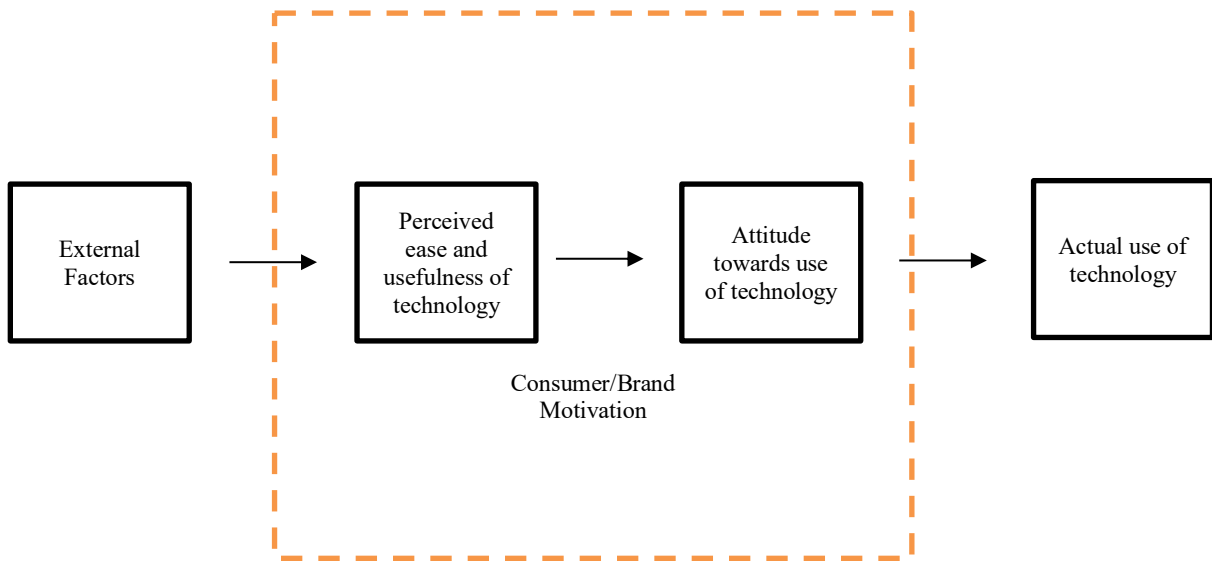


Figure 3 TAM (Extended Model)

Target Consumer Perspective

The results of this study indicate that several variables play a significant role influencing consumer acceptance of adaptive clothing. The data obtained from surveys and interviews were used to evaluate consumer perceptions of, and attitude towards adaptive clothing. Perceptions are categorized in the model according to the perceived ease of using adaptive clothing and the perceived usefulness of adaptive clothing for the target consumer. I have identified consumers' perceived ease of using adaptive

clothing through the lens of consumers' current clothing selection for their child (or "alternative solutions" in comparison to the "solution" of adaptive clothing). I have also identified consumers' perceived usefulness of adopting adaptive clothing through the lens of consumers' attitude towards their child's current clothing issues (or "pain points").

Perceived Ease of Adaptive Clothing: Alternative Solutions

One key finding of this study is that target consumers were neither aware of the definition of "adaptive clothing," nor that it is an apparel product category. The majority of target consumer survey and interview respondents selected commercial clothing for their child that was sufficient, but not ideal. I analyzed the interview data based on the 5F design framework™ to understand respondents clothing needs related to Fit, Fasteners, Fabric, Function, and Fashion (Hall, 2018). The study found several challenges based on the 5F™ criteria.

Fit

Results show that respondents experienced challenges with finding appropriate clothing size and fit (n=9). As an alternative solution, respondents purchase clothing that is larger than the child's actual size. Respondents also select clothing styles that

are loose to accommodate the lack of actual appropriate fit for the child. For example, respondents stated,

“I often get those pants for her in like an extra small women's. Because something's going on with the children like she's at size 14 or 16 now in her waist because she's got a bigger waist. And so, I either get a [size]16 children or an extra small women [‘s size] and then I have to cut the legs out because they're eight inches down. But then they cover her body in a way that's, you know, that her body should be covered and that makes her feel comfortable running and dancing and playing”

“I'm buying her women's size large, larger than my larger than what I'm wearing to be able to not choke her around the around the thigh, the upper thigh”

Clothing alteration is another way that some participants reported as a solution to their children’s everyday fit challenges (n=4). Common examples of alterations include hemming pant and sleeve length or total redesign. Hemming may provide a temporary solution but may compromise the clothing aesthetic and proportion. Redesigning clothing requires either personal sewing expertise or additional cost of hiring a tailor. Respondents’ viewed these options as either time-consuming, complex, or expensive. For example, respondents stated,

“Yeah, I adapt. I make the clothing fit her when it comes to my house.”

“I go to getting those what I call yoga pants, which they have a very wide waistband, almost like pregnancy pants. They come all the way, know they'll come up six inches and you can fold them over.”

Fasteners

According to the data, fasteners influence consumers purchase decisions. Fasteners represent the second F of the 5F Framework™ (Hall, 2018). Fasteners such as zippers, buttons, hooks etc., are important closure method that helps putting on and off clothes (M. Hall, 2021). Participants preferred soft elastic in comparison to buttons or zippers because elastic was reported as easier than any other fasteners to put on and take off garments. Hook and loop straps were also preferred due to ease of use. Participants noted,

“We just do elastic waistband, that's our life, elastic waistband.”

“And then it's one Velcro strip at the top that ties the shoe.”

Fabric

Fabric properties, such as stretch and texture, are also an important consideration for consumers' purchasing decisions. Respondents state that clothing fabric choices are made based on ease of dressing and the child's comfort. For this reason, participants choose stretchy fabric with a soft texture (n=6). In addition, clothes without tags were reported as a high priority due to the child's sensory sensitivity issues. For example, participants stated,

“(we purchase) necessarily made of a soft material that he (participants child) would easily tolerate”

“I would say Target (participant's preferred brand) because of the tag less, most things are tag less but they're always tag less.”

Function

Clothing function can be defined as the functional criteria that provide comfort, ease, and practical features (i.e., easy to access) that reduce clothing challenges (M. Hall, 2021). Respondents noted that dressing their child is difficult with typical commercial clothing. Fastener and design detail location (such as pockets) in typical commercial clothing add an extra barrier for easy access (n=6). As an alternative solution, stretchy clothing with simple closures is the most preferred option. For example, participants stated,

“I kind of always put her in like leggings, like for the simple fact that, you know, it's easier for her than a jean, you know, to try to remove for me.”

“But if she has to walk somewhere. She's going to be wearing more like tight sweats or leggings or things that are more functioning than fashionable”

Fashion

Data indicated that respondents focused more on clothing function and fit than fashion issues when purchasing clothing (n=6). One could assume that fashion considerations are a higher order concern when compared to function and fit. However, aesthetics was still a reported need. For example, participants said:

“She's a girl. She's into dresses now. So, I just put the leggings on under a dress or whatever. So that works for us”

“Target is good in that they have variety and the stuff is cute. And still often age appropriate”

Perceived Usefulness: Pain Points

The survey and interview findings were incorporated into the 5F Framework™ (Hall, 2018) to address consumer's broad range of clothing-related challenges. According to this model, the fit, fasteners, fabric, function, and fashion need for clothing are investigated to provide maximum satisfaction in clothing. This study found several issues within these five criteria.

Fit

Fit may be considered one of the most complex terms in fashion literature and thus may be defined in diverse ways (M. Hall, 2021). Fit is related to the shape and size of the user's body, overall appearance, comfort, fabric choices, style preferences, functional requirements, and so forth of the garments (Thoren, 1996; Kabel et al., 2016; Chae, 2017; Hall, 2018). Historically, fit is considered one of the major issues for people with disability or people with a unique body shape (M. Hall, 2021).

Most of the respondents in this study stated finding accurate sizes for their children with an atypical body (compared to industry sizing standards) is a daily challenge (n=9). Typical fit challenges experienced by parents/caregivers of children with Down syndrome are sleeve and pant lengths being too long and too tight, tops and dresses being too tight or ill-fitting in the torso, and clothing proportion being unflattering. For example, participants reported,

“The other thing that we struggle with is in some people, in children with Down syndrome are larger, they have got thyroid issues, or they’re larger for other reasons, health reasons or and so a lot of clothes aren’t fitting their body size.”

“For regular clothing for Malakai, it's either that the arms fit him and thinking of a long sleeve shirt, the arms fit in perfectly with the torso, or the torso is long enough, but the arms are much too long, and then he ends up chews on them when they are too long, and then that totally destroys the sleeves.”

“[I]t will be too tight on her upper arm,”

“A lot of pants are too tight and too long because they’re more made for people with longer legs and a skinnier waist.”

Fasteners

Fasteners needing fine motor skills was reported as the second most critical challenge in everyday clothing (n=8). As children with Down syndrome have limited fine motor control skills (M. Hall, 2021), they may struggle to manipulate zippers, buttons, snaps, etc. in performing independent dressing tasks. For example, one participant said,

“I don’t want to restrict her from a button or tie or things like that. I mean, I want to teach her those, but I also want her to be able to, you know, remove things easily and not get frustrated.”

Fabric

Fabric is another essential part of the 5F Framework™ and represents a key challenge for the consumers (Hall, 2018). In this study, respondents reported that

anything stretchy, soft, breathable provides comfort for their children (n=7). For this reason, cotton was identified as a preferred choice for children due to comfort. However, many of the participants expressed disappointment with the performance of 100% cotton clothing, such as wrinkling and shrinkage. Sensory-friendly fabric was another important requirement reported by the participants. Due to the child's cognitive and/or sensory impairments, clothing with tags, stiff structure, etc., were reported as a major concern. For example, participants reported,

“My daughter doesn't like tags and textures and different things”

“She doesn't like anything too fussy”

“A lot of children's clothing have like a dog or a pattern and on inside of that, it's some scratchy thing, you know, she won't have that against her skin”

Function

The data supports previous studies findings that typical commercial garments do not adequately meet the functional needs of children with Down syndrome (Hall, 2018). Examples of some common challenges are clothing proportion, length, and fastener location. Additional challenges include clothing that easily facilitates dressing and toileting. For example, participants stated,

“She still needs help getting fingers in the right glove fingers.”

“So we don't do any buckles, we don't do any snaps, we don't do any zipper's, we don't do anything that's really tight around the belly and we don't do anything complicated. If we are wearing something complicated, like one time we had that (regular) shirt that has a sleeve

here and then space and then another sleeve, that that was a style that was it was complicated and I had to help her put it on”

“I hated onesies. I like them style-wise, but they are not functioning when you have a child doing a pamper.”

“Things don’t really work very well for going to use the bathroom.”

Fashion

Fashion refers to the preferred style of clothing that addresses the user’s aesthetic needs (Stokes and black, 2012; M. Hall, 2021). Historically, fashion has a strong relationship with an individual's expression (Reddy-Best, 2017). Regardless of disability, aesthetically appealing and high-quality products work as a medium for - self-expression and social acceptance (Lamb & Kallal, 1992) . In this study, respondents expressed frustration in finding age and size appropriate comfortable and fashionable clothes for their children in the commercial market (n=7). As a result, these limitations of clothing styles may lead to negative impact on the child’s psychosocial life. For example, participants reported,

“It is harder, like I mean, I dressed my daughter cute as I can, I mean, sometimes fashion can be a challenge.”

“I would feel especially for dressier things, like gosh, I wish I could find something that really worked for Christmas.”

“As a mother of a special child, I think that if a child looks cute through their clothing, they somehow blend in better in the larger society with other children or in a school setting.”

Brand Motivation

Recently, small and large apparel companies have launched new adaptive clothing lines to meet consumer's demands (Kosinski et. al., 2018). However, study data indicates that these brands may not address the clothing requirements specific to consumers with Down syndrome. This apparel industry gap supports investigation into these brands' motivation for entering the adaptive clothing market and perspective about adaptive clothing for consumers with Down syndrome.

The results of this study indicated that the factors influencing technology acceptance (in this case, adaptive clothing) vary by brand. For this study, I conducted a series of interviews with both small and large adaptive apparel brands. Interview data were explored and contextualized within TAM to study each brand's perceived usefulness and perceived ease in the adaptive apparel business. Perceived ease was analyzed according to the brands' perception that the addition of adaptive clothing would be a business advantage. Perceived usefulness was analyzed according the brands' perception that the addition of adaptive clothing would be a business challenge.

Perceived Ease: Business Advantages

Respondents from both large and small apparel companies expressed common issues or themes related to the adaptive clothing market. These include:

Social Capital

Results show that brands invest in the addition of adaptive clothing to serve a wide consumer base beyond their current target market. Study participants report being motivated by several reasons, such as a family member (e.g., Runway of Dreams), by their medical profession (e.g., Abilitee), or social goodwill (e.g., Tommy Hilfiger). However, they all cited the same goal: to provide fashionable, functional, normative clothing options to the users with “special needs” such that they could dress them by themselves. Moreover, the collective aim was to offer clothing that improves an individual’s self-image, self-esteem, and confidence. For example, participants reported,

“I just realize look at what happens when you actually adapt to people's needs and to create an environment where people can, you know, they can feel supported, they can actually be supported, whether that's medically or just socially, emotionally.”

(Respondent from Abilitee)

“See this top, maybe the girls, only four foot six, but she's heavy. Now she's got a short little leg, she's only four-six, but she's wide, but just think how cool that is and for their self-esteem because now they're not wearing a t-shirt with sweatpants.”

(Respondent from Ashley by Design)

“If they're teens, they can go to school, and they can look like all the other kids.”

(Respondent from NBZ)

“I guess the main where we had to just say the focus was, was to allow children with disabilities to feel that they were they that they could dress. Either a more easily, so it was easier for them to get the product on and off, easy for them to feel like they had fashionable options. So that's where we had to sort of start because of the breath and that, you know, there was a lot of thought put into. You know, like what the goals were, and that was it like we want to get the most product out there for to cover the most amount of disability.”

(Respondent from Tommy Hilfiger)

Consumer Demand

Brand study respondents stated there are limited adaptive clothing options yet a growing consumer need. Data indicated that most of the small apparel brands offering adaptive clothing focused on a specific type of disability, whereas large brands are more general in their product offerings. Nevertheless, both types of apparel companies offer minimal selection in comparison to the typical clothing consumer. As a result, a large portion of the population living with Down syndrome is still underserved. For example, participants reported,

“There needs to be new, bigger adaptive brands...[T]here's a wide audience that's a fifth of the world or something close to that. And that there aren't many options like that just means you essentially have a huge market need that's not being filled or addressed.”

(Respondent from Abilitee)

“You know, these people have been relegated. Either men who can't do their zippers anymore due to whatever or Down syndrome that they

can't do zippers and buttons. And of course, they don't fit anything, but they've been relegated to sweatpants or athletic wear.”

(Respondent from NBZ)

“We're producing a small relative to the numbers that we produce for the regular line, we're producing a small amount with some of the stuff ...if the style is popular and it sells out very quickly. And that's I think that's a point of frustration for customers: the availability.”

(Respondent from Tommy Hilfiger)

Social Media Distinction

Both small and large apparel brand representatives reported that social media outlets create awareness for adaptive apparel brand offerings. Brands aim for their social media outlets, such as Facebook™, Instagram™, and Tik-Tok™ to distinguish the brand and thus facilitate consumer education and purchase decisions. For example, participants reported,

“We use social media a lot. Involvement, community involvement, we have fashion shows, luncheons, things like that, where the community can come in, we can bring in Down syndrome young ladies to model not only the clothes that we made, but we can show that clothes can be found, that will fit them.”

(Respondent from Ashley by Design)

“Social media has helped so much. So, I can have conversations like a direct message with Instagram influencers and non-influencers who have disabilities and really like back and forth, like figure out like what? What would you find helpful like in clothing? Like what do you need that you can't find like do you have suggestions, like really crowdsourcing like that data has kind of been like how I've done it from the start and just like expanded the cohort like as I got further along”

(Respondent from Abilitee)

“I think social media has really catapulted this whole topic into the forefront. I think mediums like Tik-Tok™, people with disabilities are rock stars on Tik-Tok™ are viewed incredibly differently.”

(Respondent from Runway of Dreams)

Universal Designs

The majority of brand study respondents (n=4) stated they use a universal design approach in terms of ROI (Return on Investment): serving every population with a specific type of disability creates too much customization and unprofitable markets. By generalizing adaptive clothing attributes, the brands aim to serve a larger population thus improving profitability. For example, the use of magnets as a fastener, instead of zippers, helps improve closure ease no matter the target population.

Participants reported,

“Maybe 80 percent or what percentage of the clothing we have in here, a downs person could wear. I'll show you another really cool top. See this top? It's got denim on the top, and it's got a little lace now, which increases our market for me is the business side. Mom can wear this. A college student like you can wear it. Or maybe you just might have somebody that's normal size, has Down's syndrome, could have autism, could have a whole range of things.”

(Respondent from Ashley by Design)

“That's the first question that comes to mind is like, how do you incorporate all disabilities, and the reality is you can't you know. There's no [way] unless you were doing custom clothing. There's no way to accommodate all different disabilities, so we tried to make it as democratic as we can.”

(Respondent from Tommy Hilfiger)

“Making the product adjustable already makes it better for this population as well as others. If you kind of take that notion off the table and say, OK, what can we do to make it easier to dress and or fit the body better as it relates to Down's syndrome, specifically? It's having the flexibility in the product to more conform to the body. So, for example, that one of the categories that I focused on was the adjustability of the product. So, the length of the arm sleeves, the length of the pant legs, the waistband, being able to expand and contract for this population is very important because of the diversity and all of those areas of the torso, the limbs, the roundness of the body is really, really important. So, making the product more adjustable already makes it better for this population as well as other populations for sure, within disability [such as] limb difference, those that are sitting in a wheelchair all the time require, obviously, a different length of their pants than somebody that's standing all the time. So, it definitely bleeds out to other parts of the population. But as we're talking specifically about the Down syndrome population, that was something that we learned very clearly that that would be a very big help in being able to wear mainstream clothing.”

(Respondent from Runway of Dreams)

Cross-Collaboration

All brand respondents stated that adaptive clothing is a new business experience for the company. Small brands may understand specific consumer needs, but may struggle to understand the apparel market and supply chain process. On the other hand, large brands may have more control within the apparel supply chain but not have direct target consumer knowledge. Brands cited cross collaboration was a benefit for both partners. They also note that collaboration may increase adaptive product demand and enhance each company's portfolio. For example, participants reported,

“Tommy and Runway of Dreams were the first collaboration that ever did anything in a mainstream capacity for adaptive clothing. So, the fact that since then we have five more mainstream brands, two of which are in the budget-conscious category of Target and Kohl's, that they both have adaptive versions of their children's wear line and is great progress, that this will eventually be a part of every brand's portfolio, because it's the way that the world is going. There are still platforms like Zappos that is trying to pull together brands that are more specific. So, I would say I think we're in a really exciting time right now in the industry, and they're really, really working hard to try to make a difference.”

(Respondent from Runway of Dreams)

“We collaborated with Arie almost exactly a year ago, a little bit more, and launched our adaptive line with them. And we're in talks to add new things this year as well. But, yeah, that helped a lot with awareness for sure. And that was, I mean, that was definitely kind of a match made in heaven because they're such a body-positive brand, and they've really changed the way they don't retouch photos like they stretch marks; they show ostomy bags now. Now we realize they have a very progressive mentality and want to show real bodies and be inclusive, and to partner with a brand that big really gave us a lot of street cred. And I think that helped raise a lot of awareness. I think it's kind of a movement that's just starting. So, people are sort of like catching on, that this is a thing. And I think more and more people will. It's just a matter of making sure we keep our focus on the people, basically”

(Respondent from Abilitee)

Perceived Usefulness: Business Challenges

Small and large apparel brands have similar perspectives on the advantages of offering adaptive clothing. However, business challenges for both large and small brands need to be analyzed to identify universal pain points for the adaptive clothing

industry. Interview data indicated common issues include adaptive market size, production costs, supply chain issues, and adaptive product standardization.

Adaptive Market Size

The perception that the adaptive clothing market is small is a pain point for apparel companies. Small brands often target a specific population of individuals with disabilities, resulting in narrow market share.

“It takes a long time to be profitable, and it requires huge volumes of orders and huge volumes of production to actually get those costs down enough that you’re making something. So that’s been a challenge, but not insurmountable.”

(Respondent from Abilitee)

On the other hand, larger brands have a limited selection for a generalized target population. Consequently, these adaptive clothing products may *actually* only serve a small number of the target population, leading to the perception of low buying power of these consumers.

“Until the consumers of that product show that they have buying power, then the brands won't focus on the specific disability. I mean just in terms of scale. If you say that you're producing ten thousand boy shirts for your main line and then your adaptive line, you're only producing at the most a thousand. It would be hard to segment that thousand into different types of disabilities.”

(Respondent from Runway of Dreams)

Production Costs

High production costs and less profit were reported as a major business challenge for adaptive apparel companies, in terms of return on investment (ROI). In addition, limited investment and other financial resources constrained adaptive market growth. For example, participants reported,

"Enough investments are needed to start and expand the adaptive business because extra expenses are involved in the production." Another brand owner pointed out the high expense in adaptive business and said, "If I had more money, I would love to expand."

(Respondent from NBZ)

"It takes a lot of upfront investments to create a clothing line, and that's not something you know most individuals can do."

(Respondent from Abilitee)

"I can't tell you how much attention I have gotten and not 50 cents, you know, it just didn't get me anywhere."

(Respondent from NBZ)

"Right now, there's not all the good intention of going in that direction and putting some funding behind research and development. It's not there yet. They're not there yet. Things can be solved, problems can be solved, it just takes it takes dedicated time and it takes dedicated funds to allow that to happen. You know, I think if you sat down and you really, really thought about this, there are there are solutions, and especially with the way that some of the new technologies and fabrics and in textiles, the way that they're going, there's all sorts of things that could benefit. Obviously, anything new, any new technology is expensive. But, long term, there's absolutely [are] solutions out there."

(Respondent from Tommy Hilfiger)

Supply Chain Issues

Participants reported difficulties and struggles related to the production and supply chain. Brands identified lack of expertise in supply chain management as one of the significant challenges for the beginner companies. Besides, US-based factories are reported to be more expensive than outsourcing factories. Regardless of location challenges, finding appropriate factories and skilled manpower is hard for the companies. In addition, factories need training on sewing, pattern making, and the application of appropriate trims, which adds extra cost to the product. Consequently, high product cost leads to customer dissatisfaction. For example, participants reported,

“It's just been a learning process is like figuring out how do we find manufacturers. And right now, we're opting for US-based domestic factories, which are more expensive usually, but same quality, and then lower environmental cost. So kind of just navigating all of that has definitely been a challenge”

(Respondent from Abilitee)

“I'm not that close to the feedback, but I think that there's a obviously there's a demand, and it's hard for us to meet always meet the demand just because of. Production issues and factory availability and a lot of the factories are took on this project initially. Sort of as a. You know, a pro bono, like they wanted to help and as you grow a business that you can't rely on, not solely you have to start. Showing that this is a viable business and so then your costs sort of increase and the. And if you're relying on somebody to do this for. You know, the benefit of. Everyone's business then they're not it's not necessarily going to be a priority on their production line to get it out the fastest. So you end up with delays, and so it's very complex. Unfortunately”

(Respondent from Tommy Hilfiger)

Product Standardization

Adaptive brands have begun to develop size categories to minimize fit issues (Kosinski, 2020). Some participants reported that they use their own body measurements as standard to fix the size categories. Others have developed their own method to collect data from a small sample size that lacks enough information to develop a standard size or age category. As a result, accuracy in fit could hardly be achieved by the companies (Bougourd, 2007). Also, determining size and age categories is reported to be a time-consuming process for smaller companies, which ultimately impacts production. However, the larger brands reported using no fit models in the product development stage, which they do differently in regular clothing lines. Fit models are only involved in product testing before sending the samples for mass production. For example, participants reported,

“We used Ashley as the standard because she was an average size Down syndrome person”

(Respondent from Ashley by Design)

“It took us a year to do each age group between design and then actually get them manufactured”

(Respondent from NBZ)

“The fit models are ...There's an association. Based in New York that they send the samples to and they kind of, do a fit session, but it's more I guess, a short wear test, more like a try on, because, as you know, with this population, it's kind of challenging . You don't want to ask them to come in and, you know. Come in and spend several hours in a fitting, as we do with our regular fit models.”

(Respondent from Tommy Hilfiger)

Adaptive Market Barriers

To understand the barriers on consumers and brands acceptance of adapted clothing, I recreated a model applying the extended model of TAM (Figure 4). I found that accessibility and lack of knowledge are the major barriers experienced by the adaptive clothing consumers and brands.

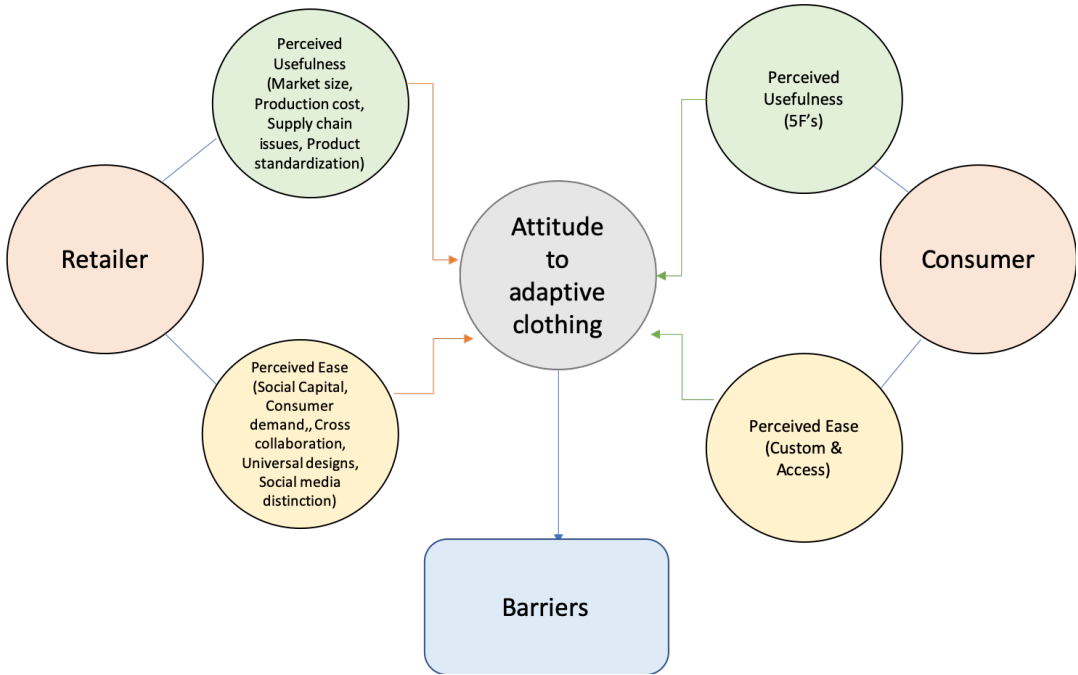


Figure 4 Recreated TAM model

Accessibility

Although several brands in the current market offer adaptive garments (Kabel et, al., 2016), most of the consumers purchase conventional ready-made clothes for

their children with special needs. This can be attributed to the fact that limited accessibility, such as inappropriate sizing of regular clothes, limited knowledge about adaptive cloth brands, and, most importantly, high costs, makes it so harder for the user to afford such clothes. In the interviews, many parents repeatedly mentioned that it is “harder,” “difficult,” and “challenging” to find an appropriate dress for my child.” Participants expressed their frustration towards purchasing clothes in different categories, for example, bottoms/tops, footwear, undergarments, one-piece, summer shorts, skirts, Halloween clothing, onesies, and sportswear. Leggings, sweatshirts, and sweatpants are found popular options in the parent's group for their children. For example, consumers cited that,

“I kind of always put her in leggings, like for the simple fact that it’s easier for her than a jean.”

“I think that will be one of the first things that I try to find out. If it's her body is a pair of pants that resembles a blue jean that she can work and access.”

Size Unavailability

Limited availability of the appropriate size and fit is a significant issue reported by the consumers. There are several products in the market, but a few could satisfy the consumer's unmet size and fit needs (Faust, 2014). This dissatisfaction continues perhaps due to the lack of information in the data collection procedure explained by the companies. However, direct communication with the target consumer

and a proper strategic data collection approach may limit the size unavailability barriers.

High Cost

Cost is another major barrier that influences consumers purchase decision (Thorén, 1996). A few consumers could build brand loyalty with any adaptive brand because those are cost prohibitive than regular garments. Also, adaptive clothes are mostly available on online platforms, which sometimes adds extra cost to the purchase. As a result, consumers make do with regular clothing with less purchase satisfaction. However, interview data indicated that mainstream brands could easily dominate this sector, expanding their line to manufacturing adaptive clothing. For example, consumers reported,

"It's not hard to find cute dresses, it's hard to find cheap dresses in size"

"We don't have the luxury to follow a brand,"

"When I went online to see about making the jeans by sending the measurements into the Down syndrome people and getting the jeans, they were cost-prohibitive. I can't remember what it was, but it was 60 or 70, it was a tremendous amount of money for a pair of pants."

"No, due to cost for them and we make do with regular clothing"

"I think if there was a clothing line for kiddo's with Down syndrome that had designs and was actually affordable, then definitely (I will purchase that)."

"Whoever starts this business will do well. Because the families and the adults with Down syndrome will go to them and get pieces of clothing"

that they can't find in the store that is easier for them, especially the undergarments. It's just a win-win for whoever is ready for that”

Limited Knowledge about Adaptive Clothing

Limited knowledge about adaptive clothing is another common barrier found among consumers. Consumers knew little or nothing about adaptive clothing. This could be the result of weak marketing and brand strategies of the mainstream brands. However, an increase in advertisements on the company’s website, news, social media portal, etc., and promotional campaigns by the mainstream brands (e.g., Target™, Tommy Hilfiger™) could minimize this knowledge gap (Akar and Topçu, 2011; Perry, 2018). For example, consumers reported,

“I don't know exactly (about adaptive clothing). I know what you mean by adaptive clothing. I think maybe a clothing that's easier for a child like a Velcro instead of a zipper or Velcro snap”

“I don't know that a plus-size would be considered adaptive”

“I think you have to do a lot of my kind of search to find it”

“I would need to know more about it (adaptive clothing). I know when she was younger, it was more of an elastic waistband, but they looked more like jeans. And that's all I can remember about it, though.”

“I can't even remember the last time that I've seen an advertisement for adaptive clothing. It's not in front of me. I think if I did see more advertisements or it was displayed more in stores that would catch my eye. And then I probably would pay attention to it more and think, hey, this might actually be something beneficial that we haven't considered yet because it's not going to be on the forefront because we are doing OK with what we're doing, then I'm not out there actively searching adaptive clothing.”

“Target did a good job of putting the campaign out when they had it, their hope. But it's not in the store.”

Lack of Awareness

In this study, lack of awareness was found as one of the major barriers for the brands. Companies agreed that lack of education is still the biggest gap in the industry and is yet to be overcome. Although adaptive brands have a positive intention to help individuals with disabilities, a lack of knowledge about target consumers and their clothing needs perhaps limits the brand's capability to serve consumers properly. To understand consumers and their specific clothing needs, many brands supported social media as the most effective platform to create awareness in the target market (Akar and Topçu, 2011; Suh et al., 2010). However, creating awareness through social media was also a hurdle for smaller companies. Companies experienced rejection advertising their models on several social media platforms because of the standard marketing policy. On the other hand, some brands never prefer social media to communicate with their consumers. As a result, brands fail to connect with consumers properly. For example, brands representatives reported,

“I would say that the biggest gap is still the education piece. I think that the industry at large does. I think they're getting there doesn't really understand the size of the population, the spending power of the population, and the fact that people with disabilities very much care about what they look like, how they dress. They want choice. And even if they cognitively aren't aware, they have family members that are that do want to look at them and say, my God, you look adorable, or he or she is so dressed just like any other typical 19-year-old or twenty-five year old or 50 years old. And I think that is probably right now still the

biggest gap because that is a ripple effect. So without understanding that and the target market, then we can appropriately have a product that is going to serve that market because you really don't understand the market. So that really is the foundation of how this all needs to grow and transpire in the industry.”

(Respondent from Runway of Dreams)

“To raise awareness. So it's just like your standard marketing. So we did try, like ads, for example, on Facebook and Instagram, and those are often rejected”

(Respondent from Abilitee)

Lack of Research

Although large and small brands are taking the cross-collaboration approach to understanding consumer’s clothing-related challenges and preferences; lack of research slows down brand's overall business progress (Perry, 2018). Special consideration on research and development can help companies better know the consumers and limit current clothing issues in the adaptive market

Recommendations and Conclusion

To date, education is the biggest gap in the adaptive market. Educational institutions can take certain measures to connect and minimize the knowledge gaps/barriers between adaptive clothing consumers and brands. For example, universities can initiate several programs to educate smart clothing brands (Perry, 2017). Programs may include:

- 1) Focus group discussion panels for adaptive brands, where university researchers would share the market need for a specific focus group and have a broad discussion on the given challenges and possible solutions.

- 2) Educational programs on smart/adaptive clothing should be tailored as mandatory courses for fashion and apparel studies and should be designed as multidisciplinary courses under STEM disciplines. Adding the courses in multiple disciplines would inspire researchers and cultivate smart clothing creators to solve current adaptive market issues.

- 3) Universities should encourage organizing on-campus campaigns, catwalks events focusing on adaptive fashion and invite outside guests (including brand representatives) to create awareness.

4) The results showed that brands are taking several measures to meet consumer's demands for clothing. Apparently, they are failing to earn the buying power from the consumers, which is a big barrier for the retailers. The most effective approach to educate consumers could be offering short-term certificate courses for brand representatives to minimize this gap. Universities can educate brand representatives on the 5F™ design needs, the recreated TAM model, etc., to get a clear market overview. Detailed documentation on difficulties may help them design strategic tools to find solutions and develop standard production methods, which perhaps help commercialize the product and serve the adaptive market.

5) Other measures to spread awareness may be taken by the retailers to build direct communication with consumers. The result indicated that brands show less interest in the adaptive wear R&D, where several companies jumped into smart clothing development in the past decades (Suh et al., 2010). This is high time brands raised awareness by offering sponsorship to the research projects and collaborate with educational institutions to develop counseling-based products. Brands can also collaborate with several Down syndrome organizations, health clinics, etc., to educate the consumers through them and draw the public eye.

This study aimed to identify the gap between consumers and brands in the adaptive clothing market. After completing this study, I was able to identify the

possible gap and, based on the data and participant's assessment, proposed some recommendations. These recommendations may direct to further research in adaptive clothing design and development to create a difference in the current adaptive market and serve a large portion of the underserved population.

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Appendix A

SURVEY QUESTIONNAIRE (FAMILIES)

You are being asked to fill out this survey because you are a parent/caregiver of a child with Down Syndrome between the ages of birth -14 years old.

The goal of the survey is to identify dressing and clothing related challenges for children with Down syndrome in order to improve independence, confidence, and self-expression.

This survey is completely voluntary. All answers are anonymous and reviewed by IRB. No identifying information will be collected.

1 What is your child's age?

- (1) 0 - 2 years old
- (2) 2 - 5 years old
- (3) 5 - 7 years old
- (4) 8 - 14 years old

2) What is the gender of your child?

- (1) Male
- (2) Female

3 Does your child have clothing or dressing related challenges? If so, please describe.

- (1) Yes _____
- (2) No

4 What brand(s) of clothing do you typically buy for your child?

5 Why do you prefer these brands?

6 Does your child prefer a certain style of clothing? If so, please describe.

(1) Yes _____
(2) No _____

7 Does your child prefer a certain type of fabric texture or type? If so, please describe.

(1) Yes _____
(2) NO _____

8 Does your child or you have difficulty with any of these fasteners? If so rate in order of difficulty (1= not difficult 5 = difficult)

Zipper (1)	★	★	★	★	★
Buttons (2)	★	★	★	★	★
Velcro (3)	★	★	★	★	★
Snaps (4)	★	★	★	★	★
Drawstring (5)	★	★	★	★	★
Other? Please specify (6)	★	★	★	★	★

9 Do you have any difficulty finding the right size/fit for your child? If yes, please describe.

(1) Yes _____
(2) No _____

10 Is there anything else you would like to share related to clothing or dressing challenges?

(1) Yes _____

(2) No

Appendix B

INTERVIEW QUESTIONNAIRE (FAMILIES)

Introduction to the lab : I would love to give a little intro about our lab before we start. Our lab is called Innovation Health & Design Lab. We try to improve health outcomes and quality of life for various patient populations through design. Our research starts with patients and empathy – we meet with members of the community to design, develop, and test wearables that will enhance patient health and overall wellbeing. Wearables include clothing, wearable technology, protective equipment, and rehabilitative or medical devices. Our goal is to design wearables that address the broad spectrum of patients’ needs and to highlight the importance of patient-centered design in health sciences. Do you have any questions related to the labs activities before we start the interview?

Clothing preference

I am going to ask you some questions regarding your child’s clothing preferences.

Could you please describe your child’s favorite type of clothing?

What brand style does your child prefer to wear? why

Adaptive clothing

Give introduction to adaptive clothing if participants are not aware of this sector: Clothing that designed to achieve the aesthetic and functional needs of a person with a disability, is frequently known as adaptive clothing.

Do you purchase adaptive wear for your child? Why and why not?

Do you want to make any comments on the currently available adaptive clothing lines? Are you satisfied with their collection?

Fit

Have you ever heard any complaint from your child regarding size and fit of the clothing and why?

Function

If you have any issues with the fasteners, how do you solve the problems?

Fabric

Is it easy for you to find your child's favorite designs on the type of fabric he/she is comfortable with? Why and why not?

Fashion

How would you comment on the aesthetic of the clothing you purchase for your child?

You mentioned that your daughter likes sweats and tights for the ease of self-care activities. Does that meet your child's fashion requirement?

If the perfect adaptive wear existed that addressed any of your/his/her challenges with typical daily activities, what would that clothing do?

Social Engagement

Are you satisfied with the clothing that you choose for your child's social involvements?

Have you ever heard your daughter saying about their peer's comments on her clothing?

Adaptive clothing lines

Do you have any recommendations on how the adaptive clothing lines can do better in improving their design considerations

Appendix C

INTERVIEW QUESTIONNAIRE (BRANDS)

Introduction: Hi (interviewee), this is Farha, I am the primary investigator of this research, how are you doing today ?

In our research we are trying to understand the clothing related challenges for children with Down syndrome and trying to understand the barriers that still remains in the industry impacting their clothing preferences. We have been interviewing families having children with Down syndrome, and industry personal like you who have plethora of knowledge and experience working in the industry to have a bigger picture and get some ideas to solve the issues that might facilitate children with Down syndrome.

Me : So, before I start this interview, can I ask your permission to record this interview?

1. In your opinion could you please tell us that are families with disabilities needs being met? In your opinion are companies meeting the needs of the adaptive wear communities? Is the target market satisfied with the market right now?
 - a. What is the biggest gap you see in consumers demands and companies abilities to meet those demands?
2. We are working with the DS children market. What have you experienced with this market, have any companies taken the lead on it?
3. Do you think brands are serving the Down syndrome children well enough? If not, what changes do you think these companies should make?
4. A lot of issues that came up during our meetings with family were price oriented. How do you address the dilemma of accessible clothes and meeting affordable pricing, what are leaders you've seen who are doing a good job with that?
5. What is the biggest challenge you have endeavored to spread awareness and gain mainstream attention to the adaptive wear?
6. What has been the most successful technique to increase awareness of the disability market? What can be done to market wider and reach mainstream industry?

What do you think the future of the adaptive wear market will look in the future?

Appendix D

IRB/HUMAN SUBJECTS APPROVAL (CONSUMERS)

CONSENT TO PARTICIPATE IN A RESEARCH STUDY

Title of Study: Interviewing Individuals with Disabilities and Caregivers About Challenges with ADLs

Principal Investigator(s): Martha L. Hall, PhD

KEY INFORMATION

Important aspects of the study you should know about first:

- **Purpose:** The purpose of the study is to better understand the functional and psychosocial challenges faced by individuals with disabilities and their caregivers during typical daily activities.
- **Procedures:** If you choose to participate, you will be asked to describe: (1) challenges with typical daily activities, (2) use of devices related to assistance with daily activities, and (3) current challenges and preferences related to products that address typical daily activities. You will have an initial contact with the researcher by phone, email, video call or in person to discuss your preference for interview setting. You and/or the person in your care will be asked a short series of discussion prompts with opportunities for further conversation or follow-up questions, if necessary.
- **Duration:** The interview should last approximately 30 minutes.
- **Risks:** The main risk or discomfort from this research is you being uncomfortable describing your challenges.
- **Benefits:** There are no direct benefits from participation.
- **Alternatives:** There are no known alternatives available to you other than not taking part in this study.
- **Costs and Compensation:** If you decide to participate there will be no additional cost to you other than traveling to the University of Delaware.
- **Participation:** Taking part or not in this research study is your decision. You can decide to participate and then change your mind at any point

Please carefully read the entire document. You can ask any questions you may have before deciding if you want to participate.

You are being invited to participate in a research study. This consent form tells you about the study including its purpose, what you will be asked to do if you decide to take part, and the risks and benefits of being in the study. Please read the information below and ask us any questions you may have before you decide whether or not you want to participate.

PURPOSE OF THE STUDY

The purpose of this study is to better understand the functional and psychosocial challenges faced by individuals with disabilities and their caregivers during typical daily activities. Challenges could be related to specific personal care tasks you perform or perform with your caregiver's assistance. Challenges could also be related to issues of independence, socializing, employment, or self-esteem.

WHO IS BEING ASKED TO PARTICIPATE?

You and/or the person in your care will be one of approximately of 100 participants, of any age, in this study. You are being asked to participate because either you or someone in your care has a cognitive, motor and/or sensory impairment. To participate you and/or the person in your care must not be confined to a prison, hospital, or in acute rehabilitative care. You must also be able and willing to be interviewed by a researcher.

PROCEDURES: WHAT WILL YOU BE ASKED TO DO?

As part of this study you will be asked to describe: (1) challenges with typical daily activities, (2) use of devices related to assistance with daily activities, and (3) current challenges and preferences related to products that address typical daily activities. Challenges with daily activities could be in terms of personal self-care, interacting with objects, activities promoting independence, or the ability to engage in social activities. Challenges could also be environmental or psychological factors that impact the performance of these activities. You have the right to refuse to answer any question(s) during the interview.

You will have an initial contact with the researcher by phone, email, Skype or in person to discuss your preference for interview setting. Interviews can take place at the University of Delaware, in a residence, or at a selected location, depending on your availability and preference. You and/or the person in your care will be asked a short series of discussion prompts with opportunities for further conversation or follow-up questions, if necessary. The interview should last approximately 30 minutes.

The interviewer will be member of our research team and may be accompanied by an undergraduate student or other member of our lab. You or the person in your care may decline the presence of additional personnel if preferred at the initial contact. We will audio record the interview for transcription purposes.

If you and/or the person in your care participate in this study, the total time commitment will be less than one hour, including the initial contact.

WHAT ARE POSSIBLE RISKS AND DISCOMFORTS?

Possible risks of participating in this research study include feeling uncomfortable describing your impairment, daily challenges, device use, and/or clothing preferences. To minimize this risk, interview questions will be worded in general terms and you and/or the person in your care may also refuse to answer any question(s).

WHAT ARE POTENTIAL BENEFITS FROM THE STUDY?

You and/or the person in your care will not benefit directly from taking part in this study. However, the knowledge gained from this study may contribute to our understanding of the needs of individuals with disabilities and their caregivers. Information from this study may be used to guide future research projects and programs.

NEW FINDINGS THAT COULD AFFECT YOUR PARTICIPATION

During the course of this study, we may learn new important information. This may include information that could cause you to change your mind about participating in the study. If any new important information becomes available while you are a participant we will let you know.

CONFIDENTIALITY: WHO MAY KNOW THAT YOU PARTICIPATED IN THIS RESEARCH?

Participants' identity will be kept confidential. The confidentiality of participant records will be protected to the extent permitted by law. Research records may be viewed by the University of Delaware Institutional Review Board, which is a committee formally designated to approve, monitor, and review biomedical and behavioral research involving humans. Records relating to this research will be kept for at least three years after the research study has been completed. No one outside of the research team or other unauthorized person will have access to the data.

To maintain your confidentiality, participants will be assigned a numerical code within the study for ID purposes. Interview data will be stored electronically on password-protected computers in a locked lab. A list linking participants' IDs with their names will be kept in a secure database file that is password-protected and stored in a password-protected computer in a locked lab. Paper data will be stored in a locked cabinet in a lockable lab. Data will be kept indefinitely but at least for five years after the study ends.

We also must let you know that if during your participation, and/or the participation of the person in your care, in this study our research team was to observe or suspect, in good faith, child abuse or neglect, we are required by Delaware state law obligates us to file a report to the appropriate officials.

The confidentiality of your records will be protected to the extent permitted by law. Your research records may be viewed by the University of Delaware Institutional Review Board, which is a committee formally designated to approve, monitor, and review biomedical and behavioral research involving humans. Records relating to this research will be kept for at least three years after the research study has been completed.

USE OF DATA COLLECTED FROM YOU IN FUTURE RESEARCH:

Identifiers about you might be removed from the identifiable private information and after such removal, the information could be used for future research studies or distributed to another investigator for future research studies without additional informed consent from you or your legally authorized representative.



COSTS AND COMPENSATION

The only associated cost with participating in this study is travel cost if you choose to have the interview occur at the University of Delaware. There are no fees associated with parking for study participants.

WHAT IF YOU ARE INJURED DURING PARTICIPATION IN THE STUDY?

There is no risk of injury during participation in the study other than those one would encounter in daily life. The interview will be paused or can be discontinued at any time if the participant appears to be uncomfortable.

DO YOU HAVE TO TAKE PART IN THIS STUDY?

Taking part in this research study is entirely voluntary. You and/or the person in your care do not have to participate in this research. If you choose to take part, you have the right to stop at any time. If you and/or the person in your care decide not to participate or if you decide to stop taking part in the research at a later date, there will be no penalty or loss of benefits to which you are otherwise entitled. A decision to stop participation, or not to participate, will not influence current or future relationships with the University of Delaware.

If, at any time, you and/or the person in your care decide to end participation in this research study, please inform our research team by telling the investigator.

INSTITUTIONAL REVIEW BOARD

This research study has been reviewed and approved by the University of Delaware Institutional Review Board (UD IRB). If you have any questions or concerns about your rights as a research participant, you may contact the UD IRB at hsrb-research@udel.edu or (302) 831-2137.

CONTACT INFORMATION

If you have any questions about the purpose, procedures, or any other issues related to this research study you may contact the Principal Investigator, Martha L. Hall at 302-831-3935, 302-831-2705 or mlucinda@udel.edu

CONSENT TO PARTICIPATE IN THE RESEARCH STUDY:

I have read and understood the information in this form and I agree to participate in the study. I am 18 years of age or older. I have been given the opportunity to ask any questions I had and those questions have been answered to my satisfaction. I understand that I will be given a copy of this form for my records.



UD IRB Approved: 03/13/2019
IRBNetID#: 1361253-1

Printed Name of Participant
(PRINTED NAME)

Signature of Participant
(SIGNATURE)

Date

Person Obtaining Consent
(PRINTED NAME)

Person Obtaining Consent
(SIGNATURE)

Date

OPTIONAL CONSENT TO BE CONTACTED FOR FUTURE STUDIES:

Do we have your permission to contact you regarding participation in future studies? If you agree to being contacted in the future, we will keep your contact information. Please write your initials next to your preferred choice.

_____ YES

_____ NO

Appendix E

IRB/HUMAN SUBJECTS APPROVAL (BRANDS)



UD IRB Approved: XX/XX/20XX
IRBNet ID#:

CONSENT TO PARTICIPATE IN A RESEARCH STUDY

Title of Study: Interviewing individuals about specific wearables and/or devices preferences and perspectives.

Principal Investigator(s): Martha L. Hall, PhD

KEY INFORMATION

Important aspects of the study you should know about first:

- **Purpose:** The purpose of this study is to better understand consumer and industry preferences and perspectives of products, including wearables and devices.
- **Procedures:** If you choose to participate, you will be asked to participate in an in-person interview session at a location convenient to you.
- **Duration:** This will take about 30 minutes to complete.
- **Risks:** The main risk or discomfort from this research is you may be uncomfortable sharing your opinions.
- **Benefits:** There are no direct benefits from participating in this study.
- **Alternatives:** There are no known alternatives available to you other than not taking part in this study.
- **Costs and Compensation:** If you decide to participate there will be no additional cost to you.
- **Participation:** Taking part or not in this research study is your decision. You can decide to participate and then change your mind at any point

Please carefully read the entire document. You can ask any questions you may have before deciding if you want to participate.

You are being invited to participate in a research study. This consent form tells you about the study including its purpose, what you will be asked to do if you decide to take part, and the risks and benefits of being in the study. Please read the information below and ask us any questions you may have before you decide whether or not you want to participate.

PURPOSE OF THE STUDY

Page 1 of 5

I/C Form Rev. 01/2019

The purpose of this study is to better understand consumer and industry preferences and perspectives of products, including wearables and devices. Wearables includes anything that interfaces with the body. Devices can include assistive devices and other devices used by individuals.

WHO IS BEING ASKED TO PARTICIPATE?

You will be one of approximately 150 participants in this study.

You are being asked to participate because you have expert knowledge relating to specific wearables and/or devices. Expert knowledge can include, production and manufacturing knowledge, experience in usage, or professional care knowledge. To participate you not be confined to a prison, hospital, or in acute rehabilitative care. You must also be able and willing to be interviewed by a researcher.

PROCEDURES: WHAT WILL YOU BE ASKED TO DO?

As part of this study you will be asked to answer a short series of questions. These questions will be regarding 1) preferences toward specific wearables and/or devices 2) perspectives of using specific wearables and/or devices. Preferences can include frequency of use, style comparison, or strengths and weakness of specific wearables and/or devices. Perspectives can include attitudes toward specific wearables and devices. You have the right to refuse to answer any question(s) during the interview.

You will have an initial contact with the researcher by phone, email, video call, or in person to discuss your preference for interview setting. Interviews can take place at the University of Delaware, in a residence, or at a selected location, depending on your availability and preference. You will be asked a short series of questions with opportunities for further discussion or follow-up questions, if necessary. The interview should last approximately 30 minutes.

The interviewer will be a member of our research team and may be accompanied by an undergraduate student or other member of our lab. You may decline the presence of additional personnel if preferred at the initial contact. We will audio record the interview for transcription purposes.

If you participate in this study, the total time commitment will be less than one hour, including initial contact. There are no known alternatives available to you other than not taking part in this study.

WHAT ARE POSSIBLE RISKS AND DISCOMFORTS?

Possible risks of participating in this research study include feeling uncomfortable when answering questions about wearables and devices perceptions and perspectives. To minimize this risk, interview questions are worded broadly and you may answer the questions according to your comfort level. You may also refuse to answer any question(s).



There is no risk of physical injury during participation in the study other than those one would encounter in daily life.

WHAT ARE POTENTIAL BENEFITS FROM THE STUDY?

You will not benefit directly from taking part in this study. However, the knowledge gained from this study may contribute to our understanding of perceptions and perspective of wearables and devices.. Information from this study may be used to guide future research projects and programs.

NEW FINDINGS THAT COULD AFFECT YOUR PARTICIPATION

During the course of this study, we may learn new important information. This may include information that could cause you to change your mind about participating in the study. If any new important information becomes available while you are a participant we will let you know.

CONFIDENTIALITY: WHO MAY KNOW THAT YOU PARTICIPATED IN THIS RESEARCH?

Participants' identity will be kept confidential. The confidentiality of participant records will be protected to the extent permitted by law. Research records may be viewed by the University of Delaware Institutional Review Board, which is a committee formally designated to approve, monitor, and review biomedical and behavioral research involving humans. Records relating to this research will be kept for at least three years after the research study has been completed.

To maintain your confidentiality, participants will be assigned a numerical code within the study for ID purposes. Interview data will be stored electronically on password-protected computers in a locked lab. A list linking participants' IDs with their names will be kept in a secure database file that is password-protected and stored in a password-protected computer in a locked lab. Paper data will be stored in a locked cabinet in a locked lab. Data will be kept indefinitely but at least for five years after the study ends.

We also must let you know that if during your participation in this study our research team was to observe or suspect, in good faith, child abuse or neglect, we are required by Delaware state law to file a report with the appropriate officials.

The confidentiality of your records will be protected to the extent permitted by law. Your research records may be viewed by the University of Delaware Institutional Review Board, which is a committee formally designated to approve, monitor, and review biomedical and behavioral research involving humans. Records relating to this research will be kept for at least three years after the research study has been completed.

COSTS AND COMPENSATION



The only associated cost with participating in this study is travel cost if you choose to have the interview occur at the University of Delaware. There are no fees associated with parking for study participants.

You will not receive any monetary compensation for participating in this study.

DO YOU HAVE TO TAKE PART IN THIS STUDY?

Taking part in this research study is your decision. You do not have to participate in this research. If you choose to take part, you have the right to stop at any time. If you decide later not to participate, or if you decide to stop taking part in the research, there will be no penalty or loss of benefits to which you are otherwise entitled. Your decision to stop participation, or not to participate, will not influence current or future relationships with the University of Delaware.

INSTITUTIONAL REVIEW BOARD

This research study has been reviewed and approved by the University of Delaware Institutional Review Board (UD IRB). If you have any questions or concerns about your rights as a research participant, you may contact the UD IRB at hsrb-research@udel.edu or (302) 831-2137.

CONTACT INFORMATION

If you have any questions about the purpose, procedures, or any other issues related to this research study you may contact the Principal Investigator Martha L. Hall, at (302) 831-3935 or mlucinda@udel.edu.

CONSENT TO PARTICIPATE IN THE RESEARCH STUDY:

I have read and understood the information in this form and I agree to participate in the study. I am 18 years of age or older. I have been given the opportunity to ask any questions I had and those questions have been answered to my satisfaction. I understand that I will be given a copy of this form for my records.

Printed Name of Participant (PRINTED NAME)	Signature of Participant (SIGNATURE)	Date



UD IRB Approved: XX/XX/20XX
IRBNet ID#:

Person Obtaining Consent
(PRINTED NAME)

Person Obtaining Consent
(SIGNATURE)

Date

OPTIONAL CONSENT TO BE CONTACTED FOR FUTURE STUDIES:

Do we have your permission to contact you regarding participation in future studies? If you agree to being contacted in the future, we will keep your contact information. Please write your initials next to your preferred choice.

_____ YES

_____ NO